Cape Peninsula
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A framework for the holistic assessment of competencies developed through undergraduate work-integrated learning in Environmental Health

by

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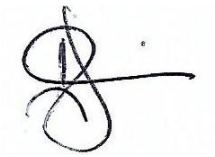
DECLARATION

I, **LOUELLA MARIA DARIES**, declare that the contents of this thesis represent **my own unaided work**, and that the thesis has not previously been submitted for academic examination towards any qualification. Furthermore, it represents my own opinions and not necessarily those of the Cape Peninsula University of Technology.



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ABSTRACT

Work-Integrated Learning (WIL), when used in discipline-specific programmes in Higher Education (HE), presents specific benefits to students, industry and the professions, such as enhanced employability, professional identity formation, discipline-specific competence development and such. Notably, literature indicate that the assessment of WIL, regardless of the modality in which it is present in the programme, is complex and challenging. The challenges present in assessing WIL vary between programmes. Among others, challenges are fuelled by broad and non-specific competency definitions in the curriculum, narrow credentialling criteria by professional bodies, and ambiguity in competency descriptions and -criteria for achieving the goals of the discipline.

An Environmental Health (EH) undergraduate professional degree programme, offered at a University of Technology (UoT) in South Africa, includes WIL, in the form of workplace-based learning (WBL) as part of its qualification. This programme, by way of its curriculum, does not clearly and explicitly describe competency criteria. Furthermore, it's curriculum does not provide definitive proficiency levels to inform judgement of student competency. The EH WIL role-players do not form part of the assessment of competencies developed by students due to WIL. The role-players include the EH WIL student, who recognises the competencies needed for success, and their WIL supervisors, who nurture, provide guidance, and feedback on competency gaps and ways to attain and enhance these. The assessment is undertaken by the academic(s) only and is informed by broad and vague assessment criteria for WIL in the EH curriculum. Additionally, the WIL component—in its entirety—is guided and strictly monitored by its professional body, focusing on time-based exposures to the mandated duties and functions of the EH profession. Consequently, the academic assessment of WIL is aligned to the professional body credentialling criteria.

The premise of this thesis was that the current assessment of WIL in the EH programme is not holistic, as it does not assess the full range of competencies developed by EH students in the workplace. The study sought to understand exactly what the competencies are that students develop and/or acquire during WIL, and which their WIL supervisors observe emerging in them.

This research employed a qualitative design, using purposive sampling and employed a variety of data-collection methods. The data was collected through individual interviews, document analysis and focus group discussions to obtain in-depth insights of participants' experiences and opinions. The data analysis was guided by Legitimation Code Theory's (LCT) Specialization dimension. A Specialization translation device was developed and applied, to the data to enhance the strength of the analysis. The results thereof informed what is legitimised as competence to practice EH and by whom it is legitimised. Additionally, tension

between the classroom assessment emphasis, workplace competencies emerging in the students, and the professional credentialling focus was confirmed. This analysis furthermore demonstrated that the EH profession is situated in an elitist code on the Specialization plane. Consequently, the current assessment of WIL must include both knowledge and knower components in its assessment of competence developed due to WIL. This research resulted in the development of a holistic assessment framework for WIL which can be adapted for numerous contexts in the EH profession.

The current assessment emphasis is narrow in its focus on the competencies needed for EH practice, and overlooks the full range of competencies comprised of specialised knowledge, technical skill and practitioner relational disposition. The relational disposition includes professional values and attitudes, necessary to achieve the EH goals.

The full competency range underpins entrustable professional activities (EPAs), which refer to fully and confidently entrusting the mandated duties, functions, and roles to the EH graduate. The assessment framework may therefore be easily adapted by the EH professional body for credentialling independent EH practitioners.

DISSEMINATION AND OUTPUT

1. JOURNAL PUBLICATIONS

1.1 ACCEPTED JOURNAL ARTICLES

- Daries, L.M., Hudson, L.S., and Reddy, L. 2025. *A framework for holistic assessment of professional competencies in Environmental Health WIL at a University of Technology*. *Education Sciences*, 15(10), 1387. https://doi.org/10.3390/ educsci15101387

- Daries, L.M., Hudson, L. and Reddy L. 2025. Exploring competencies of Environmental Health students in South Africa: insights from work-integrated learning. *South African Journal of Higher Education*, 39 (6): 85-112. https://dx.doi.org/10.20853/39-6-6608

1.2 PUBLICATION-READY ARTICLE/ IN-ROUND 2 REVIEW

- Daries, L.M., Hudson, L.S., and Reddy, L. 2025. *Capturing the development of professional competencies in Environmental Health WIL: Practitioner observations and assessment implications*. Manuscript under blind peer review, *International Journal of Work-Integrated Learning*, submitted 01 July 2025.

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- Daries, L. 2024. Using Specialization to develop competencies for Environmental Health students. Oral presentation at the 5th International Legitimation Code Theory Conference, School of Education, University of the Witwatersrand, Johannesburg, 15 – 18 January 2024.

- Daries, L. 2024. Environmental Health Practitioner workplace supervisor observations of competencies acquired by undergraduate students. Oral presentation at the 2024 WIL Africa Conference, Century City Conference Centre, Cape Town, 02 – 04 October 2024

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DEDICATION

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LIST OF ABBREVIATIONS AND ACRONYMS

DOH	Department of Health
EH	Environmental Health
EHP	Environmental Health Practitioner
EPA	Entrustable Professional Activities
HE	Higher Education
HEI	Higher Education Institution
HPCSA	Health Profession's Council of South Africa
LCT	Legitimation Code Theory
NQF	National Qualifications Framework
PBEH	Professional Board for Environmental Health
POE	Portfolio of Evidence
RSA/SA	Republic of South Africa/ South Africa
SAQA	South African Qualifications Authority
WBL	Workplace-based learning
WIL	Work-integrated learning

CLARIFICATION OF TERMS

Assessment	The process of evaluating a student's performance, skills, or competencies against defined learning outcomes.
Attitude	The approach, behaviour and disposition of the individual toward and in the enactment of their professional practices.
Competence	Knowing what to do, when to do it, and how to do a task to obtain a desired outcome, by employing the appropriate resources, skills and professional practice requirements. For this study it includes skills, knowledge, attitude, and values. (Adapted from: Martin and Latshaw, 2020)
Competencies in EH	Desired knowledge, skills, attitudes, and values (professional abilities) to perform work as an independent practitioner. (Adapted from: HPCSA, 2021)
Course & Subject	The units which make up a programme or qualification; for purposes of this study, course and subject will have the same meaning and may be used interchangeably. (Adapted from: Collins, 2021)
Emotional Intelligence	The capacity to be aware of, control, and express one's emotions, and to handle interpersonal relationships judiciously and empathetically (Oxford English Dictionary, 2021)
Entrustable professional Activities	Units of professional practice (tasks or responsibilities) that can be entrusted to a student on demonstration of sufficient proficiency and competence to perform the task without supervision (Adapted from: ten Cate, 2005)
Holistic Assessment	A thorough assessment that provides a holistic

	view of learning, i.e., acquisition of knowledge, skills, attitudes, and values by gathering data from multiple perspectives and multiple places of learning; the assessment requires the student to apply the same competencies, or combinations of knowledge, skills, and attitudes that they need to apply in professional life (Adapted from: Gulikers *et al.* 2004)
Independent EHP	A graduate who has the skill, professional ability and competence to act within the legislative framework as an Environmental Health Practitioner and who is registered as such with the Health Professions Council of South Africa. (Adapted from: HPCSA, 2021)
Knowledge	The acquisition of facts and information (Oxford English Dictionary, 2021)
Legitimation Code Theory	A sociological framework used to unpack knowledge-building practices, so that the underlying codes, which dominate academic and professional fields, may be revealed with the aim of enhancing access and social justice. (Adapted from Maton, 2014)
LCT Specialization	A dimension of LCT that explores what is valued as legitimate in a field or practice., e.g. knowledge, disposition, both or neither (Adapted from Maton, 2014)
Skills	The ability to do a task or complex activities well (Oxford English Dictionary, 2021)
Work Integrated Learning	An umbrella term to describe curricular, pedagogic and assessment practices, across a range of academic disciplines that integrate formal learning and workplace concerns. (CHE, 2011)
Workplace Learning/Workplace-Based Learning	These terms are used interchangeably throughout this thesis and refer to the following: Workplace-based learning: (WBL) has been defined as 'learning for, at, or through work' (Brennan and Little, 1996, In CHE, 2011: 77); WBL involves the acquisition of work-related knowledge and skills both in the university and in the workplace, with the formal or non-formal involvement of employers (Boud and Solomon 2001), the focus being on learning in the workplace itself and what is being done there (adapted from CHE, 2011).
Work-placement/ Work placement	Work placement: a way of gaining 'on the job' experience in the real world and is part of the curriculum design for WIL for professional qualifications. The aim is to develop the student as a professional through observation, participation, and completion of tasks that demonstrate competency (Maseko, 2018). Work placement refers to student learning situated in the workplace, where the practical environment provides the context for undertaking work-integrated learning. It highlights the experiential aspect of learning as part of the broader pedagogical approach of work-integrated learning.
Workplace/WIL Supervisor	An independent EHP responsible for overseeing a student's professional progress during workplace-based learning, ensuring alignment with environmental health goals, and who provides guidance, support, and feedback to a student during their learning journey.

WIL-related assessments	Formative and summative assessments in which WIL-related components are assessed, whether intentionally or coincidentally. (Adapted from: Smith, 2014)
Student Development	Progression in the development of the student whereby the student can integrate academic learning with issues of personal improvement and individual growth. It is a student centred, holistic experience focused on understanding (and demonstrating) values, nurturing skills, and moving towards knowledge. (Adapted from: Ridley, 2012)
Student Growth	The achievement of goals set by the student which relate to increasing intensity in personal, professional and academic outcomes; the resultant transformation can be expressed by the student and objective observed. (Adapted from: Australian Department of Education and Training. 2019)
Soft skills	Personal attributes that enable an individual to interact effectively and harmoniously with other people in the workplace; it may include the following characteristics: • Empathy and emotional intelligence • Ability to work as part of a team • Social Intelligence • Values Intelligence (Adapted from: Oxford English Dictionary, 2021.)
Technical skills	Practical skills which relate to the complete performance of specific tasks, requiring the application of procedures e.g. legislative requirements, etc. (Adapted from: Chen, 2021)
Theoretical knowledge base	This involves reasoning techniques obtained from theory presented in teaching, learning and assessment and may be supplemented through reading, reflection, inquiry and discussion, without using a practical approach. (Adapted from: Ramnani, 2017)
Values	Ethical principles and standards of behaviour considered important, and which guides performance and actions in the to the way one lives or works

CHAPTER 1

1. INTRODUCTION AND CONTEXT OF THE STUDY

This chapter provides a brief overview of the research topic and situates it in global, regional and local contexts. The associated issues, relevant to the research context, are described and the current state of knowledge on the topic is briefly presented. It further defines the specific problem addressed by this study, the methods and theoretical underpinnings employed to reach the research aims, and the significance and contribution of this study. The chapter concludes with a description of the thesis layout.

1.1 Introduction

Work-integrated learning (WIL), regardless of modality, presents numerous benefits to students, academia and industry (Drewery et al., 2020; Jackson and Dean, 2023; Ndlovu and Mofokeng, 2018; Taylor and Govender, 2017). Despite its benefits, the assessment of WIL remains challenging (Ferns and Zegwaard, 2014; Jackson, 2018; Winchester-Seeto and Rowe, 2017) in many academic programmes in Higher Education Institutions (HEIs) across the globe. These challenges occur across programmes, and are ascribed to, amongst others, gaps in the curricula, for example shortcomings in assessment criteria for WIL in undergraduate teacher education in Australia (Schonell and Macklin, 2018), not assessing total competencies developed in students in various Higher Education (HE) programmes in Finland (Keinänen et al., 2018), and not foregrounding non-discipline specific competencies in HE programmes in Canada (Drewery et al., 2020). Consequently, the full competency range, essential for achieving a profession's goals, are being over-looked and even missed in assessments (Jackson, 2015). Unclear and unspecified professional competencies in an academic programme may lead to inadequate professional identity development in graduates (Gerding et al., 2020), full competency range being disregarded as important by students (Jorre De St Jorre and Oliver, 2018; Nyanjom et al., 2023) and a waning work-force due to non-interest related to unfamiliar and unspecified contributions of the profession (Gerding et al., 2019).

1.1.1 Roles of Higher Education Institutions and its Programmes

Higher education in general, and the HEI's in particular, have many roles in society. Amongst others, HEIs remain steadfast in their role to be a teaching and knowledge production and -transfer facility (Williams and Cochrane, 2010); contribute to social, economic and cultural

development of communities surrounding the HEI (Kohoutek *et al.,* 2017); respond to the labour market (McGuiness *et al.,* 2016), ensure graduate employability (Teijeiro-Alvarez *et al.,* 2013) and encourage life-long-learning (Boud and Falchikov, 2006).

Universities of Technology (UoTs) are part of the higher education landscape in South Africa, having career-focussed programmes with a compulsory work-based learning component in the structure of its qualifications. The main role of UoTs in HE is to prepare graduates who are work-ready, to develop a professional identity due to their work-place exposure and contribute to society (Maseko, 2018).

1.1.2 Role and Benefits of Work-Integrated Learning (WIL) in Higher Education

The aim of WIL in training programmes at HEIs, such as UoTs are, among many others, to familiarise students with the professional practice (Dunn *et al*., 2018); to expose students to authentic and vocational focussed learning experiences (Rowe *et al.,* 2012); to facilitate an easy transition from the HEI to the workplace (Lewis *et al.,* 2010); to afford students the opportunity to learn about professional culture and professional identity (Trede, 2012) and to deliver a graduate that meets industry's "desired graduate profile" (Taylor and Govender, 2017: 106). WIL additionally allows the student to recognise and understand the social and ethical requirements needed for interaction with communities (Cordner *et al.,* 2019) and assists the student to gain "self-knowledge" and develop interpersonal skills (Lewis *et al.,* 2010: 33).
Graduates from UoTs are granted a likely edge over HE programmes in traditional universities as it has always included WIL as its distinctive mark (Scholtz, 2020) and it produces work-ready graduates (Ndlovu and Mofokeng, 2018).

Whilst literature in EH WIL is sparse, the extensive literature on WIL assessment confirms that not much is known about the full range of competencies that students acquire during WIL. The curricula of the EH qualification does not make these competencies explicit. The current assessment of WIL in the EH programme remains underdeveloped, privileging theoretical knowledge and technical skill, academic assessors and excluding other key role players. This calls into question issues of legitimacy and fairness.

Despite the identified scholarly gap, there remains insufficient exploration of multi-stakeholder inclusion and how this approach may enhance reliability and validity of competency assessment of EH WIL. This research therefore addresses the epistemic gap, namely understanding the competencies developed in EH students due to WIL, the validity gap of the assessment focus, by exploring the adequacy and fairness of current assessment practices,

and the theoretical gap, meaning the integration of broader perspectives into an assessment framework for EH WIL**.**

1.2 The Context of this Research

This thesis focusses on the assessment of the work-integrated learning (WIL) competencies that are acquired and/or developed by environmental health (EH) students at a University of Technology (UoT) in South Africa (SA). These competencies are necessary for achieving the goals of the EH profession and underpins the students' progress towards independent practice.

1.2.1 Background and overview of the Environmental Health (EH) Profession

The goal of the EH profession is enshrined in section 24 of the Bill of Rights, of the Constitution of South Africa (RSA, 1996). The Environmental Health Practitioners (EHPs) operate within a legislative framework, and their duties are guided by a mandated scope of the profession (DOH, 2009). However, in SA, as in other regions across the world, the competency set of the EHP traverse mere theoretical knowledge and technical skills as varying contexts requires interaction with often aggrieved clients and communities, presenting issues that have no right or wrong answer, but rather fair resolves (Stewart et al., 2023). Recent literature, such as that by Bandhari et al., (2020), Morse et al. (2020), Omid et al., (2021), Patthanaissaranukool et al. (2020), Rodriques et al. (2021), and Walekwha et al. (2022), describe the essential EHP competencies across a range of contexts in Africa and other regions.

1.2.2 Work-Integrated Learning (WIL) in the Environmental Health (EH) Professional Degree

The undergraduate environmental health (EH) qualification, offered at a HEI, namely a University of Technology (UoT) in South Africa (SA), has WIL as a component in its programme to better prepare students for professional practice. The WIL is strictly monitored by a professional council, through a mid-year verification of students meeting minimum prescribed time in the workplace and monitoring exposures to the mandated functions and duties of the EHP. It is structured such that EH students undertake WIL, in the form of workplace-based leaning (WBL), for varying periods during each year of study.

1.2.3 Issue: Environmental Health Work-Integrated Learning Assessment Challenges

The undergraduate EH curriculum does not clearly define the competencies, nor the associated assessment criteria and -indicators explicitly described therein. Consequently, the academic assessment focus is on the theoretical and technical, and on meeting the professional body's credentialling criteria of meeting a prescribed number of days and associated exposures, of the student, during the work placement. The professional council foregrounds the management of WIL in the programme (HPCSA, 2018).

The competencies described in the literature (Morse et al, 2020; Omid et al, 2020; Bandhari et al., 2020), and others, are missed in the WIL assessment. The aforesaid present a disconnect between what is foregrounded in classroom learning, teaching and assessment, the credentialling criteria of the professional body, and what is desired and essential for competent practice in the workplace.

Workplace supervisors, spend more time with the student during WIL, and are privy to the students' competency gaps, -development and -acquisition. Additionally, students must be made aware of their competency gaps and unique strengths (Jorre De St Jorre et al., 2021), learn from --and lean on-- their peers to overcome self-identified shortcomings in their competency set (Cano et al., 2023). Von Treuer et al. (2011:195) regard the WIL student as a "neglected stakeholder" in the assessment of their own WIL competencies, as students can identify and work towards reducing gaps in their competency set (Boud and Falchikov, 2006; Heidari et al., 2019; Jackson, 2018). Despite their involvement in EH WIL, it is only the academic(s) who assesses the EH WIL students and students themselves have no part in this activity. For assessment to be valid and reliable, it should comprise a variety of evidence provided by all stakeholders, namely: students, academics and industry supervisors (Henderson and Trede, 2017; Jackson, 2015; Jackson, 2017; Mcnamara, 2013).

This thesis argues that a valid and reliable assessment of EH WIL students' competencies requires that the curriculum be explicit in defining the full range of competencies developed and/or acquired by EH students during WIL. It further asserts that the reliability and validity of the WIL competency assessment can be strengthened by including all the key role players involved in EH WIL and not merely consist of the academics who foreground the theoretical and technical as guided by the criteria embedded in the EH curriculum.

1.3 Research aim and objectives

The aim of this study was to develop a holistic framework for the assessment of competence in the Environmental Health work-integrated learning undergraduate students.

The objectives of this study were to:

- Understand the competencies acquired by the environmental health senior student and alumni, during workplace-based/WIL learning using in-depth interviews and document analysis of the student reflective journals.
- Establish the competencies observed by workplace supervisors in the EH WIL student, using focus group discussions.
- Analyse the competencies acquired during EH WIL from the student and supervisor perspective using the Specialization dimension of Legitimation Code Theory (LCT).
- Develop a framework for holistic assessment of workplace-based learning of EH students against the professional competence indicators as informed by the LCT analysis.

1.4 Methods

This study used a qualitative phenomenological design, underpinned by an interpretivist approach, as it was best suited to capture the in-depth and nuanced experiences of the participants (Rahman, 2017). The participants were able to relate and provide 'legitimate insight' (Maton and Chen, 2017) into their lived experiences of WIL in EH practice.

1.4.1 Research participants

As guided by the literature, participants were selected through purposive population sampling, to include senior students, and alumni who have completed the professional degree. Alumni were included as they, and the senior students at the time of data-collection, had completed the WIL requirements of the recently implemented bachelor's degree in EH. For this part of the study, i.e. to obtain student perspectives on their competencies developed due to WIL, the inclusion criteria, were clearly defined, i.e. that the participants had experienced and completed EH WIL in the recently implemented undergraduate EH 4-year degree programme in municipal health services and under supervision of independent EHPs. The EHP WIL supervisors that were included for objective 2, were also purposively sampled meeting the clearly defined criteria of having experience of supervising EH WIL students in the undergraduate degree programme. Additional to their experience, the participants had comprehensive knowledge of

the phenomena being researched. All participants therefore understood and could vividly articulate the phenomenon being researched (Palinkas et al., 2015). Clearly defining the inclusion and exclusion criteria increases trustworthiness and rigour of the study (Cambell et al., 2020).

1.4.2 Trustworthiness and Rigour in Qualitative Studies

Trustworthiness and rigour in qualitative studies require that the researcher ensures that the criteria of transferability, dependability, confirmability and credibility, of the entire process, are ensured when managing the research process.

This section presents consideration and steps abided with, to provide quality assurance throughout this study.

1.4.2.1 Researcher positionality

The positionality of the researcher, relative to the research participants and sources of data, may serve as a limitation in qualitative studies and the researchers may play multi-dimensional roles (Holmes, 2020). Researcher positionality therefore needs to be considered for the potential biases it may introduce to the study results (Chavez, 2008). The researcher, due to her role as Environmental Health WIL coordinator at the UoT which served as study site, had an existing working relationship with participants. This role created familiarity with participants due to it involving interaction with participants including arranging for student placement in the workplace, and having briefing sessions pre-WIL placement, interviews during WIL placement and debriefing post WIL placement with all participants. Additionally, the researcher had direct access to WIL related documents that formed part of the data-sources for this study. This familiarity and pre- existent rapport between researcher and participants resulted in free and open discussions. Additionally, the researcher has a comprehensive understanding of the issues being investigated which, as reported by Flemming (2018), serves a benefit to the study. However, the researcher must remain conscious of her insider role (Chammas, 2020). Thus, assumptions and biases were carefully considered and steps, to avoid these, were consciously taken, including practicing introspection and self-awareness (Bukamal, 2022), maintaining focus through considering the contextuality and relevance of all information to the research aim and objectives (Gurr et al., 2024), and through being mindful of fluctuating viewpoints and researcher roles during the data collection process, as suggested by Chammas (2020). This means the researcher had to situate herself in the space between insider and researcher as advised by Bukamal (2022) and Dwyer and Buckle (2009).

1.4.2.2 Quality Assurance

Transferability, i.e. being clear about the entire research process, and allowing for readers to judge the validity and reliability of findings, is an important part of ensuring quality of the study (Johnson, 2020). To this end, a complete and detailed process for each of the research objectives, and finally reaching the research aim, is described in the various chapters, namely chapters 3, 4 and 5, following this section.

Dependability and confirmability relate to the validity of the methodological processes followed and the transparency and consistency of the results derived from the study (Kakar et al., 2023). This was achieved through member-checking, whereby transcripts were shared with participants to confirm that data was correctly captured and to effect correction where necessary. Summaries were also shared with participants during interview and focus groups, so that they could confirm correctness and provide clarity or correction where needed. Additionally, to enhance credibility and dependability, transcripts were shared with research supervisors, who had different disciplinary backgrounds, thereby viewing through different lenses, and after robust discussion and debate, agreed on eventual categories and themes derived trough data analysis (Noble and Smith, 2024). This collaboration discussion trail was documented through a combination of structured- and informal annotations, capturing spontaneous analytical insights and through formal deliberations.

As suggested by literature (Ghafouri and Ofoghi, 2016), confirmability was ensured through iterative refinement of the research semi-structured questionnaire with research supervisors, from diverse backgrounds and colleagues with different specialisation areas. The semi-structured questionnaires underwent pilot-testing, to identify ambiguities and to allow for revision for clarity and alignment with the research objectives, as suggested, to enhance confirmability (Coleman et al., 2021).

1.4.3 Data Collection

The collection of data was aligned to the respective objectives of the study. This research employed in-depth individual interviews with student- and alumni participants. Appendix A presents the semi-structured interview question guide that was used for the collection of data from this group of participants.

Student reflection journals were used as additional source for data collection, guided by a document analysis guide, of the participating students' WIL reflection journals for objective 1, and is presented in Appendix B.

Focus group discussions were facilitated with the WIL EHP workplace supervisors. Appendix C contains the semi-structured interview guide that was used for the focus group discussion. These data collection methods provided rich information, capturing the participants' viewpoints and allowed for dialogue between facilitator and participant to uncover and understand their experiences. Focus group discussions provide insight to participants' shared perspectives and provide nuances of their underlying attitudes and beliefs (Shabina et al. 2024).

1.4.4 Ethical considerations

Written and verbal informed consent was obtained from all research participants in both the student, alumni and focus group participants (see Appendix D). Participants were ensured of their anonymity, and their right to withdraw from the study at any point during data collection, or thereafter. Participants were additionally assured that the audio-recordings of the interviews would be embargoed and that it would not be available for sharing as it contains personal identifiable information, such as voice and commonly used expressions and phrases of the participants. These audio recordings and transcripts will be stored in the UoT secured repositories. As documented in the data management plan, transcripts will be made available—on request—only after this research is concluded.

As student participants were enrolled at the UoT serving as research site, permission was requested and granted by the Dean of the faculty concerned to interview the students and access their WIL reflection journals. Appendix E presents a copy of the request letter and includes permission granted, while Appendix F presents the permission granted to undertake the research at the specific University of Technology (UoT).

Permission for the EHP WIL supervisors to partake in the focus group discussion was requested from, and granted by, the municipal employer. Appendix G presents this notification of the permission granted.

All protocols for observing the UoT's (see Appendix H) ethical conditions were observed in this study.

1.4.5 Data Analysis

Data analysis was guided by the steps described by Saldanha (2016), thematic analysis as guided by Braun and Clarke (2006) and underpinned by the Legitimation Code Theory's (LCT) Specialization dimension (Maton, 2014). A translation device, presented in Appendix I, was developed to analyse identified themes using the theoretical lens of Specialization. This analysis revealed the competencies legitimised by the participants as essential for EH

competency, from the perspective of the students and that observed by their workplace supervisors.

Figure 1.1 presents a diagram depicting the mapping alignment of the research process, research objectives, and links it to the main findings and outputs of the study.

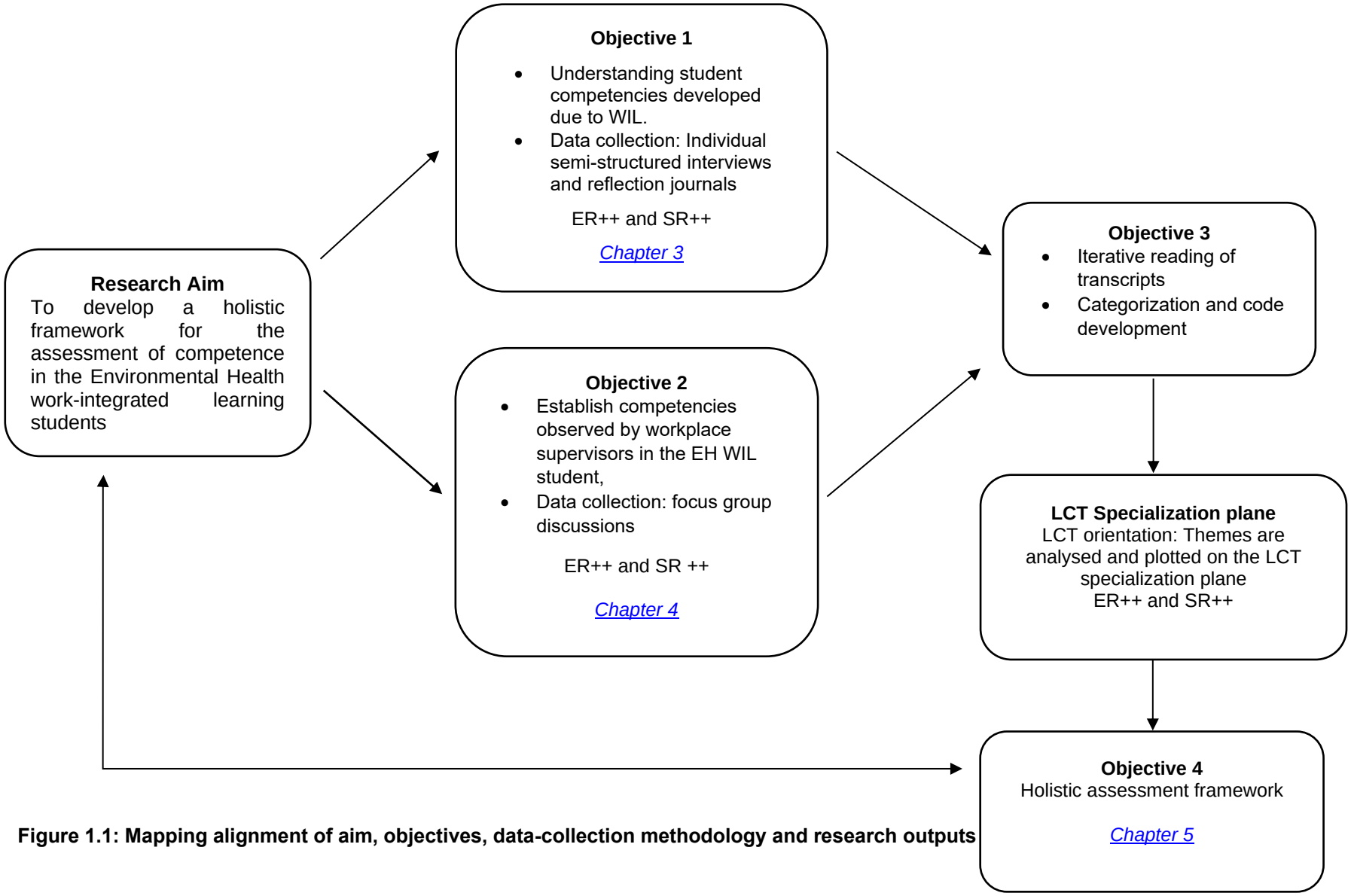

Figure 1.1: Mapping alignment of aim, objectives, data-collection methodology and research outputs

1.5 Significance and Contribution of the Study

The holistic assessment framework for EH WIL competency can reduce the gap uncovered by the research by foregrounding the legitimised competencies in learning, teaching and assessment. The gaps revealed differences in focus between the classroom, which foregrounds the theoretical and technical and the workplace, which demand a full competency range comprised of knowledge, skills and professional behaviours. Additionally, the professional body emphasises a time-based exposure to mandated EH functions. These deficiencies and epistemological tension may indeed be reduced and/or eliminated. Highlighting the essential competencies in the preparation of students for the workplace may allow them to understand the requirement for achieving success in EH practice. Additionally, understanding the full range of desired competencies for the profession means that it can be clearly defined and its associated assessment criteria and -indicators can be made explicit in the EH curriculum. Making the competencies explicit may promote the profession, clarify its role and contribution to the preservation of preventative public health and futureproofing it, especially in global regions where interest in the profession is decreasing.

The LCT Specialization analysis, translation device, and devised holistic assessment framework may be used and adopted by varied disciplines that are situated in an *elite* code on the LCT Specialization Plane. It may be particularly useful where there are misalignment and/or ambiguity between current assessment focus and what counts as legitimate for professional practice competencies. The gap, identified in the literature, between graduates leaving HEIs and employer expectations, can be reduced by foregrounding the legitimate competencies in learning, teaching and assessment in undergraduate programmes.

1.6 Delineation of the study

The study focused on the professional bachelors' degree in EH at only one of seven HEIs offering the qualification in South Africa. Only senior students enrolled for the final year of the undergraduate degree, who had completed work-integrated learning at the time of data collection, and alumni who had completed the EH degree programme, were included in the study. All student participants had completed their WIL at the same municipality in SA and were supervised by the same EHPs. This means that the 1st, 2nd and 3rd year students were not part of the study, as, at the time of data collection, they did not complete WIL or had too short a period of work-placement to add depth to the study. Documents reviewed were limited to participating students' WIL reflection journals.

Only EH officials from one municipality in Cape Town, SA, who were involved in the supervision of EH WIL students enrolled at the UoT used as study site, were included in the study.

The mandatory EH WIL practical training for EH students that takes place at an abattoir did not form part of this study, and the only focus was on duties performed as part of municipal health services, as described in Chapter 2, section 2.3.1 of this thesis..

1.7 Layout of the Thesis

Chapter 1 described the specific issue addressed by this research and its context.

This thesis comprises the following additional chapters:

Chapter 2 presents a review of literature relevant to the issue addressed and provides a description of current and recent developments on the assessment of work-integrated learning (WIL) in higher education. It furthermore describes the challenges associated with WIL assessment in various disciplines offered by some HEIs across the globe. It furthermore explores various suggestions for reliable and valid assessment of WIL competencies in authentic contexts such as those presented by learning in the workplace.

Chapters 3, 4 and 5 present findings in article form. All articles are included, maintaining the referencing style in the format of the specific journals it was submitted to for review and publication.

Chapter 3 presents findings relevant to objective 1, namely: to understand the competencies acquired by the environmental health senior student and alumni, during workplace-based/WIL learning using in-depth interviews and document analysis of the student reflective journals. Objective 3 was integrated into this objective, namely: to analyse the competencies acquired during EH WIL from the student perspective using the Specialization dimension of Legitimation Code Theory (LCT). The findings were plotted onto the Specialization Plane, using the Specialization translation device and the legitimated competencies and their relatively stronger-, relatively weaker-, both stronger or weaker-, or neither stronger or weaker-, epistemic relations and/or social relations, on the Specialization plane, was revealed. This part of the study was submitted as a manuscript to the *South African Journal of Higher Education*. The manuscript was peer reviewed, edited and re-submitted. The manuscript was accepted and published as an article in November 2025, under the title: *"Exploring competencies of environmental health students in South Africa: Insights from work-integrated learning", published in Volume 39, Issue 6 (2025)".* The abstract for this article may be accessed via the following hyperlink: *Chapter3_JournalArticle_abstract.*

Chapter 4 presents the results of objective 2, namely to: establish the competencies observed by workplace supervisors in the EH WIL student, using focus group discussions. The findings of this objective were too submitted as a manuscript to the *International Journal of Work-Integrated Learning (IJWIL)* and has undergone a first round of reviews and was submitted on 01 July 2025 for a second round of reviews after editing the manuscript in response to the reviewer comments. The title of the manuscript is: "*Capturing the Development of Professional Competencies in Environmental Health WIL: Practitioner Observations and Assessment Implications*." The abstract for this article may be accessed via the following hyperlink: *Chapter4_JournalArticle_abstract.*

Chapter 5 presents a synthesis of the total study together with a proposed holistic assessment framework for the assessment of WIL competencies in Environmental Health. This chapter was also submitted in manuscript form to the *Education Sciences* journal for publication. The manuscript was accepted and published in October 2025. The title of this article is: "*A framework for holistic assessment of professional competencies in Environmental Health WIL at a University of Technology*." The abstract for this article may be accessed via the following hyperlink: *Chapter5_JournalArticle_abstract*.

Chapter 6 presents the discussion, in which the key findings are interpreted and synthesised in relation to the research objectives. This chapter aims to align the results to existing literature by presenting the similarities, disagreements and new contributions relevant to the aim of this study. The chapter furthermore foregrounds the implications of the findings for EH WIL assessment practices. The chapter presents a conclusion and recommendations for future research, and the limitations of the study are acknowledged.

Access to the thesis Turnitin reports—per chapter—are accessible via a link provided at the end of each chapter's reference list, linking it to the respective reports per chapter combined in *Appendix S*.

In accordance with the University's guidelines for a thesis by publication, the author and co-author statements for each article are included in the following appendices:

- Appendix T: Co-Author Statement for Article 1- SAJHE
- Appendix U: Co-Author Statement for Article 2- IJWIL
- Appendix V: Co-Author Statement for Article 3- EDSC

ARTICLE 1- ABSTRACT: CHAPTER 3

Exploring competencies of environmental health students in South Africa: Insights from work-integrated learning

ABSTRACT

Although the value of work integrated learning is well documented, limited reports showcase the students' perspectives. Self-perceived competencies gained by undergraduate Environmental Health (EH) work-integrated learning (WIL) students from a University of Technology in South Africa were obtained through in-depth focus group discussions and analysis of their workplace reflection journals. The Legitimation Code Theory Specialization dimension guided the qualitative data analysis. The analysis uncovered a *tension* between current assessment criteria and tasks, professional verification and auditing criteria for workplace learning, and real-world competence norms. Exploring this tension revealed a *shift* in students' competency focus, fluctuating between conceptual knowledge for classroom success, process- and procedural skills for the professional body evaluation, and a combination of knowledge, skills and behaviours for the workplace. This *shift* reveals ambiguity, limitations and biases in current assessments favouring the assessment of knowledge and skills. Uncertainty in graduates' professional identity may further exacerbate the prevailing misconceptions about the EH profession and its contribution to public health among allied health professionals and within society. This research confirms that knowledge and skills are essential in EH practice. However, these are limited as the comprehensive competency range includes soft skills, i.e. professional behaviours consisting of attitudes and values.

Keywords: Environmental Health, holistic, assessment framework, workplace-based learning, Legitimation Code Theory, Specialization

ARTICLE 2 - ABSTRACT: CHAPTER 4

Capturing the Development of Professional Competencies in Environmental Health WIL: Practitioner Observations and Assessment Implications

ABSTRACT

Work-integrated learning (WIL) supervisors directly observe the development of professional competencies in undergraduate Environmental Health (EH) students during workplace placements. While these competencies are crucial to EH practice and readiness for independent work, they are often absent from formal assessment and not explicitly addressed in the curriculum. This study explores the professional competencies emerging during WIL, as observed by Environmental Health Practitioner (EHP) supervisors, and examines their alignment with competency-based education and frameworks such as entrustable professional activities (EPAs). A qualitative design and purposive sampling strategy were used to conduct focus groups with EHP WIL supervisors, followed by thematic data analysis. The findings reveal a disconnect between current assessment practices and the full range of competencies observed in the workplace, particularly relational- and context-sensitive behaviours. The study suggests the integration of EPA-aligned assessments to more authentically reflect students' readiness for independent practice and to augment holistic WIL evaluation.

Keywords: Environmental Health, supervisor observations, professional competence, holistic assessment, entrustable professional activities

ARTICLE 3- ABSTRACT: CHAPTER 5

A Framework for Holistic Assessment of Professional Competencies in Environmental Health WIL at a University of Technology

ABSTRACT

The benefits of work-integrated learning (WIL) in higher education are well-documented. Conversely, the assessment thereof, across disciplines, remains challenging. WIL is embedded in the environmental health (EH) degree at the University of Technology (UoT) in South Africa (SA), with similar challenges. The absence of explicit competency indicators and associated assessment criteria in the current curriculum necessitate an understanding of the full range of professional competencies necessary for achieving environmental health goals. Concomitantly, research relating to EH WIL and its assessment in EH programmes are sparse. The aim of this study is to present a holistic assessment framework for competencies developed due to WIL. Using a qualitative design, data collection occurred through in-depth interviews, document analysis and focus group discussions. Data analysis was guided by the Legitimation Code Theory's (LCT) Specialization dimension. The results foreground competencies beyond mere knowledge integration and technical skill development in WIL. It is thus recommended that the current assessment be altered to adopt a holistic assessment of EH WIL and include the full range of professional competencies essential for EH practice success. Further research may explore where additional opportunities exist for authentic assessment of the foregrounded competencies.

Keywords: work-integrated learning, environmental health, holistic assessment framework, competency indicators, assessment criteria

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CHAPTER 2

2. LITERATURE REVIEW

2.1 Introduction

Chapter one revealed a significant limitation in the challenges presented in the current curriculum design and assessment practices in Environmental Health (EH) work-integrated learning (WIL). The Bachelor of Environmental Health programme includes an organised WIL component and is subject to regulatory audits and verification of WIL by its professional council. However, the monitoring focus remains on verifying the duration of time spent in the workplace and exposure to legislated functions and does not include assessing professional disposition of the Environmental Health WIL student. These professional behaviours include values, i.e. the accepted and expected professional conduct, as well as the attitudes, i.e. the mindset of the EHP and their approach toward the profession. The workplace supervisors, who are ideally positioned as daily observers of student development, are excluded from formal assessment procedures despite contributing to student professional growth, through guidance, monitoring and feedback. Although feedback pertains to student progress in the workplace, the current policy on learning teaching and assessment, of University concerned, dictates that marks only be managed by an academic. The assessment criteria relevant to WIL are unclear, implicit and lack specific assessment criteria. Subsequently, the current WIL assessment does not capture the full scope of competencies developed by students during their work placements.

The literature review that follows builds on the research justification by engaging with local and global knowledge on EH practice, WIL training, and competency-based assessment frameworks. This chapter presents existing debates and conceptual underpinnings to explore how assessment practices in EH WIL might be reframed for holistic validity and contextual relevance. This chapter will also provide a justification for the analytical choices made and align the study to scholarship relevant to authentic assessment practices, regulatory expectations, and evolving ideas of competence in EH. As such, this chapter scaffolds the theoretical, contextual, and scholarly foundations that underpin the integrative aims of this thesis

This chapter argues that the central problem in EH WIL assessment is not merely procedural inconsistency but an unresolved question of what counts as legitimate competence and who has authority to define it.

2.2 The Concept of Work-Integrated Learning (WIL)

The South African (SA) policy on Higher Education Qualifications Sub-Framework (HEQSF) (DHET, 2014) acknowledges WIL as a distinguishing feature of qualifications with a vocational- and professional-directed nature. The WIL may be integrated in the modality, and at any SA National Qualification Framework NQF level(s) of the qualification, as is relevant to the context of the qualification. Consequently, WIL, as educational approach, is integrated into the curricula of various programmes in Higher Education (HE), whereby practical, theoretical and technical learning is merged with real-world workplace experiences aimed at enriching the student's learning experience (Adegbite and Govender, 2022).

The Council on Higher Education (CHE, 2011: 4), in South Africa (SA), describes WIL as:

> An umbrella term to describe curricular, pedagogic and assessment practices, across a range of academic disciplines that integrate formal learning and workplace concerns.

The modalities of Work-integrated learning (WIL), across vocational and professional-oriented programmes include, amongst others, the following:

- problem- and/or project- based learning (PBL and/or PJBL) whereby students engage in practical and realistic problems and challenges, and is included in programmes such as information technology and business studies, with the aim of developing problem-solving skills, innovative thinking and teamwork amongst students (Ferns, Russel and Kay, 2014)
- work-directed theoretical learning (WDTL), described as a structured academic component, implying intentional curriculum design and assessment integration (CHE, 2011; Ferns et al., 2025), whereby classroom-based teaching and learning are specifically geared toward, and mirror the workplace. This WIL modality aligns learning with activities that enhance professional practice, clinical exposures and working as part of multi-disciplinary teams, and may even integrate case studies in the classroom to enhance student learning (CHE, 2011). Work-directed theoretical learning is commonly applied in qualifications such as professional nursing, physio-therapy, medicine and pharmacology programmes (Matinho et al., 2022).
- workplace-based learning (WBL) prioritizes student learning and performing in the workplace under the supervision and guidance of skilled professionals (CHE, 2011; DHET, 2014) aiming to produce work-ready graduates (Fung, 2017). This WIL modality is applied in, amongst others, teacher education and training through practicums under supervision in real-life classrooms, enabling the student to apply pedagogical theories and align their practice to professional accreditation requirements (Rusznyak, 2021). It is also commonly part of medical-, nursing-, and allied health professional qualifications such as environmental health (Daries et al., 2025a).

- Simulations may be part of a WIL modality, such as WDTL or PBL, and is used where there are potential or real, ethical, safety and logistical limitations. Students learn how to operate equipment, machinery and/or tools in a virtual or simulated environment before using these in the actual workplace. Simulated WIL is frequently used in professional degree programmes such as radiography (Hudson et al., 2020),

  The resultant collaboration between industry and Higher Education Institutions (HEIs), due to the WIL component, may ensure that graduate programmes are current, relevant and responsive to the needs of society and industry (Govender and Taylor 2015). It may furthermore ensure that the requirements of the academic programme, and the demands of professional councils which regulate the profession, are met (Lewis et al., 2010). Due to its many benefits, WIL, in its varying modalities, have been adopted by many programmes in various HEIs (Peggy et al., 2022).

2.2.1 The Benefits of Work-Integrated Learning (WIL)

Work-integrated learning, across disciplines and programmes in Higher Education (HE) offers well documented benefits to students (Jackson, 2024). The value and contribution of WIL to student growth and development is widely recognised and bears many educational benefits (Jackson, 2013). Billet and Choy (2013) claim that WBL can inculcate and encourage an aspiration for life-long-learning and that it presents the opportunity for integration and sharing of experience and knowledge gained in the workplace.

Hudson et al. (2020) reports how work placements are important for students' development into competent practitioners, and its role in familiarising students with how to make sense of the practices and values of their chosen careers. Workplace-based learning (WBL) holds benefits for the development of students, for example, it results in improvements in final year academic performance (Jones et al., 2017), ensures continuous advances in student competencies, aides with time-management skills (Rambe, 2018) and confirms career choice and enhances career prospects (Govender and Wait, 2017). It furthermore prepares students for the practice, role, organizational culture, values and standards and aides the development of a professional identity (Trede, 2012). WBL presents the opportunity for the student to not only develop consciousness around the development of aspects of the full domains of human personality, but also to explore and learn how to apply these in the demands related to the world of work (Fung, 2017). Consequently, WIL, in various modalities, is included as part of training, in various higher education qualifications, in, e.g. the United States of America, Australia and South Africa (Abery, 2015; Govender and Wait, 2017; Jackson and Dean, 2022).

2.2.2 The Role of Universities of Technology in Higher Education

Higher education and the HEI's have many roles in society, amongst which, they play the role to be a teaching and knowledge production and knowledge transfer facility, (Ashwin, 2022; Chan, 2016), contribute to social, economic and cultural development of communities surrounding the HEI (Kohoutek et al., 2017); respond to the labour market (McGuiness et al., 2016), promote graduate employability (Teijeiro-Alvarez et al., 2013) through preparing students for employment and thereby contribute to the economy of societies (Van Eeden et al., 2021) and encourage life-long-learning (Boud and Falchikov, 2006). However, HEIs are also expected to face challenges associated with the evolving societal needs (Ashwin, 2022; Chan, 2016). The challenges facing HEIs, amongst others, include gaps in equality in access, responding to employers and global job markets (Tsou, 2024) and aligning graduate profiles with market demands (Mlambo and Mpanza, 2024)**.** Responding adequately to the challenges, requires HEIs to pivot and to adopt pedagogies that involves all stakeholders, including employers and students, in teaching, learning and assessment of learning (Aver et al., 2021).

Universities of Technology (UoTs) are part of the higher education landscape in South Africa, having career-focussed programmes with a compulsory WIL component in the structure of its qualifications (Winberg et al., 2018). The main role of UoTs in HE is to prepare graduates who are work-ready, develop a professional identity due to their work-place exposure and contribute to society (Maseko, 2018). In the case of RSA, WIL has always been a distinguishing feature of Universities of Technology (UoT) - previously Technikons - focusing on real-world, discipline specific integration of knowledge with practice (Scholtz, 2020). Real world contexts are those that are authentic and powerful (Wesselink et al., 2017), and which encourages and supports the meeting the HEIs' goals, i.e. teaching, learning and assessment of competence to practice (Scholtz, 2020).

2.2.3 Role of Work Integrated Learning (WIL) in Universities of Technology (UoTs)

The aim of WIL in HE training programmes are, among many others to: familiarise students with the professional practice (Dunn et al., 2018); expose students to authentic and vocational focussed learning experiences (Rowe et al., 2012); foster and sustain links with industry (Jackson and Dean, 2023); facilitate an easy transition from the HEI to the workplace (Lewis et al*.,* 2010); afford students the opportunity to learn about professional culture and professional identity (Trede, 2012) and to deliver a graduate that meets industry's "desired graduate profile" (Govender and Taylor, 2015). Workplace-based learning (WBL) allows for the student to recognise and understand the social and ethical requirements needed for

interaction with communities by integrating their social science knowledge with that of more technical and theoretical environmental health areas (Cordner et al*.,* 2019) and assists the student to gain “self-knowledge” and develop interpersonal skills (Lewis et al., 2010). It also grants graduates from UoTs an edge, in that it produces work-ready graduates (Ndlovu and Mofokeng, 2018).

In SA, a variety of WIL modalities are integrated into the curricula of academic programmes in UoTs. Workplace-based learning (WBL) presents an opportunity to assess whether the student is skilled, competent and able to apply the theoretical and technical knowledge, obtained during academic training, in the workplace (Smith, 2014). This WBL assessment may prepare the student for life for learning beyond the HEI (Boud and Falchikov, 2006; Boud et al., 2023). Despite its many benefits and opportunities for enhancing student learning, WIL, regardless of modality, is fraught with many challenges.

2.2.4 The Challenges Associated with Work-Integrated Learning (WIL)

As confirmed by the literature, evaluating WIL outcomes is complex, due to discipline-specific variability, interpretation of the assessor, and a disconnect with authentic practice settings (Bosco & Ferns, 2014; Ferns & Zegwaard, 2014).

The following paragraphs presents a snapshot of some challenges presented by WIL, as identified in the literature:

2.2.4.1 Social factors impacting on learning during workplace-based learning.

In some programs, due to its structure, WIL involves no compensation for the student. Due to the varying and often difficult economic backgrounds, students have reported not being able to afford the commute to their WIL placement office (Personal Communication, 2018). Pennaforte (2016:10) reports an increase in behaving pro-actively when WBL students are regarded as “full-time” employees during their work-placement. The transition from the classroom to the workplace is often an uncomfortable one for the student and often they feel unprepared for the realities of the workplace (Oraison et al., 2017). Having an income due to WIL, befits the student in that they experience an income value associated with their profession and can strengthen future salary negotiating skill (Govender and Wait, 2017). Unpaid WIL may diminish student quality of life and affect their quality of learning during the work placement (Gillet-Swan and Grant-Smith, 2018; Tudor et al., 2025).

2.2.4.2 A lack of workplace-based learning placement opportunities

In some programmes students must seek their own placement which may also lead to undue stress due to the uncertainty of whether they will find placement and if so, whether the placement will present a good fit for learning and growth (Govender and Taylor, 2015). Placement opportunities are not always guaranteed (Lewis et al., 2010; Dunn et al., 2018).

2.2.4.3 Misalignment between student and employer expectations and actual competencies

It is increasingly clear that traditional university teaching, learning and assessment, whereby theory and facts are presented to students and their recall of these facts and theories are assessed, does not meet the demands and requirements of industry, governments and society (Herrington and Herrington, 2008). Students expect the core-competencies desired by industry such as behavioural skills, attitude and a wide array of professional social skills, will be developed during their training and it being the responsibility of the higher education institution (HEI) (Assamoi, 2015). This gives student the perception that their "preparedness for industry are more than adequate" as these competencies have presumably been developed during their study period (ibid).

2.2.4.4 Vast array of assessment criteria and practices for workplace-based learning

Workplace-based learning (WBL) assessments and associated assessment criteria, even for same qualifications, vary vastly between HEI's (Personal communication, 2020). Schonell and Macklin (2019) refers to a lack of standardised criteria for assessing WIL in education at a university in Australia; Jackson et al. (2017) in urban and regional planning in Australia; McNamara (2013) in undergraduate law students in Australia, and Dhesi and Lynch (2016) in environmental health (EH) programs across the United Kingdom and Ireland. One reason for this could be dependent on where the students are placed and may call for individualised assessments (Bilgin, 2017).

2.2.4.5 Holistic student growth and development during workplace-based learning not assessed

Aprile and Knight (2019) found that teacher education students felt that authentic learning experiences offered by WBL, including professional growth, skill and social factors impacting on learning during work-placement, are not assessed. During WBL the students not only learn about aspects of their profession, but also about themselves (Ajjawi et al., 2020). Reflection journals are useful to record this personal growth (Martin and Rees, 2019), but failure to guide

and supervise reflection during WBL may remove the potential benefit thereof (Mann et al., 2009). Students perceive the development of soft skills, including development of professional competence, and technical skills and abilities, to be the responsibility of the higher education institution (HEI) (Assamoi, 2015). However, workplaces play a bigger role in this development, as it may influence performance relating to “behaviour-related dimensions,” which may be influenced by competence (Pennaforte, 2016: 69).

2.2.4.6 Non-involvement of the main role players in the assessment of workplace-based learning

Literature suggests that stakeholders, such as the industry partner(s) with whom students are placed, are often not - and needs to be - part of the assessment team (Ajjawi et al., 2020). Ferns and Zegwaard (2014) echo this as it is the workplace supervisor who observes the students for the full duration of placement and how they handle unexpected workplace situations. Ajjawi et al. (2020) suggest that the WIL student too be part of the assessment team. Bilgin et al. (2017) mention that time must be factored in as a resource to ensure valid and reliable assessments of WIL.

2.2.4.7 Students’ development of a professional identity is not considered in workplace-based learning assessment.

Students are aware of their own short-comings, from a soft-skills perspective, and can thus, through collaboration, identify and set goals for achieving these during their WIL placement (Zegwaard and Rowe, 2020). They may reflect upon these competency gaps and record it in a portfolio (ibid.) or on an e-platform in an e-portfolio (Ferns and Zegwaard, 2014). The students’ understanding of what constitutes authentic learning is underestimated (ibid.). Due to work placements, students can identify a misalignment between their personal learning experiences, their development of a professional identity, i.e., their “future-selves”, and the gap between what is foregrounded in assessment by the academic institution and that of industry (Ajjawi et al., 2020). Additionally, students prefer clear, concise and simple guidelines for the assessment of their WBL as opposed to flexibility thereof (Dunn et al., 2018).

2.3 Work-Integrated Learning (WIL) in the Environmental Health Undergraduate Programme

Environmental Health is a profession regulated under the Health Professions Act no. 54 of 1974 (RSA, 1974) requiring registration with its professional board, namely the Professional

Board for Environmental Health Practitioners (PBEH), which resorts under the Health Professions Counsil of South Africa (HPCSA). In this profession, the EHP's duties, roles and functions are all geared toward ensuring that EH goals, such as protecting health of the public through taking measures to ensure a safe environment for all are met (McCormick, 2020; Morse et al., 2020). These measures vary between ensuring legislative compliance and acting as interface between government and people (Mbola et al., 2024), requiring the EHP to play a multi-functional role and to have specific discipline- specific competencies. The Bachelor of Environmental Health undergraduate degree prepares students for working as professional Environmental Health Practitioners (EHPs). Due the focus of integrating WIL and work-exposures into all its programmes, situating the qualification in a UoTs, serves as an ideal platform for the training of environmental health practitioners (EHPs) in South Africa (SA).

The scope of practice of the EH profession is clarified in the Regulation relating to the scope of the profession of Environmental Health, regulation no. 698 of 2009 (as amended) (DOH, 2009). This scope of practice is expansive and comprises technical, regulatory and community/client oriented activities, performed at different levels of government in SA, namely national, provincial and local government. At local, or municipal level, the focus of the practice is on rendering municipal health services (MHS) whereby the core roles and responsibilities include the following:

- Water quality monitoring, which involves ensuring safe public drinking water supply through sampling, testing and compliance to standards
- Food control, which involves inspection and regulatory compliance of foodstuffs and food premises, health and hygiene education and to prevent food-borne illness
- Waste management, which involves the monitoring and managing of all types of waste, ensuring safe disposal, regulatory compliance and promoting sustainable waste handling practices
- Health surveillance of premises which involves monitoring- and undertaking health inspections of premises, such as schools, early childhood development centres, prisons and homes for the aged, and health and hygiene education to prevent ill health
- Surveillance and prevention of communicable diseases (excluding immunisations), which involves the identification and investigation of communicable diseases, such as tuberculosis (TB) and diarrhoeal diseases, and providing hygiene and health promotion and -education, to prevent its spread and outbreaks
- Vector control, which involves managing disease carrying vermin such as rodents and mosquitoes to protect public health

- Environmental pollution control, which involves the identification, assessment and regulatory control of pollutants, in all forms, as well as sanitary promotion to protect community health
- Disposal of the dead, which involves inspection and ensuring regulatory compliance of mortuaries, crematoria and funeral parlours ensuring safe handling and disposal of human remains
- Chemical safety, which involves the control of chemical substances, including the safe handling, storage and disposal thereof.

To put the multi-faceted role into perspective, a typical work-day for the EHP may start with office administration and ensuring inspection reports are up to date and shared with clients. They may then proceed to do food control whereby a food premises is inspected for regulatory compliance. During this inspection they may discover a lapse in maintaining hygienic handling of foodstuffs, which they will document in an inspection report, or compliance notice depending on the severity of the non-compliance, and additionally provide health education on-site, on how to maintain hygiene, and the importance thereof in preventing food-borne illnesses. Thereafter they may conduct water quality monitoring by taking water samples, complete chain of custody forms, and deliver the samples timeously to the laboratory for analysis. They may follow this by environmental pollution control in an informal settlement and address the community on ways to manage waste properly to ensure a sanitary environment and to limit infestation of vermin. This blend of technical inspection, community and relational engagement, and ensuring legislative compliance bears testament to the wide range of competencies necessary to successfully meet the aims of the profession.

2.3.1 Overview of the Environmental Health Profession

The practice of environmental health centres on ensuring the protecting community health from environmental exposures and therefore places the EHP's in a position to be the intermediary between government and community when advocating for environmental health issues (Trudnak et al., 2009; Shezi et al., 2019). The EHP is the first point of contact between the community and local government, especially as it relates to problems the community members may experience with health- and sometimes non-health- related issues (Dhesi, Hannelly et al., 2019; Jepngetich et al., 2019). Thus, in performing duties, the EHP must be able to interact with the community and ensure the upkeep of the environment under all circumstances (Stewart et al., 2023).

In South Africa (SA) EH centres around ensuring society's constitutional right to a healthy environmental for all is achieved (RSA, 1996). The EHP, due to their position between local government and communities (Shezi et al., 2019), have a pivotal role in advocating for community health and well-being (Gerding et al., 2020a). EHPs operate within dynamic local, regional, and global demands, such as responding to pandemics (Jepngetich et al., 2019; Morse et al., 2020), managing health-related impacts of climate change (Shezi et al., 2019) and collaborating within a muti-disciplinary municipal health services team (McCormick, 2020). In addition to being able to apply theoretical knowledge and technical skills (Dhesi and Lynch, 2016), EHPs must also be able to interpret and understand routinely collected data (Gerding et al., 2020). Due to their interaction with society, they must have the social disposition to manage societal health outcomes through multiple interventions (Jepngetich et al., 2019) beyond legislative confines (Dhesi and Lynch, 2016) and be able to discern between the two. Consequently, the EHP requires variable competencies, beyond technical skills and theoretical knowledge, to meet preventative health demands (Leonardi et al., 2024). Additionally, EHPs must employ strategies suitable to the socio-economic contexts of SA society (Morse et al., 2020), to solve EH problems by employing innovative strategies that complies to legislation but navigate beyond its confines (Dhesi and Lynch, 2016; Stewart et al., 2023) and to reach desired EH outcomes (Rodriques et al., 2021). The realities of the EH practice presents having to be adaptable and flexible as the workplace demands changes, (Omid et al., 2021), facing exposures that may be fatal (Rodriques et al., 2021) and are exposed to working in strenuous and challenging environments (Stewart et al., 2023). EH practice requires the practitioner to have a well-developed soft skill set due to frequent social interaction with communities and members of the public (Patthanaissaranukool et al., 2020 Walekhwa et al., 2022).Thus, the EH program is required to produce graduates with a significantly high level of emotional maturity and values intelligence (Omid et al., 2021), not merely a practitioner with knowledge relating to scientific and technical skills and abilities (Leonardi et al., 2024).

2.3.2 Work-Integrated Learning (WIL) Curriculum in an Environmental Health Undergraduate Programme in South Africa

Work integrated learning (WIL) for EH students comprise of WBL at predominantly municipal health services offered by local government municipalities, under the supervision of an independent, registered EHP. The aim is to expose the EH student to municipal health services for a minim period of 100 days, in scaffolded format, their 1st to final, i.e. fourth year of studies.

Various components of WBL are assessed by the academic, post the work-placement period, including structured academic assessments and projects, attendance registers and a portfolio

of evidence (POE) of work completed. Students complete a reflection journal, detailing their learning experiences. WIL, in its entirety, is subject to strict monitoring by its professional board, through a mid- academic year verification and end-of academic year auditing of the student's WBL POE. Amongst others, the auditing criteria foregrounds requires evidence of time-based exposure (HPCSA, 2018) to the mandated scope of practice which details the core EH functions of the profession (South Africa (SA): Department of Health (SA: DOH, 2009). Graduation is followed by registration as community service incumbent- comprised of one year community service in EH practice- and ultimately registration as independent practitioner with its professional body, the Professional Board for Environmental Health (PBEH).

Figure 2.1, illustrated below, was developed to illustrate the relationship between the key role players in EH WBL

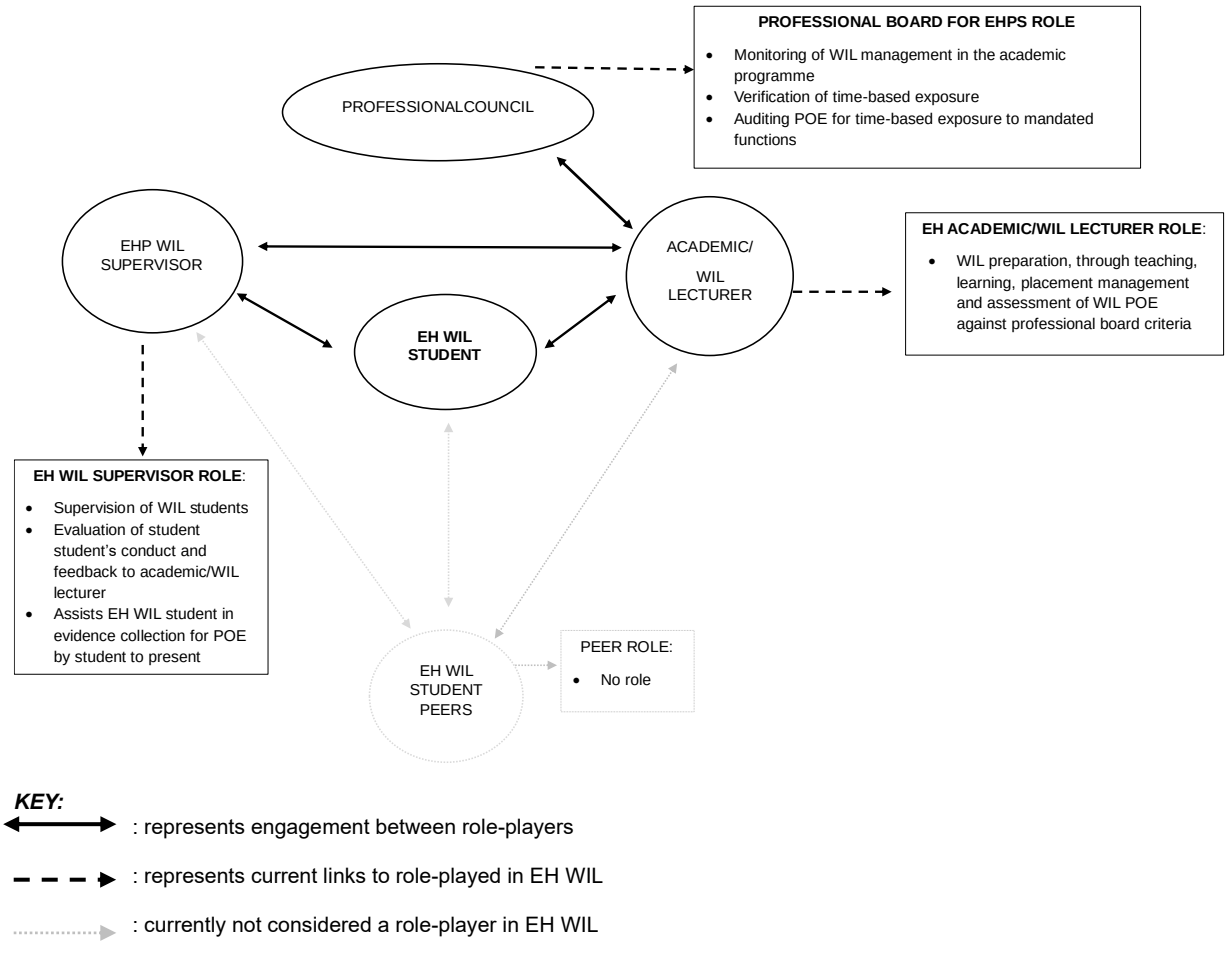


Figure 2.1: Role players, roles and their interaction in current Environmental Health WIL (*adapted from Daries et al., 2025b)*

The EH profession thus requires the individual to have competencies beyond technical and theoretical knowledge due to their wide range of core functions (Shezi, et al., 2019) and they must be able to “understand community dynamics and social and cultural norms” (Morse et al., 2020: 2).

2.4 Assessment Challenges of WIL

2.4.1 Global Workplace-Based Learning Assessment Challenges

Despite the benefits of WIL, the assessment thereof, particularly of competencies developed through workplace exposure remains challenging (Govender and Wait, 2017). This is especially true and unevenly addressed in Environmental Health (EH) education and its associated assessment of WIL (Jackson, 2018). Literature on environmental health (EH) training and practice is sparse and not well researched Dhesi and Lynch (2016). The assessment of WBL in EH globally appears to present a challenge. In Australia, the EH program is offered by 10 institutions of higher learning, yet the approaches to WBL at the various institutions are vastly different (Dunn et al., 2018). The literature consistently describes WIL as a mechanism to enhance students’ transition into practice (Jepngetich et al., 2019; Jorre De St Jorre & Oliver, 2017), and yet, its integration within EH curricula often default to exposure-based models, rather than structured competency development as described by Omid et al. (2021) in Iran, Morse et al. (2020) in Malawi, Uganda and South Africa, and Walekwha et al. (2022) in Uganda.

The role of WBL supervisors in industry is underestimated or reduced to mere feedback regarding the professional behaviour of WBL students (Ajjawi et al., 2020) presenting a missed opportunity as supervisors understand the shortcomings in the student and can partake through “social participation” (ibid). Several studies report on the limitations of current assessment modalities in WIL environments: reliance on singular assessors, lack of standardised criteria, and minimal involvement of industry partners (Jackson, 2018; Winberg et al., 2022). When work-place supervisors do assess the WIL student, they are often impartial and assign higher marks than the academic, possibly due to not being part of, or familiar with the development of assessment criteria (Jackson, 2018). If they understand and are part of the development of the assessment criteria, they would be in a better position to complete student assessment McNamara (2013).

The assessment of the WIL component and student growth poses equal challenges across disciplines. Jackson (2018) and Winberg et al. (2022) report of assessments being poorly aligned with the anticipated desired learning outcomes and identified the need for WIL assessments that are relevant and consistent with learning that takes place in the workplace

(ibid.). Boud and Falchikov (2006) foregrounds the importance of aligning the assessment with what is learnt in the workplace, i.e. what is echoed and/or mirrored by the student during workplace-based learning. This perspective echoes the argument of Rusznyak and Bertram (2021), that if competencies are deliberate and made explicit, professional practice can be strengthened. Critical thinking skills in new EH graduates, who are not merely responsive to needs, but who will develop into “competent managers” are needed (Leonardi et al., 2024; Omid et al, 2021). Students must have clear and concise frameworks for measuring performance-related behaviours in the workplace, such as adaptability and being pro-active (Pennaforte, 2016:). The relationship between “competence and self-efficacy” must be explored (ibid.: 71)

2.4.2 Assessment Challenges in Environmental Health Workplace-Based Learning

Environmental Health (EH) practice occurs at the point where legislative obligations, community engagement, and technical expertise converge (Shezi et al., 2019; Dhesi and Lynch, 2016). Defining professional competence within this discipline becomes both intricate and contested, possibly due to this converging combination of factors (Omid et al., 2021). Consequently, if professional competencies are unclear, it may pose a significant impact on the programme delivery, meeting expected proficiencies desired by employers and meeting demands of a successful practitioner in a dynamic field (Omid et al. 2021; Walekwha et al., 2022; Patthanaissaranukool et al., 2020). In this instance, WIL principles, regardless of modality, emerge as an academic intervention, with varying modalities, which has potential to bridge academic preparation with professional expectations (CHE, 2011; Gerding, et al., 2020a; Dean and East, 2019). Despite WBL being a catalyst for work-readiness (Jepngetich et al., 2019; Jorre De St Jorre & Oliver, 2017), its integration within EH curricula often default to exposure-based models, such as that described earlier for EH WIL in Africa, South Africa, and elsewhere, rather than structured competency development (Omid et al., 2021; Morse et al., 2020; Walekwha et al., 2022).

As mentioned earlier in this section, WBL in the EH programme is scaffolded from year one in the EH programme. Recent literature supports the scaffolding of WIL, reporting that exposure to disciplinary practices as early as possible during their academic studies, helps the student to adapt to evolutionary shifts in the practice (Ferns et al., 2025) and thereby better prepares them for real-life disciplinary dynamics. However, this EH undergraduate degree, as guided by the current curricula (South African Qualifications Authority (SAQA), 2017) describes broad exit-level outcomes and adheres to professional registration protocols, rather than a framework that articulates explicit competency progression.

Neither the EH undergraduate curriculum document (SAQA, 2017), nor the standard operating procedure for the management of WIL (HPCSA, 2018) sufficiently specifies what competencies are expected or how these could be measured. The current curriculum and its associated assessment criteria, at a specific University of Technology (UoT) offering the EH qualification, is merely partially competency-based (SAQA, 2017). It does not clearly specify competencies necessary to practice or obtain EH goals or how the competencies should be assessed. Curricula that narrowly defines competencies, such as those to be obtained in the qualification, may run the risk of students merely completing tasks without developing deeper capabilities required for entrustable professional activities (EPAs) and independent practice (Rusznyak and Bertram, 2021). When competence is inconsistently, or poorly framed, it risks fragmenting the curriculum and creates confusion amongst students, assessors, and industry partners (Omid et al., 2021). This may obscure the role of WIL as it is poorly articulated in academic practices.

In EH, where societal health outcomes centres on practitioners' ability to act with both technical precision and ethical discretion (Walekwha et al., 2022; Omid et al., 2021; Morse et al., 2020), the intention of the curriculum, and describing competencies and associated assessment clearly and explicitly, become critical (Gerding et al., 2020b).

Defining competence varies across the literature, as it takes on different meanings given the context in which it is used. Chuang et al. (2025) offer a consolidated view that integrates "knowledge, skills, attitudes, and values", i.e. a multidimensional conceptualisation that moves beyond technical mastery to include professional disposition. In EH WIL education, this definition remains underutilised, and the assessments predominantly focus on knowledge reproduction and procedural adherence, rather than relational or context-sensitive behaviours required in the workplace (Dhesi and Lynch, 2016).

Regardless of the real-world setting and contextual, discipline-specific complexities offered by EH WIL, the subsequent challenges presented by this mismatch, means the processes, practices and role-players involved in assessing readiness to practice EH is limited, assessment focus is fragmented and inconsistent across programme offerings (Omid et al., 2021). Industry partners are neglected in the evaluation of students, even-though they are the ones who have insight into the students' professional growth and development of the hidden curriculum competencies (Garraway and Reddy, 2016). Workplace supervisors direct and provide feedback to students on their professional growth an achievement of competence and should play a role in its assessment (Jackson, 2018; Winberg et al., 2022). Additionally, in the South African context, the relegation of EH WIL supervisors to the assessment periphery,

together with the unclear and inexplicit competency indicators or tools for assessors within municipalities, contributes to inconsistent feedback on student professional growth.

The disconnect, between classroom and workplace is not unique to the EH programme in SA. Langsford and Rusznyak (2024) reports for pre-service teacher students, the disconnect between classroom assessment and workplace competencies may similarly affect the holistic assessment of EH student progress during WIL, toward independent practice. During WBL the student applies, not only hard- and technical skills, e.g., principles of physics or chemistry, but also skills of communication, emotional intelligence, social intelligence, etc., while working on addressing a particular real-world issue (Rule, 2006). The demands and challenges placed on HEI's by industry and society, requires the entrenchment of graduate attributes throughout the curricula of HE programmes (Lombardi, 2007; Fraser et al., 2019). The explicit inclusion of graduate attributes in teaching, learning and assessment serves to encourage students to develop these skills and competencies (Bitzer and Withering, 2020). To achieve this, students must recognise and make a connection between the theoretical and that which occurs in real-world settings (Georgiou et al., 2022). A gap exists between the student's understanding of what graduate attributes are and how this is communicated to them (Bitzer and Withering, 2020). For students to find meaning in graduate attribute development, they need to know what these attributes are and how to attain them (Blaszczynski et al., 2012). The development of soft skills is time-consuming, difficult to attain and due to its nature, complex to assess (ibid.), but it is what employers value (Coll et al., 2002). Winberg et al. (2018: 248) suggests that work-placements which "relates strongly to the field of practice" as a solution to attain the much-desired graduate attributes which may encourage employability in graduates.

Profession-specific authentic learning occurs when the student is exposed to a community of practice, and under supervision of a professional, experiences the culture, language and practices of that community (Jackson, 2018). In the absence of an authentic environment, tasks that mirror the real-world, such as a simulation, may also result in an authentic learning experience (Roach et al., 2018; Zegwaard et al., 2020). This allows the student to be eased into the real world of work (Lombardi, 2007) providing them with experience, but without the pressure of having to 'get it right' (Hudson et al., 2020).

Assessment must mimic that which the students learn during work-placements to be significant (Jackson, 2017). To assess WBL holistically, it should mirror the same competencies, including skills, knowledge, values and attitudes that is needed in professional practice. (Gulikers et al., 2004)

Environmental Health practice requires competencies beyond mere knowledge and technical competencies to meet 21st century employability criteria (Tushar and Sooraksa, 2023). Preparation for professional practice should include assessing competencies relevant to professional and ethical dispositions, relational behaviours, appropriate attitudes and context-relevant responsiveness (Dean & East, 2019; Tushar and Sooraksa, 2023). However, in EH programmes, assessment practices have typically prioritised knowledge reproduction and procedural adherence, rather than the desired holistic enactment of duties within community-based settings (Dhesi & Lynch, 2016; Morse et al., 2020; Stewart et al., 2023). This is largely due to the misalignment between unclear WIL outcomes and professional obligations in the curriculum. Despite students being exposed to real world practice, and developing holistic, adaptable and critically reflective competencies, they are not assessed on their full developmental path (Jackson et al., 2023; Omid et al., 2021; Walekhwa et al., 2022).

Collectively, the aforementioned suggests that the EH profession is marked by ambiguity, unclear and inexplicit competency outcomes and assessment frameworks, particularly around WBL competence development. These gaps suggest a need for inquiry that explores which competencies evolve through WIL and how assessment can holistically reflect students' readiness for independent practice. It furthermore informs of a need to have a multi-stakeholder approach, involving more than merely the academic, to gauge and evaluate the student's path to professional independence. The literature, on meeting the unique demands of Environmental Health (EH) practice through various pedagogies, such as WIL in higher education, and describing the role of competencies, its assessment is sparse. Unlike the clinical settings, such as those presented in nursing and medical education, Environmental Health contexts involve multi-sectoral coordination, is guided by legislation, and involves community engagement in non-clinical settings. The unpredictability of this contexts challenges conventional approaches to competence verification (Shezi et al., 2019). It furthermore highlights a need to unpack the assessment of EH WIL (Gerding et al., 2020a) and to adapt competency-based assessment (CBA) models to account for risk assessment, ethical judgment, and relational behaviours (Omid et al., 2021).

As mentioned earlier, professional credentialling in EH, in South Africa, prioritises exposure duration and procedural compliance over performance entrustment in various EH contexts. The 100-day/600hour work placement benchmark (HPCSA, 2018), required by the professional accreditation body does not provide sufficient guidance on the levels of entrustability desired, i.e. competency assessment criteria and thereby dilutes opportunities for meaningful assessment. Existing EH curricula (SAQA, 2017) is only partially competency-based, by way of broad and generalist assessment criteria and does not clarify entrustable

tasks or the criteria for independent action, further complicating the assessor's capacity to distinguish between competent exposure and competent performance (Omid et al., 2021).

The literature suggests a need to reframe assessments within EH WIL education, developing an assessment framework that clearly describes competencies, their association assessment criteria and how these translate into EPAs, that is, into discipline-relevant tasks and aligning them with workplace expectations (Rodriques, et al., 2021; Omid et al, 2021). Doing so would not only enhance the credibility of competence assessment results but also strengthen the profession's readiness to meet evolving health challenges and dynamic societal demands (Gerding et al., 2020a; Gerding et al., 2020b).

2.5 The Value of a Holistic Assessment Framework

The workplace, and workplace-based learning, provides an authentic environment in which students may learn and experience the realities of the discipline and its practices. Assessment of amongst others, competencies developed in the workplace, is to prepare the student for life for learning beyond the HEI (Boud and Falchikov, 2006).

For WIL assessment to be valid and all-encompassing, the assessment should be made up of a variety of evidence provided by all stakeholders, namely: students, academics and industry supervisors (Mcnamara, 2013; Jackson, 2015; Jackson, 2017; Henderson and Trede, 2017). Student perception of what is important in practice determines what they regard as relevant for their future work (Gulikers et al., 2004). The absence of a clear and holistic assessment framework means that although students complete WIL in authentic settings and develop desired discipline-specific professional competencies, they may regard these as unimportant (Boud and Falchikov, 2006; Nyanjom et al., 2023). Furthermore, a lack of clarity of assessment criteria, means that students may develop desired discipline-specific professional competencies, but may regard these as unimportant (Jackson, 2018; Rowe and Zegwaard, 2017). Literature reports that students themselves can relate their learning, competencies developed and shortcomings in their professional progress (Boud and Falchikov 2006). Von Treuer et al. (2011:195) describes omitting the recent graduate and their WIL experience from the WIL evaluation as a "neglected stakeholder." Including the student and recent graduate experiences in the WIL assessment and/or evaluation, may contribute to enhancing the entire WIL component and make it holistic (Boud et al, 2023; De Vos et al., 2024).

Supervisors of WIL student, due to their proximity to the student, the profession, and the employer, can provide feedback to the student on their professional progress as well as gauge how they would adapt in the profession (Nisbet et al., 2022). They form a valuable stakeholder in assessment of discipline-specific professional competencies developed in the student due to workplace learning (Winberg et al., 2022) and may thus contribute to a comprehensive and holistic assessment of WIL. Broadening the scope of involvement of the WBL supervisors in assessment, requires them to also partake in the development of criteria for competence developed in the WBL student (McNamara, 2013).

The assessment of workplace-based learning requires that the realities of the workplace be echoed in the assessment, whereby the clients, contexts and tasks are performed (Gulikers et al., 2004; Bosco and Ferns, 2014). Work-integrated learning calls for structured assessment, particularly when it is part of the formal academic curricula, together with clear assessment outcomes, assessment criteria and be structured in a manner that aligns to the learning outcomes, HEI graduate attributes and discipline-specific competencies (Scholtz, 2020; Garraway, 2022). However, due to the EH professional accreditation requirements focussing on exposures and time spent in the workplace as assessment benchmarks, the academic assessment focus is largely designed to satisfy these requirements. Assessment of competence is thus sparsely applied in EH education in RSA. The resulting concern centres around the neglecting of EH WIL students' development of soft skills, such as emotional intelligence, ethical practices, judgement and relational capabilities and behaviours, which are necessary for achievement of success in EH practice, especially in the diverse South African contexts, (Shezi et al., 2019; Rodrigues et al., 2021).

A legitimacy conflict is therefore present, as no theoretically informed framework for valid competency assessment, across all EH WIL stakeholders exist. To holistically assess the competencies developed and/or acquired by EH undergraduate student due to WBL, it was therefore necessary to establish exactly what is legitimated as competence to practice EH successfully, by stakeholders directly involved in WBL.

2.6 Commonly Used Assessment Practices in Health and Allied Health Education Programmes

Competency-based education (CBE) focusses on what a student can do in the workplace, i.e. in real-world settings, and transcends possessing mere theoretical and technical knowledge, to result in the student displaying an understanding of its practical application (Janssens et al., 2023). Initially, CBE was introduced into medical education to measure how students meet the real-world demands of patient care, reducing the theory-practice gap and promoting

continuous competency development (Mackay et al., 2023). As CBE and its associated assessment, meaning competency-based assessment (CBA), measures performance of students in the workplace (Cruess et al., 2016), a common modality used to operationalize CBE through assessment, is through objective structured competency education (OSCE) (Sola-Pola et al., 2020). This modality presents a standardized method of observation in which the student's clinical- and/or practice competence can be evaluated in a simulated environment (Tacettin et al., 2021; Lai et al., 2022). The OSCE is commended for judging practical - in the case of medical students clinical - abilities (ibid.) Thus, in EH students, OSCEs could be relevant to assessing technical competencies in some EH contexts. However, associated challenges and deficiencies have been identified in OSCEs, mainly linked to its controlled nature which ultimately impact an authentic assessment environment (Schuwirth and van der Vleuten, 2003).

These challenges and shortcomings associated with OSCEs, include amongst others, a lack in consistency, credibility and impartiality (Dewan et al., 2024), due to it being time-bound, structured and rigid. These limitations make OSCEs unfavoured for assessing EH WIL competence, in preparing students for current and future real-life contexts with all its associated nuances (Khan, 2017). Additionally, shortcomings in assessing analytical and critical thinking skills in students (Witheridge et al., 2019) are present. These shortcomings may are creating a gap in assessing all the required competencies, such as it poses in medical practice skills assessment, as students prepare for specific routine assessment scenarios and are able to successfully practice and duplicate 'correct' skills (Khan, 2017; Bilgin et al., 2022). These factors are amongst those fuelling a re-think of clinical skills assessment via OSCEs, which are simulations in medical- and allied health clinical skills assessment in favour of work-place based assessments of clinical and technical skills (Khan, 2017). For the EH discipline, this implies relinquishing the current dependence on theoretical-and technical skills assessment so that practitioner disposition and attributes, such as values and attitudes required for competent practice in the workplace, be included. Some even suggest the inclusion of the client, i.e. patient in medical clinical skill assessments, to provide feedback about soft skills and competencies (Sokhanvar et al., 2021; McNulty et al., 2023). Engaging in simulations and using conditioned contexts are valuable, especially in contexts where sensitive and ethically sensitive issues are involved in the assessment tasks (Drisko, 2015). The applicability of OSCEs in EH assessments remain limited as EH WIL occurs in the real-world setting, making it authentic, and daily work involves having to engage with people and all its associated- and at time unexpected- real-word challenges requiring solution that will satisfy clients, but still meet EH goals and expectations (Stewart et al., 2023: 156).

One other assessment guide for assessing performance in health disciplines is the Miller Pyramid (Miller, 1950, In Dewan et al., 2023). The pyramid was introduced to reduce the limitations of practices merely assessing knowledge and clinical skills, but to also include

assessment of individual behaviour in real situations (Witheridge et al., 2019). Cruess et al. (2016) felt that a level above the ‘Does’ level, which includes the professional identity is not considered in this model and subsequently suggested the pyramid be revisited to include this. Eraky and Marei (2016) too re-visited the Miller pyramid to include who the student ‘Is’- meaning their personal attributes and values, and how these attributes feed into them being the practitioner. They further suggest exploring reasons why the student acts in a particular way in a specific context, by exploring what the student does, i.e. described as the ‘Do’ in a team- setting, as it aligns with 21st century employability criteria, and, in their model, express these in term of “assessment orbits” (ibid: 1255). This could be useful in EH contexts, as the EHP duties require working within multi-disciplinary and multi-sectoral teams within employer organisations and thus need to adopt and exhibit desired EH professional behaviours.

Gulikers et al. (2004) developed a five-dimensional assessment framework, in which a complete competency range, relevant to real-world tasks, are used for authentically assessing competence. Such an assessment framework aligns assessment tasks to an authentic context, consider actual resources, e.g. time and materials available to the practitioner, and the social contexts, i.e. whether the practitioner would tackle the problem/issue as an individual or collaboratively with others internal or external to the organisation. Real world contexts are those that are authentic, powerful (Wesselink et al., 2017) and inspire meeting the goals of HEIs i.e. teaching, learning and assessment of competence to practice, and particularly those of UoTs in South Africa that has WIL as a characteristic mark (Scholtz, 2020). Additionally, assessors will include all those concerned with learning in the workplace, i.e. the students, WIL supervisor, academic and, where relevant, peers (Dewan et al., 2024). These dimensions are echoed by Bosco and Ferns (2014) in their authentic assessment framework for various programmes and disciplines with a WIL part in the curriculum.

Environmental health WIL provides the perfect environment in which to conduct such learning and assessment, due to its reliability and fidelity in meeting the requirements for an authentic context (Gulikers at el., 2004). The workplace presents an authentic assessment context allowing all role-players to partake—despite the renowned complexity, as reported, among others, by Bilgin (2022)—in the assessment. Due to the variable workplace learning contexts, students are not able to replicate answers and solutions to previous assessments, (Bilgin at al., 2022) as is the case with assessments used during simulations, e.g. OSCEs (Dewan et al., 2024), or other aspects such as assessing knowledge or technical skills.

Developing a holistic assessment framework using the five dimensions meets the requirements for assessment as prescribed by the South African Qualifications Authority (SAQA, 2017), as well as those of the UoT that serves as the research site. Figure 3 was developed to illustrates the overlaps, and similarities between these guidelines. It is useful to note that some of the SAQA (and UoT) credibility criteria, as well as that required of

competency based assessments (CBAs) (Cano et al., 2023) have been grouped together, e.g. validity, reliability, replicability and integrity as it embraces credibility criteria relevant to the ‘task’ considerations as suggested by Gulikers et al. (2004).

As illustrated in figure 2.2, there are indeed overlaps and similarities between the credibility requirements of the programme, UoT, CBA and Gulikers’ et al. (2004) 5-dimensional framework. It meets the requirements of the UoT, Department of Higher Education and Training (DHET) SA, and EH programme. The results for these desirable outcomes, i.e. either by performance and/or product will be informed by the EH issue used as the basis of the assessment.

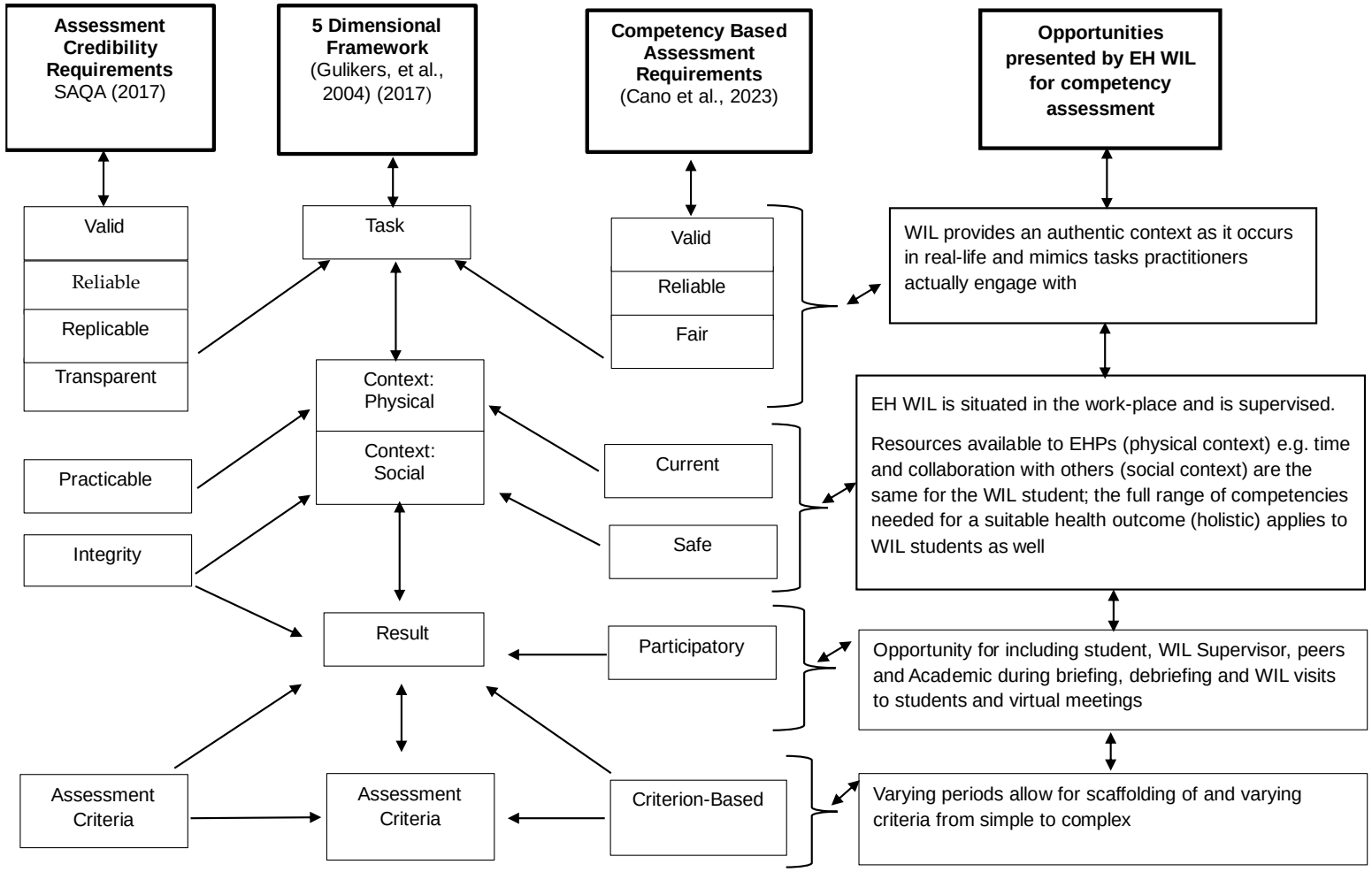


Figure 2.2: Comparison of assessment credibility requirements and suitability for use in EH WIL assessment

Thus, to ensure the transition to independent practice, i.e. to obtain professional accreditation, the desired competencies must be explicitly defined and aligned to an assessment framework that is credible, contextually responsive, supports and evaluates the progress towards professional activities that the student can be entrusted with. This alignment can ensure that the requisite competencies cultivated through WIL, and assessed in an authentic context, effectively supports the development, and meets the expectations, of entrustable professional activities (EPAs) and independent practice.

2.7 Theoretical Lenses in Competency Evaluation

Despite a clear need for more holistic approaches in competency assessment, EH education, and especially EH WIL, is yet to adopt consistent theoretical frameworks to guide the evaluation of professional development (Dunn, 2019; Dunn et al., 2024). The literature presents a girth of findings on the contribution of WIL in reaching outcomes of the curriculum and procedural standards, but there remain shortcomings in the literature on how the competencies are conceptualised, acquired, and by whom the competencies are legitimised in practice (Rowe et al., 2018; Boud et al., 2023; Nyanjom et al., 2023). This oversight in the curriculum and professional credentialling criteria, especially for the EH discipline, which hinges upon relational behaviours, ethical conduct, and contextual responsiveness (Morse et al., 2020; Shezi et al., 2019), may be missed in competence acquisition and progress toward independent practice and its assessment (Rusznyak and Bertram, 2021). It thus becomes crucial to identify and enact mechanisms to bridge the gaps identified between all stakeholders in WIL so that the intended outcomes are aligned, and the best results are achieved for all.

Legitimation Code Theory (LCT) (Maton, 2014) presents a conceptual framework to bridge the disconnect between the classroom, workplace and professional credentialling body. Karl Maton describes LCT as “a theoretically sophisticated but practically useful” framework that may be used to unpack the features that make-up knowledge practices (Amundrud, 2020:19). Legitimation Code Theory (LCT) is underpinned by the work of sociologist and education theorist Basil Bernstein (Bernstein, 2000, cited in McLean et al., 2013). Bernstein (1999, cited in Georgiou et al., 2022:4) distinguished between two dimensions of knowledge. Firstly, he described discourses: “horizontal discourse,” referring to everyday, context-specific knowledge, and “vertical discourse,” referring to more formal, systematic, hierarchical knowledge. Secondly, he identified knowledge structures: “hierarchical,” meaning cumulative knowledge that is integrated from basic to complex, and “horizontal,” meaning segmented knowledge, with specialized, non-cumulative fields. Maton (2014) extends this by exploring knowledge practices and examining how knowledge is formed by individuals through

interaction in a social setting, and how they work with knowledge either explicitly, implicitly or routinely.

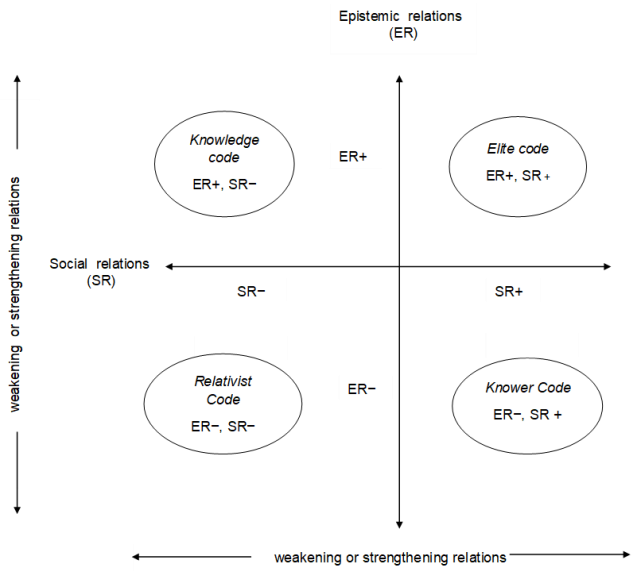
LCT provides a set of tools to observe, analyse and interpret teaching and learning practices (Pott and Wollf, 2019). To this effect, LCT presents a "toolkit," in the form of 'dimensions' to judge what can be counted as legitimate, and therefore used as a measure of success, in the context of teaching, learning and assessment (Ellery, 2017). As learning is social context- and student background dependent, the actors involved may themselves provide "legitimate insight" (Maton and Chen 2020: 47). Understanding what is being legitimated in teaching, learning and assessment allows actors to perform accordingly and be successful (Maton and Doran, 2020).

The LCT dimensions includes Specialization, which considers whether the orientation leans more toward epistemic (knowledge) or social relations (knower); Temporality, which considers whether change over time influences what is legitimate knowledge; Semantic Gravity, defined as "the degree to which meaning relates to its context" (Maton, 2014:41); Semantic Density, defined as "the degree of condensation of meaning within symbols" (Maton, 2014:41); and Autonomy, which considers whether the orientation leans more toward positional autonomy- (decision about the curriculum is external to the HEI) or relational autonomy (orienationdecision about the curriculum is from within the HEI offering the programme) (Maton, 2014). Legitimation Code Theory (LCT), and particularly the Specialization dimension, proves to be a suitable framework, as it enables the analysis of knowledge practices within educational and workplace contexts (Maton, 2014), such as those presented in the various EH contexts.

As EH is in the applied sciences field, legitimation of student learning is often dependent on quite an *inflexible* set of scientific and discipline specific rules (Ramos De Lobles et al., 2015). Yet it is an accepted fact that learning beyond this inflexibility contributes to student growth and development within the discipline (ibid.). Garraway and Reddy (2016) argue this fact and suggest the approximating of the "inside knowledge" i.e., that which is strictly discipline-related scientific knowledge and "outside practice" i.e., that which is more practical related, but still valuable and legitimate for student learning.

The application of the LCT Specialization dimension, enables the development of a translation device which may be used to organise the components of teaching, learning and assessment in relation to its orientation, referred to as codes of legitimation (Maton and Chen, 2017). This translation device can be applied to guide what is legitimised as success in performance and by whom these are legitimised, i.e., the "languages of legitimation" (Maton, 2016: 10). The Specialization plane guides programme orientation in describing what is legitimised and by

whom this is legitimised and can be analytically demonstrated on a Cartesian plane, towards either epistemic relations, meaning towards “practices and their objects or focus”, or social relations, i.e., leaning more towards” practices and their subject, author or actor(s)” (Howard and Maton, 2011: 196). The Cartesian plane can demonstrate relatively stronger or relatively weaker epistemic relation of social relations, as illustrated in the figure 2.3 below:



SPECIALIZATION DIMENSION DESCRIPTION

ER+, SR+: relatively stronger orientation towards both ER and SR (the right kind of knower/possession of knowledge and having the correct attributes/disposition)

ER−, SR+: relatively weaker orientation towards ER and relatively stronger orientation towards SR (possession of knowledge is downplayed and attributes/disposition are foregrounded)

ER−, SR−: relatively weaker orientation towards both the ER and SR (neither the possession of knowledge or attributes/disposition are foregrounded/both ER and SR are downplayed)

ER+, SR−: relatively stronger orientation towards ER and relatively weaker orientation towards SR (the Knowledge code, i.e. stronger epistemic relations (possession of knowledge is foregrounded and attributes/disposition are downplayed)

Figure 2.3: The Specialization dimension and its code descriptions (Adapted from Maton, 2014: 30-31)

The Legitimation code theory (LCT) Specialization dimension may thus be used as analytical framework in this study to guide what *should* be legitimated as WIL competency achievement versus what *is* being legitimated as EH WIL achievement, by way of the emanating themes.

Competency assessment often fluctuates between emphasising theoretical knowledge and technical skill in the classroom, and relational practices such as collaboration, ethical and professional behaviour in the workplace (Dean & East, 2019; Bosco & Ferns, 2014). This may result in the student adopting different ‘codes of achievement’ depending on the context, i.e. classroom, and who is assessing them (Bertram and Rusznyak, 2024). This can result in a disconnect between competencies acquired and how the students regard these as part of their professional growth (Langsford and Rusznyak, 2024). This fluctuation in relational emphasis may, in turn, result in confusion amongst other WIL stakeholders, i.e. WIL supervisors, and

create ambiguity between the academics who assess them, and the professional credentialling body (Dunn, 2019; Jackson, 2018; Jackson, 2024).

Environmental Health practice, due to its context specific- and relational nature, requires the competent practitioner to navigate complex environments with a combination of knowledge, technical skill and having the desired dispositional and professional behaviours; it does not depend on competencies isolated from one another (Rodriques et al., 2021; Stewart et al., 2023; Shezi et al., 2021; Omid et al., 2021; Morse et al., 2020) . To this end, the LCT Specialization dimension, through application of a Specialization translation device, can reveal whether competencies required for achieving EH goals implicitly favour knowledge and technical skill, disposition, both or neither. After plotting competencies required for achievement in EH, it can be plotted on the Specialization plane and provide a diagnostic map to inform curriculum and assessment refinement. Literature highlights and confirms the ability of the LCT Specialization dimension to reveal such shifts in competency emphasis across classroom, workplace, and credentialling contexts (Winberg et al., 2018; Maton and Chen, 2020)

By highlighting these fluctuations, i.e. code shifts, LCT supports a rational, clear and context-sensitive assessment strategies for the curriculum designers. Using LCT dissects EH WIL as a pedagogy, can inform how competence is legitimized and inform how the reconceptualize its role in its teaching and assessments, as well as how it is understood on professional practice. It can thus assist in reconciling the identified disconnect and enable the integration of theoretical rigour with practical relevance and thereby improve assessment practices in the Environmental Health discipline.

2.8 Pertinent findings from the literature review

The literature reviewed collectively informs of a group of interconnected gaps posing challenges to the recognition of legitimate competencies in EH practice, competencies acquired by EH WIL students and the assessment thereof in EH education. The literature furthermore highlights challenges and shortcomings in WIL assessment, across disciplines, despite its vast benefits to students in readying them for the realities of the workplace and professional practice. In the EH undergraduate programme at a particular UoT, these assessment practices are inadequately aligned to the real-world contextual and practice-demands. Additionally, the emphasis and foregrounding of time- and exposure based credentialling criteria distorts students' development into desired professionals. The unclear and limited focus on competencies in the curriculum furthermore creates fragmentation between classroom and workplace.

Clear competency criteria and associated assessment thereof may enable a direct path to establishing competence and independent practice, i.e. entrustable professional activities (EPAs). The evaluation of EPAs, underpinned by CBE and CBA, have been adopted in the curricula of various public health disciplines, but remains strikingly underutilised in EH curricula. The current curriculum depends on implied competencies, inconsistent frameworks for competence trajectories and suppositions for the achievement of thereof.

The LCT Specialization dimension, serves as a tool to reveal and analyse the mentioned tensions. Furthermore, it presents an analytical lens to understand the relative strength of the orientation of EH competence towards either the epistemic relations (ER) or the social relations (SR), both or neither. This will aide in situating it in a knowledge code, knower code, elite code or relativist code. In doing so, it can foreground what matters – or what is legitimized- as competence and subsequent independent EH practice. The literature essentially suggests that EH practice is relatively stronger epistemic relations and relatively stronger social relations. This suggests that the current assessment focus need a revision to assess competence in both the knowledge and knower codes- currently not reflected in the curriculum. The revised assessment framework suggested, must therefore be holistic, clearly and explicitly describe competency domains necessary for EH practice—as informed by the LCT Specialization dimension, fully utilize the authentic context presented by the workplace learning and direct these toward EPAs. The need for a holistic and scaffolded framework for assessing EH WIL competence development, is accentuated by the limitations presented by the theoretical, technical and procedural assessment focus. The reframed assessment framework must benefit from the authentic context presented by the work placement through WIL and must integrate the students' progression towards reaching independent practice, i.e. EPAs. Under the guidance of LCT's Specialization dimension, the vagueness in current assessment criteria for competence can be eliminated to reveal legitimate competencies which can inform explicit criteria to inform the focus of a holistic EH WIL competency assessments. Revisiting, analysing and reframing the EH Wil assessment component is necessary to ensure the graduates are not merely academically sound, but that they can be entrusted to meet the dynamic and evolving demands of the EH practice. Given the inherent relational and context-specific nature of the EH practice, the LCT Specialization dimension provides a crucial analytical lens. Through the application of a Specialization translation device, it enables the systematic mapping of legitimated competencies across the full range of competency domains of knowledge, technical skill and relational capabilities. Consequently, the LCT Specialization dimension offers the analytical underpinning necessary to refine both the curriculum revision and EH WIL assessment practices.

The literature search revealed that, outside South Africa, research and literature regarding the training of allied health professionals from Africa is sparse. Inside South Africa, although growing, and if compared to other allied health professions research and literature relevant to EHP training and WIL remains sparse. Subsequently, this presents – and contributes to - a literature gap in the African EH WIL context. Australia and the USA presents decades of deeply institutionalised WIL learning and thus present a larger girth of research and literature on the topic. It was therefore deemed necessary to draw form these countries to provide a global perspective and to situate the study against this context.

In summary, the literature on WIL assessment directs EH programmes in RSA to a revision of WIL assessments practices. It foregrounds the need to pivot from a knowledge- and technical assessment focussed WIL component, meeting time-bound exposure-based verification criteria by its professional accreditation body, and merely using the academic as assessor, toward integrated, context-sensitive evaluation strategies that foreground competence as both technical and relational. Through executing this shift, the realities, practicalities and complexities of environmental health practice, and the broader public health goals achieved through enactment thereof, may be prominently reflected, and the contribution of EH to the public health field highlighted.

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CHAPTER 3

EXPLORING COMPETENCIES OF ENVIRONMENTAL HEALTH STUDENTS IN SOUTH AFRICA: INSIGHTS FROM WORK-INTEGRATED LEARNING

Daries, L.M., Hudson, L. and Reddy, L. 2025. Exploring competencies of Environmental Health students in South Africa: insights from work-integrated learning. South African Journal of Higher Education, 39(6): 85-112. https://dx.doi.org/10.20853/39-6-6608

CHAPTER 3

Preface

This chapter presents two sections: an introductory preface-like section, to situate the published article within the broader, over-arching analytical framework of the research and to describe how the EH curriculum, EH WIL assessment and accrediting body documentation were analysed. This is followed by a full published article presenting the specific research objective and outcomes for this part of the thesis.

This first section describes the methodological processes applied in:

- the analysis of the EH curriculum and the EH WIL assessment practices, at the specific University of Technology (UoT), whereby the course outcomes, current WIL assessment practices of the students' WIL portfolios of evidence (POEs) were reviewed – using the LCT Specialization translation device mentioned in chapter 1 (see Appenix I); this analysis informed whether disciplinary knowledge, technical skill and/or relational abilities are foregrounded and its position on the LCT Specialization plane

- the professional body verification and auditing criteria relevant to WIL and professional credentialling of graduates, which focusses on time-based exposure to the functions in the regulated scope of the profession of EH (DOH, 2009), to determine its position on the LCT Specialization plane

- the functions specified in the regulated scope of the profession of Environmental Health (DOH, 2009) were examined to map and determine its position on the LCT Specialization plane; the functions specified in the scope of the profession – which are described in chapter 2 with relevant examples of roles, functions and duties – are used to guide the professional body credentialling criteria for successful completion of time-based WIL exposure; these functions were mapped against the LCT Specialization translation device to determine its position on the Specialization plane.

As mentioned, the Legitimation Code Theory (LCT) Specialization dimension (Maton, 2014) was used as analytical lens in the analysis of the relevant documents and assessment practices. Additionally, the Specialization translation device, referred to in chapter 1 of this thesis (see Appendix I), was applied to the textual sources and assessment practices. By using these tools as analytical lens, it revealed how the curriculum, the professional body credentialling criteria - which includes the regulatory scope of practice for the EH profession (DOH, 2009) – and the current WIL assessment practices, are positioned on the LCT

Specialization plane. This analysis provided a mapping of the positioning of the respective sources resulting in the identification of distinct Specialization code relative strengths, or wekness, as either having relatively stronger or relatively weaker epistemic relations (ER), relatively stronger or relatively weaker social relations (SR), or: neither relatively stronger or relatively weaker epistemic relations and/or the social relations.

The curriculum document and current WIL assessment practice were analysed the for the degree to which disciplinary knowledge was foregrounded in the assessment criteria, resulting in their classification as knowledge codes. This means that it has relatively stronger epistemic relations (ER ++) and relatively weaker social relations (SR) due to an emphasis on the theoretical and technical knowledge. This is consistent with relative strength or weakness toward a knowledge code, as the emphasis of the assessment foregrounds disciplinary knowledge, practical application of technical knowledge and procedural mastery.

Contrastingly, the professional body credentialling criteria focuses primarily on duration spent in the workplace, quantified by the number of days or hours accumulated, and on mere exposure to the regulated functions of the Environmental Health profession. This foregrounding of time-based exposure, rather than proficiency in the application of theoretical and technical knowledge, demonstration of mastering procedural and technical applications, and exhibition of relational capabilities, such as contextual judgment, is consistent with, and privileges a relativist code. The analysis thus informs that the professional body credentialling criteria has relatively weaker epistemic relations and relatively weaker social relations, positioning it firmly in a relativist code on the LCT Specialization plane.

The results of this analysis served as the foundation for contrasting the EH curriculum outcomes, the current WIL assessment focus, and the professional orientation on the LCT Specialization plane with student and supervisor perspectives. By applying this method of interpretation and analysis, it informed the conclusion of not merely illuminating which code orientation was distinct, but also whether the orientation was relatively stronger, or relatively weaker toward to the disciplinary knowledge and technical skill, relatively stronger or relatively weaker toward the relational capabilities, or relatively stronger to neither the disciplinary knowledge and technical skill, nor relational capabilities or both stronger oriented in relation to the specialization plane, thereby making the analytic logic explicit.

With this analytical framing established, the following section presents the published article in full, where these code orientations are integrated into the specific research objectives addressed in this chapter of the thesis.

3. EXPLORING COMPETENCIES OF ENVIRONMENTAL HEALTH STUDENTS IN SOUTH AFRICA: INSIGHTS FROM WORK-INTEGRATED LEARNING

3.1 Introduction

Environmental health (EH), an allied health profession in South Africa (SA), focuses on preventative health care. The EH profession's purpose is to fulfil society's constitutional right to a healthy environment, as declared in the Bill of Rights, section 24 of the Constitution of South Africa (RSA 1996). EH is a multi-faceted profession (Kuhn et al. 2021) and is subject to rapid environmental changes (Shezi et al. 2019; Morse et al. 2020). Environmental Health Practitioners (EHPs) promote societal health and well-being (ibid.; Omid et al. 2021) and implement interventions (Dhesi and Lynch 2016) to protect society. Due to them being in the "real firing line" (Walker et al. 2014, 29), when environmental issues of concern arise, they must foster inter-professional- and community relationships to advocate for improved environmental health conditions (Morse et al. 2020). Correspondingly, EHPs require extensive competencies to perform EH roles in varied contexts (Patthanaissaranukool et al. 2020). Despite their perceived role as law enforcers, they must be able to perform beyond legislative confines (Dhesi and Lynch 2016) and graduates must be proficient in practicing and achieving EH goals beyond curriculum outcomes (Omid et al. 2021).

However, for South Africa, performance standards relevant to the full competency range for EH graduates, beyond theoretical and technical outcomes, still need to be defined, as elsewhere (Smith et al. 2021; Fleming et al. 2009). A focus on what students is expected to *do* rather than merely on what they are expected *to know* is needed (Chacko 2014), or students will have varying views of requirements for classroom-, professional credentialling- and workplace achievement due to tensions in performance standards.

Universities of Technology (UoTs) in South Africa include work-integrated learning (WIL) in most programmes as "a way of gaining on-the-job experience in the workplace" (CHE 2011, 78) and benefits to its role-players (Jackson 2015; Molomo 2021; Fung 2017, 84-100). Despite the benefits, a limitation presented is the WIL assessment tools and methods (Scholtz 2020; Dunn 2012). If not carefully designed and assessed, these may not reliably assess - and even miss - the intended competencies to be achieved by students (ibid.). Understanding the learning experiences of the students directly involved in WIL may enhance the entire WIL exercise as students themselves can better relate learning, competencies developed and gaps in their progress (Boud and Falchikov 2006). Von Treuer et al. (2011, 195) describe omitting recent graduates from WIL evaluation as a "neglected stakeholder". Competency can be

accumulated like “building blocks” that integrate holistic growth (Frank et al. 2010, 641). Therefore, it can also be observed, measured, and assessed.

This article presents the EH students’ perspectives on the full range of professional and personal competencies gained during WIL. The research aimed to understand the comprehensive competencies acquired by EH students from a University of Technology in South Africa and its orientation on the Legitimation Code Theory (LCT) Specialization plane (Maton 2014) so that limitations of WIL assessment in the current curricula may be addressed.

3.2 Environmental Health Profession and Practitioner roles in practice

The EH practice is mandated by a professional scope outlined by the Department of Health in South Africa (DOH 2009), predominantly focusing on ensuring compliance with EH legislation relevant to reaching the EH profession’s purpose. In SA, as elsewhere, there are conflicting views regarding the EHP's role in applying legislation, varying between a law-enforcement- and a developmental approach (Dhesi and Lynch 2016; Omid et al. 2021).

To navigate varied encounters, and render efficient EH services, EHPs require a comprehensive set of capabilities beyond mere knowledge and technical skills (Morse et al. 2020). This skill set comprises competencies “to perform a specific task, action or function successfully” (Frank et al. 2010, 45). For EH students, these competencies are the outcomes and indicators of the learning process and include the practitioner’s dispositions (Omid et al. 2021).

3.2.1 Work-integrated learning (WIL) in the EH Programme

Work-integrated learning (WIL) is adopted by higher education institutions (HEIs) as an essential curriculum feature (Abeysekera 2006; Govender and Wait 2017). It prepares students for practice and organisational- and professional culture and promotes the development of a professional identity (Trede 2012) whilst in the workplace.

Work-integrated learning (WIL) is a compulsory part of the training of EHPs in undergraduate Environmental Health (EH) programmes offered by HEIs in SA. Figure 3.1 was developed to illustrate the relationship between EH WIL role-players and their roles.

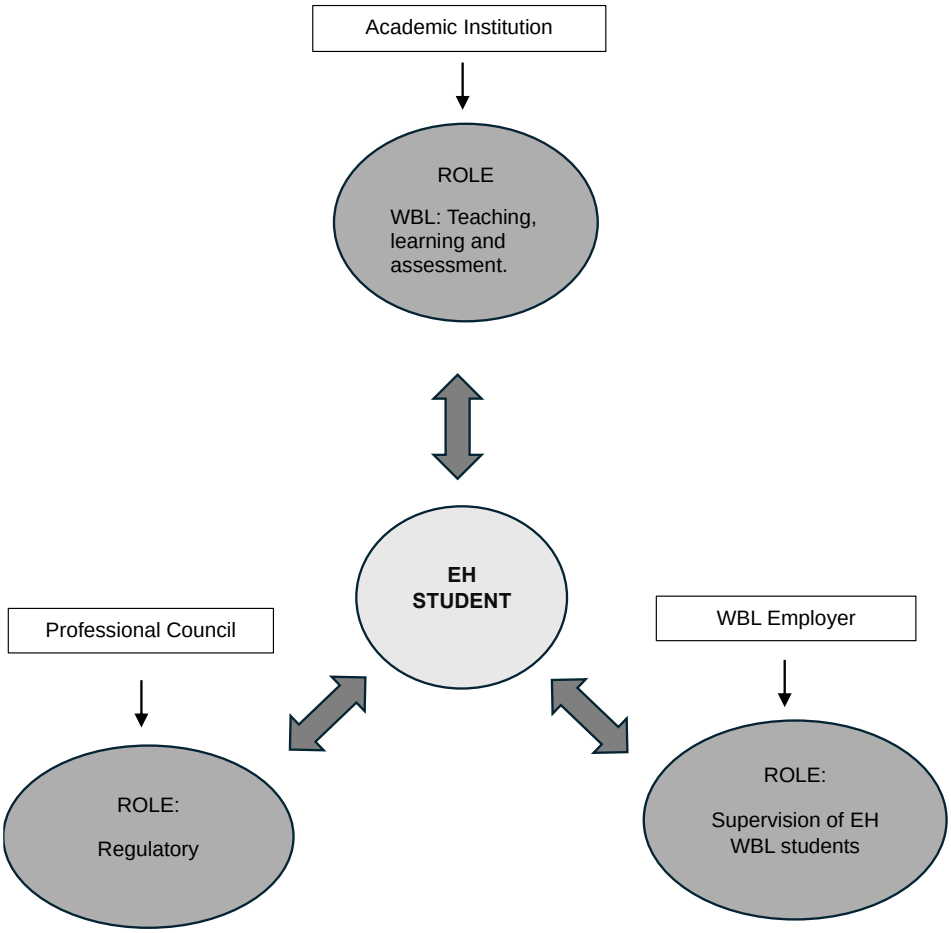

Figure 3.1: Role Players in Environmental Health (EH) Work-integrated learning (WIL) (Daries et al. 2025)

EH WIL is strictly monitored and verified by its professional council, the Professional Board for Environmental Health (PBEH) of the Health Professions Council of South Africa (HPCSA). The monitoring by the professional board includes a mid-year verification of final-year students' progress toward the completion of the prescribed minimum period spent in the workplace under the supervision of an EHP, and auditing for the students' exposure to the items in the professional scope (DOH 2009) final year students' portfolios of evidence (POEs) before graduating. This is to validate that the criteria for professional credentialling, upon the completion of the EH degree, are met (HPCSA 2018).

The EH curriculum at the academic institution used as the study site has WIL embedded in its curriculum, in the modality of work placements (CHE 2011), scaffolded for varying periods during each year of study, and aligned to the technical and theoretical criteria for meeting exit-

level outcomes (SAQA 2017). These aspects are assessed post-work placement through different methods. Criteria for competence beyond these need to be clearly stated in the curriculum, and present shortcomings as the actual competencies acquired by students are not acknowledged or assessed (Scholtz 2020).

Challenges and short-comings exist across undergraduate disciplines offering WIL as part of their curricula, e.g. a lack of standardised assessment criteria and practices for workplace-based learning (Jackson et al. 2017); no assessment of holistic development of WIL beyond the technical and theoretical (Aprile and Knight 2020); a misalignment between student and employer expectations and actual competencies of the student (Herrington and Herrington 2008) and non-involvement of the central role players in the assessment of WIL, including the students themselves or their workplace supervisors (Ferns and Zegwaard 2014). The role of WIL in bridging the theory-practice gap may be lost due to tension between role players created by these limitations (Björck 2021).

3.2.2 Challenges & Limitations in the assessment of EH WIL competence

Environmental health (EH) training research and literature are sparse and not researched (Dhesi and Lynch 2016). The global assessment of WIL in EH programmes present a challenge, regardless of the modality. In Australia, the EH program is offered by ten institutions of higher learning, yet the approaches to WIL at the various institutions are vastly different (Dunn et al. 2018). This is the case too for the 7 HEIs in RSA offering the EH qualification programmes across SA, each with its programme structure, WIL modality and assessment method, despite monitoring by its professional council.

Following the re-curriculation of EH programmes to a professional degree, the PBEH introduced a standard operating procedure (SOP) for managing WIL in HEIs in SA (HPCSA 2018). Despite this, the auditing and verification continue to centre around how WIL is managed in the programme. Therefore, the WIL assessment is partial and ignores total professional growth (Jorre de St Jorre et al. 2021).

A way to understand the WIL's effectiveness and contribution to competency development is to engage students in identifying, developing and evaluating their competencies based on *their* learning experiences and performance in the workplace (Boud and Falchikov 2006). These self-perceived gains are what students recognise as essential for competence and achievement, and they could use them to guide their future professional growth (Merga 2016).

Ignoring these may result in antagonism between curriculum (classroom) success criteria, professional body criteria, and workplace performance criteria instead of bridging this gap, thereby missing the intention of WIL (Björck 2021).

The assessment of actual competencies developed during the work placement may require a different approach (Fung 2017). Due to the nature of EH practice (Morse et al. 2020; Dhesi and Lynch 2016), the UoT is the ideal space for training EHPs, as WIL is its distinguishing mark (Scholtz 2020). When well designed, WIL allows for the student to identify goals for their professional development, whereby the assessment of WIL competencies is student-centred and based on a process of goal-setting, evidenced progress monitoring and feedback (Frank et al. 2010) from all key WIL role-players. WIL is a key component of a competency-based approach as it offers authentic contexts for students to apply their knowledge and skills and obtain feedback from supervisors (CHE 2011). It presents an opportunity to engage EH students and supervisors to support and measure professional growth through a holistic assessment.

3.3 Problem statement

Although embedded in its undergraduate curriculum, the full range of competencies relevant to achieving EH goals are vague, not fully assessed, and ignores WIL students' professional growth beyond technical and theoretical knowledge (Von Treuer et al. 2011; Patthanaissaranukool et al. 2020; Bhandari et al. 2020). Legitimation Code Theory (LCT) (Maton 2014) can organise and make sense of these competencies through an appropriate LCT dimension to reduce the gap posed by the current EH WIL competency assessment. The research objectives are to: i) understand the students' perception of competencies gained during EH WIL through in-depth interviews and document analysis; ii) use the Legitimation Code Theory (LCT) Specialization dimension to guide the analysis of the competencies by way of a Specialization translation device, and iii) use the findings, as guided by LCT Specialization to inform a holistic framework for the assessment of competencies for EH WIL students.

3.4 Theoretical Framing: Legitimation Code Theory (LCT): A Guide to Frame a Holistic Assessment Framework

The theoretical framework guiding this study is Legitimation Code Theory (LCT), which flows from the works of Basil Bernstein (Bernstein 2000, cited in McLean et al. 2013) with a focus on structuring the significance of knowledge.

Karl Maton describes LCT as “a theoretically sophisticated but practically useful” framework that may be used to de-construct the features of knowledge practices (Amundrud 2020, 19). LCT uses specific conventions for writing and spoken presentation, and additionally provides a set of six tools, referred to as dimensions, to observe, analyse and interpret teaching and learning practices (Pott and Wollf 2019; Ellery 2019). These dimensions may guide what is legitimated as a measure of success in teaching, learning and assessment (Ellery 2019). The LCT dimensions have proven useful in unpacking challenges in various education contexts, such as in engineering (Pott and Wolff 2019) to understand opportunities for learning, and in radiography to understand the challenges involved in teaching, learning, and assessing threshold concepts necessary for practice (Hudson et al. 2022). The LCT Specialization dimension was used as the lens to orientate the professional competencies, recognised as essential for success by students, i.e. legitimated by them, on a Specialization plane. This orientation (of competencies) on the plane are expressed as codes of legitimation (Maton and Chen 2017) and could result in it having relatively stronger or weaker epistemic relations (meaning knowledge) or relatively stronger of weaker social relations (meaning knower disposition), by using a Specialization translation device (Maton 2014).

Learning is social context- and-student background-dependent and therefore, the actors involved may themselves provide “legitimate insight” (Maton and Chen 2017, 47). When students understand what is legitimated in teaching, learning, and assessment, they can perform accordingly and succeed (Maton and Doran 2017). Legitimation Code Theory (LCT) thus guided what should be legitimated as WIL achievement versus what is legitimated as EH WIL achievement from the perspective of the EH students. The orientation may be located in one of four quadrants on a Cartesian plane, resulting in one of the codes of legitimation, i.e. knowledge-, knower-, relativist or elite code, as illustrated in Figure 3.2.

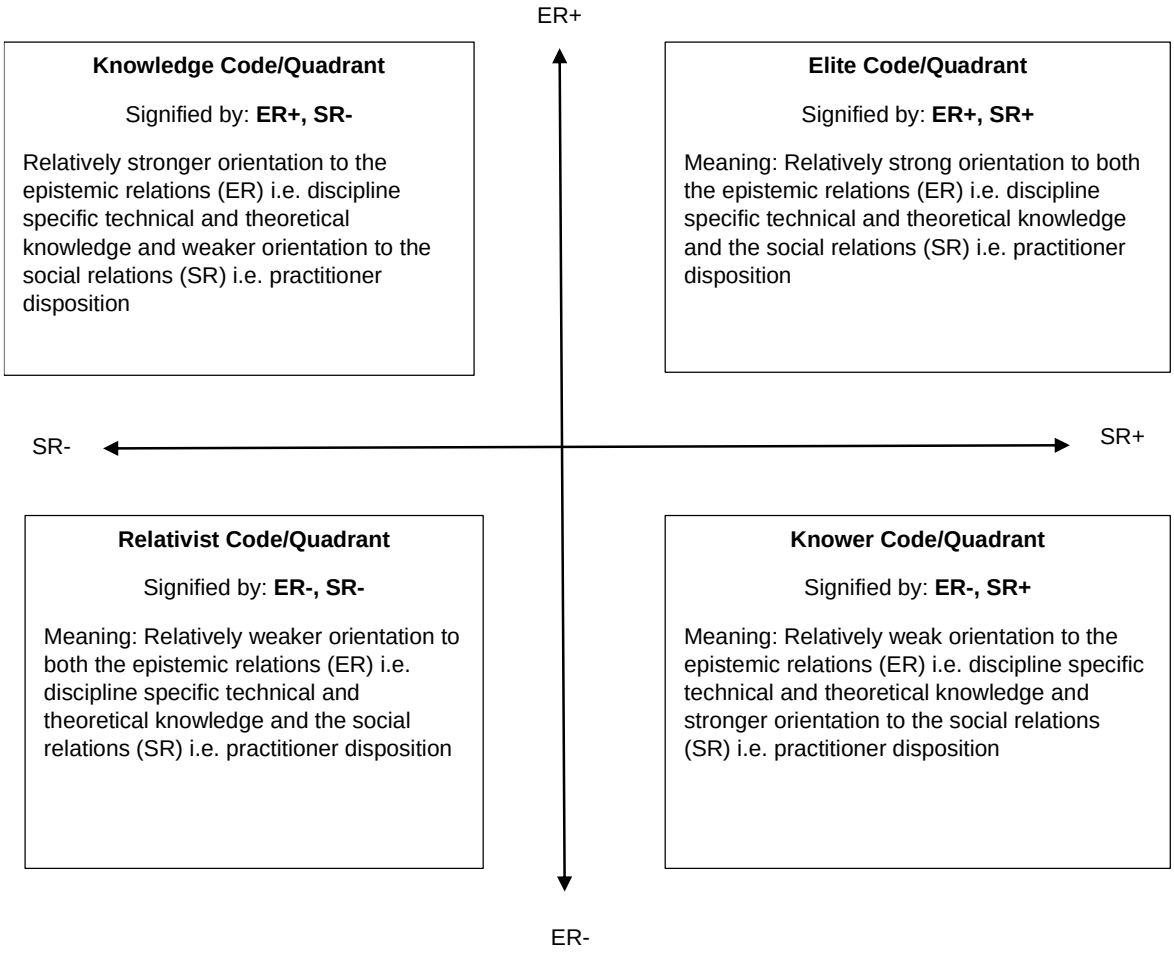

Figure 3.2: The LCT Specialization dimension and legitimation code descriptions (adapted from Maton 2014)

3.5 Research methodology

3.5.1 Research design

A qualitative methodology, underpinned by interpretivism was best suited for this study as it yielded in-depth information about participants' experiences in each context and rich, dense data through direct engagement with research participants (Umanailo 2019; Queirós et al. 2017). Interpretivism differs from a positivist approach in that the design is quantitative, the analysis is statistical, and the in-depth and nuanced experiences of the participants are not captured (Burney and Saleem 2008).

3.5.2 Selection of participants

Purposive total population sampling included all students who understood and could vividly articulate the phenomenon studied (Palinkas et al. 2015) and who completed all the WIL requirements for the EH professional degree. One cohort of senior students and one cohort of graduates had met the criteria i.e. all alumni (N=7) and all senior students (N=21). This group had sufficient exposure and experience of WIL over the four years of workplace exposure and grasped what matters and what is valued in EH practice.

3.5.3 Data collection

Data was collected through semi-structured interviews and document analyses of the students' WIL reflection journals. Guiding questions for the interview and document analysis were:

- What skills have you developed during your work placement?
- What knowledge have you acquired during your work placement?
- What values unfolded in you during this experience?
- What attitudes were you encouraged to develop during your work placement?

3.5.4 Data analysis

The Atlas.ti 9 software (ATLAS.ti Scientific Software Development GmbH, 2021) was used for the initial organising and transcribing of data as it can handle audio recordings and large volumes of textual data.

Data from interviews and documents were analysed by thematic content analyses (Braun and Clarke 2006). Audio-recorded data was first transcribed, and then iteratively interpreted to determine and map patterns from recurring data (Saldanha 2016). Following this was open, inductive coding, focused categorisation, and descriptive and interpretive coding (Saldanha 2016 informing final codes and themes (Braun and Clarke 2006). Meaningful information relevant to the study objectives was extracted through textual analysis.

A Specialization translation device was developed to "enable productive dialogue between data and theory" (Maton and Chen 2017, 27). This translation device served as the lens through which the data was analysed, and the emerging themes were plotted on the Specialization plane. The Specialization plane presents a continuum of strengths, from stronger to weaker, in its relation to the epistemic relations (ER) or the social relations (SR).

Thus, a competence, i.e. emerging theme, would always have both an epistemic relation as well as a social relation, but vary in its relative strength to the ER and or SR, i.e. could have a stronger (+ or ++) or weaker (- or - -) relation to the ER or SR. The participants used qualifying words, phrases, tones, or nuances to express emphasis. These emphasising expressions aided in determining the strength of a theme toward either ER or SR. It was, therefore, necessary to adapt the translation device to capture the emphasis in its different forms, as less than one-third of participants have English as a first language.

The LCT Specialization dimension provided the basis of analysis to ascertain whether the competencies gained by the participants are relatively stronger (+) or relatively weaker(-) in its epistemic relations (ER) or social relations (SR), to both or neither. It was anticipated that the outcomes would inform criteria and guide the competence assessment in EH WIL, thereby reducing limitations in current assessment practices and making it holistic rather than replacing them.

Table 3.1 presents an example of the Specialization translation device and how it was applied to the data.

Table 3.1: Specialization Translation Device with examples of its application to the data collected (Daries et al. 2025)

RELATIONSHIP STRENGTH	EPISTEMIC RELATIONS (ER)		SOCIAL RELATIONS (SR)	
	Relative strength about an identified competency	**Examples of self-perceived competencies from the data and its relative strength toward the epistemic relations**	**Relative strength about an identified competency**	**Examples of self-perceived competencies from the data and its relative strength toward the social relations**
Strengthening relations ↓ **Weakening relations**	ER++: express strong emphasis, e.g. vital, crucial, very important or essential	*"…it is **crucial** to check inside the fridge because they always have a lot of bodies to keep and therefore, they might be storing one on top of the other." (RJ_SS6)*	SR++: to express strong emphasis, e.g. vital, crucial, very important or essential	*"Number one is respect towards people …the public, the members of the public ... as well as your colleagues."* (SS1))
	ER+ : express importance but not a strong emphasis, e.g. important, required, favoured or valued.	*"I would say when it comes to the legislation, …I could actually see how to apply that knowledge … and why it is **necessary** to know the legislation."* (SS5)	SR+: express importance but not strong emphasis, e.g. important, required, favoured or valued.	*"Professionalism goes a long way. Therefore, you must be professional."* (AL1)
	ER- : Express no emphasis, e.g. trivial, no role or not relevant	*"It is important that someone has this kind of qualities because it's **not really about the knowledge**; it's about the type of person that you are." (SS13)*	SR- : Express no emphasis, e.g. trivial, no role or not relevant	*"…an EHP without knowledge, I don't think is a good idea; people out there will challenge you…"* (SS6)
	ER- - : express strong down-play, e.g. not needed at all, does not matter or plays no role	*"…legislation is **not a big issue**… legislation is not cast in stone…it changes all the time based on new knowledge being developed." (AL6)*	SR- -: express strong down-play, e.g. not needed at all, does not matter or plays no role	*"I think the most important knowledge that I've gained is from the legislation because they outline our scope of practice … they act as a guidance in order for us to execute the job correctly."* (SS11)

3.5.5 Ethical considerations

Verbal and written informed consent were obtained before the commencement of each interview. Participants could withdraw from the interview at any point during or after the interview.

For document analysis, consent was obtained from the relevant faculty at the UoT (Ethical clearance ref. no. 189045701/11/2021) to gain access to the students' documents and to conduct interviews with those enrolled at the UoT at the time of data collection. Individual verbal and written informed consent were obtained from the rest of the participants not enrolled at the time of data collection, i.e. alums.

Due to the presence of personal identifiers, e.g. in statements commonly used by a participant in everyday speech, audio recordings will not be shared. The anonymized data transcripts may be shared via the UoT's data repositories and the restrictions in the data management plan will be observed.

The study focussed only on the EH professional degree programme at one UoT, focusing only on work placement in municipalities.

3.5.6 Quality assurance and rigour

Researcher positionality is considered a limitation in qualitative research (Holmes 2020) due to the researcher's context-dependent and inter-changeable role. As the WIL coordinator of the EH programme at the UoT under study, i.e. research site, the researcher became aware of the system-related challenges relevant to WIL in the EH undergraduate programme.

Working closely with the participants in this position may have created a benefit due to an existing rapport with participants. Being aware of this potential bias, the researcher remained flexible and avoided informant bias by abandoning information irrelevant to the study (Chavez 2008) and using identical probes where participants assumed the researcher understood the depth of their experience (Dwyer and Buckle 2009). Understanding the biases helped the researcher to mitigate them by being flexible (Morse et al. 2002), giving neutral responses to irrelevant responses (Clarke 2006), and practicing ongoing researcher reflexivity to circumvent them (Holmes 2020; Chammas 2020). The researcher remained conscious of changing

perspectives, positions, and relationships with the study (Holmes 2020), taking a position in the ‘space’ between the role of insider and researcher (Dwyer and Buckle 2009).

The semi-structured interview guide was piloted to ensure clarity and dependability of questions, consistency in depth-soliciting prompts, and time for the interview. A process of iteratively checking data, moving back and forth through data interpretations (Morse et al. 2002) was done. Participant ideas were corroborated through summarised feedback of responses during interviews and member-checking for accuracy. Peer review was done through debriefing and debate with research supervisors to ensure credibility, confirmability, and dependability (Lincoln and Guba 1985, In Morse et al. 2002). A ‘data collection form’ was used to guide and organise the document analysis data into categories and describe the themes.

Accuracy was maintained by traversing between the document and transcript analyses to obtain clarity where sufficient detail was required to answer the specific research questions. Bowen (2009) suggests this is useful for corroboration of information obtained from the interviews and the documents.

3.6 Findings & discussion

A total of 21 participants, consisting of 15 senior students (SS) and six alumni (AL), were interviewed, and their WIL reflection journals (RJ) were analysed. Codes were assigned to anonymize each participant and their respective documents.

3.6.1 Thematic Framework

As guided by Braun and Clark (2006) and from the data analysis, the themes derived are knowledge, skills, and professional behaviours, the latter having values and attitudes as sub-themes.

3.6.2 Using LCT Specialization to orient current assessment of competence in the EH programme

The LCT Specialization dimension was the tool that was used to establish the current assessment focus of both the EH curriculum and the PBEH verification and auditing orientation on the plane. The current assessments, as per the curriculum document (SAQA 2017) are stronger in their epistemic relations (ER++) than the social relations (SR-). Therefore, the

assessment focus is located in the *knowledge* quadrant of the Specialization plane. It assesses theoretical and technical knowledge as part of curriculum exit level outcomes- and scope of practice exposure perspective.

The standard operating procedure (SOP) for the management of WIL in the EH undergraduate programme by the credentialling body (HPCSA 2018) is relatively weak in its orientation toward epistemic relations (ER- -) and social relations (SR - -). The PBEH WIL verification tool (PBEH 2022, email message to author, 25 May 2022) focuses on WIL administration in the EH programme, placing it in a *relativist* quadrant as neither knowledge- nor knower code is emphasised, meaning it is relatively weaker in its epistemic relations and relatively weaker in its social relations.

The self-perceived competencies gained by students during WIL, as per the analysis results, are relatively strong in their orientation to both the epistemic relations (ER++) and the social relations (SR++) and are located in the elite quadrant of the Specialization plane. These are described and discussed further in this article. Figure 3 illustrates the *tension* uncovered by the LCT analysis and the *shift* in the focus of EH students' competencies depending on context.

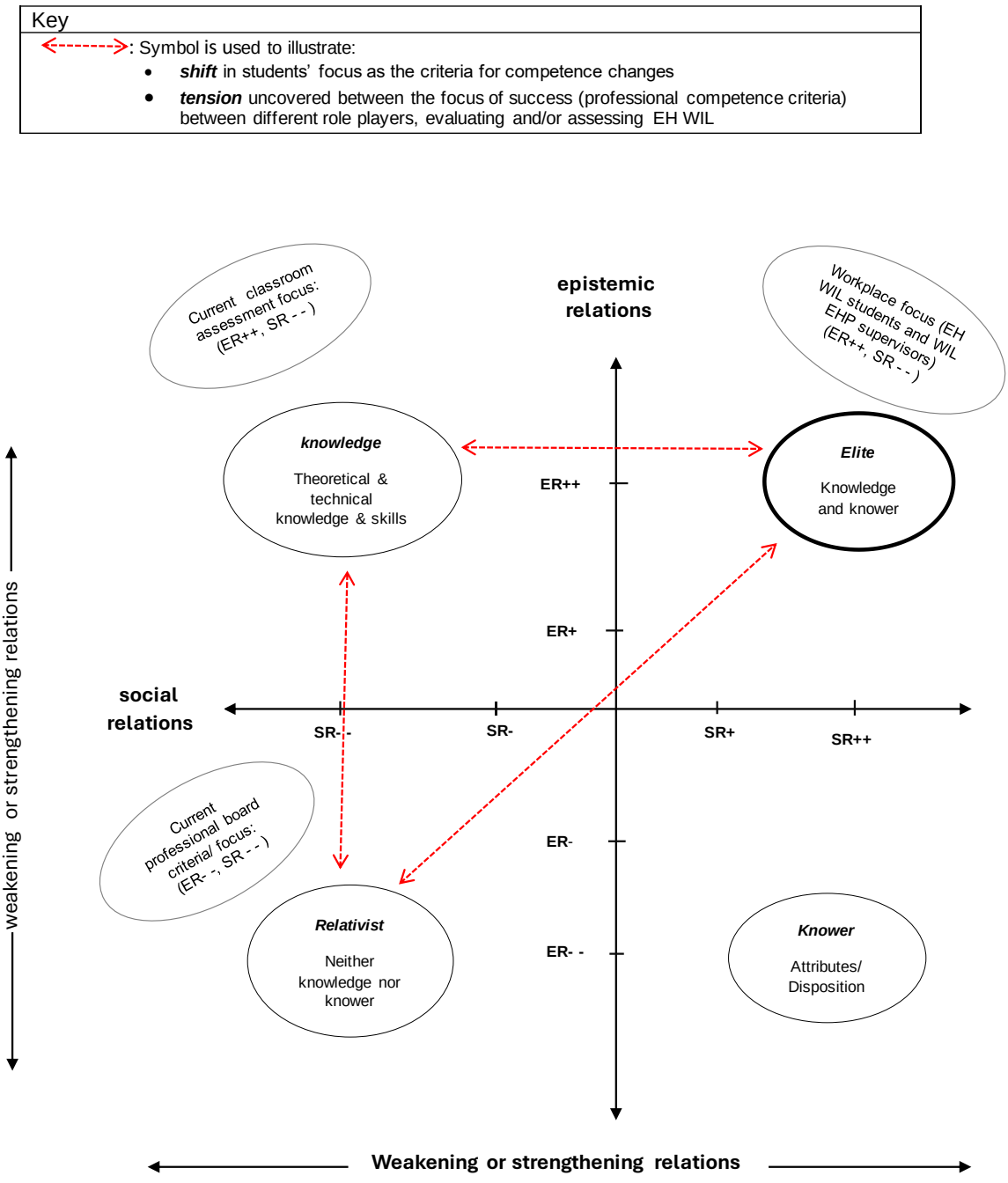

Figure 3.3: Diagram illustrating tensions between role players and shifts in EH WIL students' competency focus (Daries et al. 2025)

3.6.2 LCT Specialization orientation of EH students' perceived competencies gained during WIL (as illustrated in Figure 3.3)

3.6.2.1 Knowledge (Conceptual)

This theme centres around the 'what,' i.e. 'conceptual knowledge,' defined as factual information (Schmidmaier et al. 2013), i.e. the technical and theoretical knowledge necessary for EH practice. This knowledge supports the processes and procedures to perform practice-related work tasks (Franz et al. 2022). Participants emphasised conceptual knowledge as "very important to have" (AL4) and described lacking this as "meaningless" (SS1) to the EH profession. They related that being in the workplace enhanced their understanding of using conceptual knowledge in EH practice.

Two participants felt that too much theoretical content is imparted in the classroom: "There's way more stuff that we learn out in the classroom" (SS8) and that it is "totally different from what is practiced in the workplace" (SS9).

Participants shared that knowing and understanding the EH legislation, such as the scope of practice and EHP roles are essential in EH practice. This was described as "more important" (SS14) than other knowledge, and that "You must know your legislation before you can actually do your work" (AL2). They equated knowing the legislation to being a competent EHP, as explained by one participant: "When you know your legislation, you would really be an [sic] competent environmental health practitioner" (SS4).

Despite this emphasis on knowledge, many participants however, felt that applying knowledge of the legislation and the professional scope requires a "soft approach" (AL4) as EH practice "deals 100% with people" (AL6) both inside the organisation and within society. Participants thus recognised the practitioner's disposition in enacting mandated duties and roles. Participants are acutely aware of the powers and authority assigned to the EHP but view the EHP's role as one of uplifting the community and promoting health and well-being:

…(you) shouldn't put that on your mindset that you have the power to close them down. Just have a positive attitude and try to help them so that they may comply, rather than to enforce, enforce and acting all big and all that. (SS13)

Possessing conceptual knowledge of various EH legislation and its contents was foregrounded and emphasised as crucial for competence, but so too was the disposition of the EHP. Thus, the epistemic relations are relatively stronger than the social relations in this context and are illustrated as ER++, SR+ on the LCT Specialization plane.

Although emphasised by the participants, conceptual knowledge cannot solely solve 'wicked problems' of EH, meaning issues that cannot be solved by a 'true or false' solution but rather by a 'good or bad' approach (Stewart et al. 2023,156). This approach requires a set of capabilities (Whiley et al. 2019), such as the disposition of the EHP, the possession and extent of their soft skills, and social- and relationship skills to achieve the outcomes of legislation. Thus, conceptual knowledge alone, such as legislation application and enforcement, cannot solely be used for problem-solving in EH practice (Schmidmaier et al. 2013). Others support this notion that EHPs do not merely perform within legislative confines, such as in Australia (Dhesi and Lynch 2016), a misconception that exists even within the organisations in which EHPs operate (Smith et al. 2021).

Additionally, as EH issues vary from one geographic location to the next, EH's "wicked problems" require the complementary skills of other disciplines within the organisation (Stewart et al. 2023). Thus, relationship skills and fostering cooperation amongst clients and inter-departmentally to achieve desired health outcomes are necessary for EHP competence. In doing so, the complete competency set of the EHP can be better utilised and supplemented (ibid.) to solve EH problems. This aspect depends on the attributes and disposition of the individual and is discussed further in this section. Emphasizing knowledge and technical skill in the training of EHPs may result in a practitioner being unable to reach EH goals. Identifying and addressing these gaps in undergraduates may eliminate the space between classroom and workplace, as was the case in an engineering undergraduate programme (Pott and Wolff 2019), thereby enhancing employability and meeting employer requirements. Criteria for knowledge assessment are present and explicit in the EH curricula, but not so for practitioner dispositions. Re-design of the WIL to include the knower disposition in teaching, learning, and assessment is thus necessary.

3.6.2.2 Skills: process and procedural

This theme describes the practice-related procedures, actions, and processes applied in EH. Processes are the actions taken to achieve an outcome, while procedures are the specific instructions or steps to complete the task (Nguyen 2020). For example, the EHP must perform

the Food Control (DOH 2009) function as a process. The procedures to achieve this include, amongst others, taking food samples following steps prescribed by legislation (DOH 2018) and conducting food premises inspections.

Participants explained that being in the workplace enhanced their understanding of EH practice by giving them “more of an idea of what you're going to be doing exactly” (AL4). This includes which “steps and procedures to follow in the performance of functions,” related as “one of the pre-requisites” (SS9) “to execute the job correctly” (SS11).

Conceptual knowledge helps students to understand these processes and procedures applied in practice. This finding is supported by studies exploring the benefits of WIL (Jackson 2015; Smith 2012; Björck 2021)

Participants repeated that having the skills to enact the technical work requires specific soft skills, as one participant explained:

…how you handle yourself, how you approach people, how you interact with them, and how you communicate with them is more important than your knowledge, because you can go and tell someone all your knowledge, but as long as you are not presenting yourself good enough to them, they are not going to listen to you, so it's just a waste of time… (SS12)

In addition to technical procedure, participants highlighted interpersonal communication skills as a significant requirement for competently executing EH duties. They described this skill as “one of the main abilities… strengths that you have to have” (SS7). Being capable of effective interpersonal verbal communication is regarded as “the key” (SS1, SS15) to (practice) environmental health and is regarded as “extremely important” (SS9). Participants foregrounded communication abilities as integral to EH practice, thus having strong epistemic relations and strong social relations, i.e. ER++, SR++ on the Specialization plane.

Criteria for process and procedural skills are explicit in the EH undergraduate curriculum, but not for the practitioner attributes underpinning these. Using the workplace - an authentic context - for its assessment will enhance the development of this skill, and its assessment validity (Ajjawi et al. 2020).

3.6.2.3 Behaviours: Values and Attitudes

In the study context, behaviour is how participants interact with others in the workplace. Behaviour in the workplace is underpinned by the disposition of the individual, which is comprised of attitudes and values deemed appropriate in the performance of EH duties. Thus, attitude describes how participants feel or think about the EH profession. Attitudes are underpinned by values, i.e. personal – and professional principles of behaviour such as confidence, humility, being approachable, and managing conflict, and together, these inform behaviour. Values subscribed to are informed by personal beliefs that participants either possessed before, developed during WIL, or that were enhanced by WIL. Emotional intelligence (EI) underpins behaviour and is the ability to recognise the emotions of oneself and others and to act accordingly (Gribble et al. 2017).

The data informs that emotional intelligence (EI), and its various traits inform and direct behaviours. Figure 3.4 was developed to illustrate the relationship between the aspects influencing behaviours, such as beliefs, values, and attitudes, as well as the underpinning role of EI.

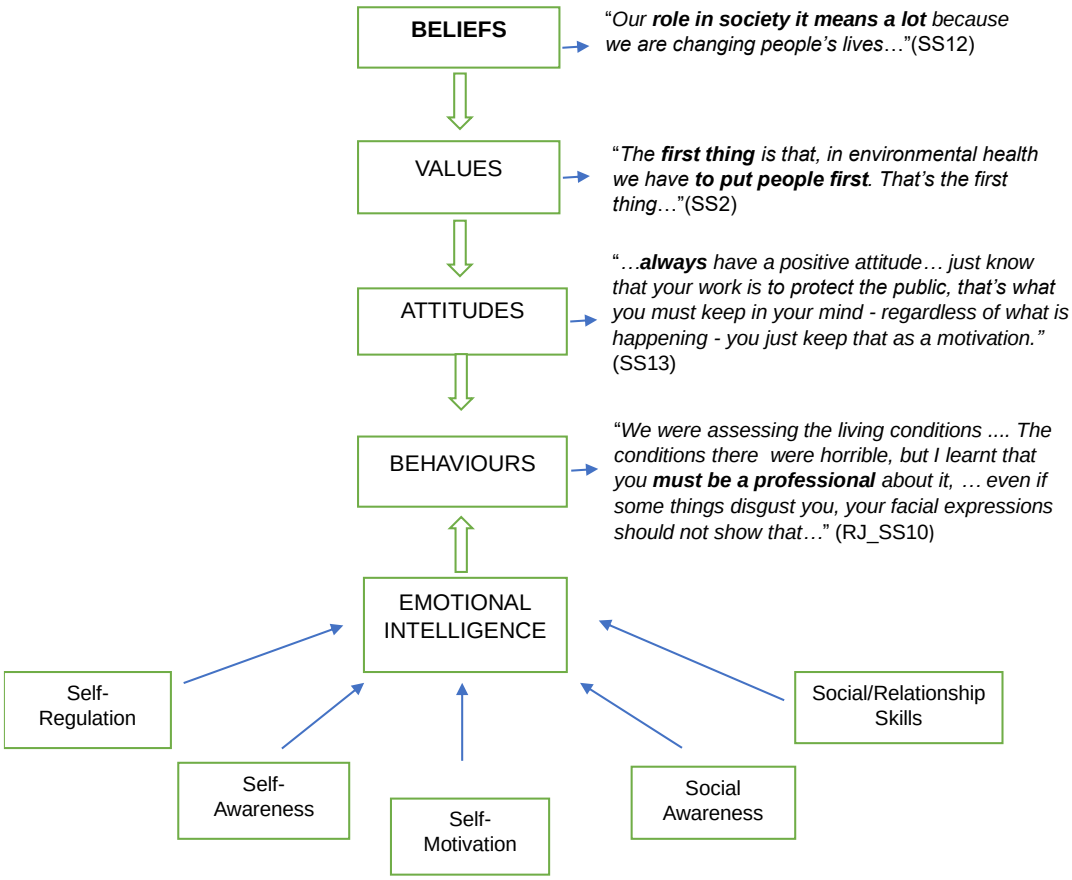

Figure 3.4: Relationship between professional and personal values, attitudes, behaviours and EI as a competency (adapted from IAA, 2015)

The emotional intelligence traits reported by participants are illustrated in Table 3.2 and supported by relevant examples from the data.

Table 3.2: Attitudes and values: Relationship with emotional intelligence categories (Daries et al. 2025)

Emotional Intelligence Trait Description (Serrat 2017)	**Examples from the Data**	**Competence Theme & Specialization Strength of Relations**
Self-awareness Emotional awareness/ Accurate self-assessment/ Self confidence	*"I was so nervous because I had not answered the phone before, but I answered, and after talking on the phone, it was as if I had overcome a milestone, but it is still something I need to get used to*." (RJ_SS7)	Attitude SR+/ER+
Self-regulation Self-control/ Trustworthiness/ Conscientiousness/ Adaptability/ Innovativeness	*" I've realised that now, that I need to work on the patience, because of lack of patience, now, the temper then comes in as well. "* (SS4)	Valued behaviour SR+/ER-
Self-motivation Achievement-driven/ Commitment/Initiative/ Optimism	*" I still want to be an EHP. I want to stay being an EHP. I don't want to break out for something else; I want to be an EHP …I think the fact that we are not recognised - as much as it is demotivating - in some way, it makes you want to do more! It makes me want to make a difference so that we are recognised."* (SS7)	Attitude SR++/ER- -
Social awareness Empathy/ Service orientation/ Diversity understanding & acceptance/ Developing others/ Political awareness	*"…for example, I do inspection, and I see a non-compliance, I can't just close down the business; it's still that person's bread and butter! So, you must be compassionate towards the next person because you don't know what his situation is about." (AL3)*	Attitude, Valued behaviour SR++/ER++
Social/Relationship skills Influence/ Communication/ Leadership/ Change Agent/ Conflict management/ Building bonds/ Collaboration and cooperation/ Team Capabilities	"*I feel like a warm approach works better because I've been out with other EHPs, and they just came with a more welcoming approach, just more positive, cause with a positive approach, you just get the best out of people you work with."* (AL4)	Attitude, Valued behaviour SR++/ER- -

Participants described various aspects of EI required for competence in practicing EH. Table 3.2 describes participants' self-awareness about their strengths and short-comings; self-regulation, meaning the ability to control their own emotions, e.g. conflict de-escalation; self-motivation, as it relates to their opinion about the practice; social awareness, relevant to how their actions, in whatever form, may affect others and social and relationship skills, relating to fostering cooperation and being able to work as part of a team.

EI traits were consistently highlighted, either as being enhanced by WIL or essential for EH practice competence. EI is an ability, personal trait, or both (Srivastava 2013). Literature suggests that having low EI may impact the ability to work independently, cope with stress and increase anxiety (Gribble et al. 2019). Possessing increased emotional intelligence traits is regarded as especially important in service-delivery practices requiring interaction with clients (Srivastava 2013). EI is considered essential for effective reciprocal communication and conflict management (Ghanbari et al. 2019; Heris and Heris 2011), attaining success in the workplace and contributing to organisational goals (Papoutsi et al. 2019), a positive work experience and attitude in the workplace (Carminati 2021) and enhancing efficiency (Lima et al. 2022) and teamwork (Serrat 2017). Increased EI may also impact graduate employability as it forms part of employers' desired 21st-century skills for employability (Kumar et al. 2019; Tushar and Sooraksa 2023).

Despite its valuable role, including the development of EI in the curricula of many disciplines offered by HEIs needs to be improved (Gribble et al. 2019; Kumar and Sharma 2019). Although some individuals may innately have higher EI than others, emotional intelligence traits can be taught and learned (Serrat 2017). Participants indeed reported that the WIL helped them develop conflict management, problem-solving, and critical thinking skills- especially during the emotionally charged events they are exposed to during their workday-, adapt to the workplace, cooperate with others, teamwork, being flexible, having empathy, being efficient and having a positive attitude towards the practice.

Behavioural competency depends on the individual's level of EI and is relatively stronger in its social relations (SR++) than its epistemic relations (ER+). Participants relate that knowledge means nothing if the EHP does not have the desired personality traits to enact it. Participants understand that knowledge is relevant and essential to EH (ER+) but requires a specific disposition to enact it in the real world of work (SR++).

Behaviour is currently not explicit in the undergraduate EH curriculum nor assessed. To best prepare undergraduate EH students for the realities of EH practice, workplace requirements beyond the technical and theoretical should be made explicit and be part of a holistic assessment of competence. Thus, it is recommended that the development of EI be made more explicit in the EH curricula by way of teaching, learning, and assessment and included as part of the full spectrum of competencies needed for success in EH practice. It should be consciously developed in the EH student and, as suggested, be scaffolded in the curricula (Heris and Heris 2011; Kumar et al. 2019). To reduce the mismatch between employers in EH, and other discipline-specific educational contexts, EI capabilities must be included in curricula and consciously developed to meet 21st century employability criteria (Tushar and Sharooksa 2023). This includes a process of goal setting, reflection, and feedback for the student during the assessment in an authentic context such as the workplace (Ajjawi et al. 2020).

3.6.2.4 Attitude

Participants reflected on how they felt about the EH practice. They felt that the EH profession needs to be recognised, and better understood, and that it is under-valued by society and other allied health professions. Despite this, participants remained optimistic about their future role as EHPs and the contribution they could make towards the well-being of society, as per the interview excerpt:

AL2…other professions at the Department of Health don't even know about us, and they take advantage, or they take us as nothing.

R: Okay, and how does that make you feel about the profession?

AL2: It makes me sad and - because I know what we do and we are important and we do…yeah… there is something positive that comes out of our work, so, even though they don't know about it it's fine! At least I know!

Smith et al. (2021) concur with this invisibility of EH in Australia, amongst allied healthcare workers, and within the broader primary/public healthcare system. The value of the EH practice may be lost without a conscious effort to highlight the EHP's role in reaching organisational goals and community well-being (Whiley et al. 2019) due to the EHP's role being unknown to the general public (Whiley et al. 2019). A basic understanding of exactly what they do, and the vital role they play in protecting public health, is lacking, as is the case for EH in North America (Gerding et al. 2019) and Australia (Dhesi 2014). Most do not understand their functions and

roles beyond the confines of legislation (Dhesi and Lynch 2016), or the value added in managing health disasters (Whiley et al. 2019). Smith et al. (2021) suggest that EHPs' roles are diminished and simplified to law enforcement, and their full range of competencies and contributions to organisational goals and health protection need to be recognised. The implication is that there may be little interest in EH as a career for the future (Gerding et al. 2020).

Despite this, the positive attitude shared by participants extends to their future career plans and growth in EH practice and their contribution to societal health:

I've learnt that I need to always try and look at different aspects with open eyes, and try to not approach situations the same way; … I still believe I made the right choice by choosing environmental health, but the next few years in the field will reinforce that...(RJ_SS8)

Making the full range of competencies explicit in the training and assessment of EH students further strengthen the argument for establishing exactly what holistic competency criteria look like from the student's view beyond the confines of the curriculum exit-level outcomes. This view may subsequently contribute to the EH profession's promotion and recognition by society and its contribution to the broader primary healthcare goals within society (Stewart et al. 2023). The student perspective could assist in adapting the curriculum and making explicit the competencies required in the future EH professional. These may be used explicitly to promote the discipline by its professional boards, EH employers, and HEIs to train future EH professionals.

3.7 Conclusion

When viewed through the LCT Specialization lens, competence to practice EH is located in the *elite* quadrant, i.e. ER++ and SR++, as participants relate to gaining the combination of *knowledge* and *knower* attributes to practice EH competently. The implication is that a *code shift* is present amongst EH students across geographic regions and differing contexts, as the curriculum assessment is on knowledge and skills, and the credentialling criteria are on managing WIL in the programme, i.e. *relativist* code, without regard to competence to practice. During WIL, students recognised competency indicators, i.e., the game's actual rules, using the full range of competencies consisting of knowledge and knower attributes.

The gaps in the EH training curriculum and the associated competence assessment are not unique to South Africa. These too have been identified in Australia (Dunn et al. 2018), Iran (Omid et al. 2021), Thailand (Patthanaissaranukool et al. 2020) and India (Bhandari et al. 2020). A paradigm shift is suggested for all role players involved in the assessment and

credentialling of competence. WIL, being an authentic learning context, and one in which all the discipline-specific essential professional competencies are developed and enhanced - as identified in this paper - can be re-designed to address these gaps in EH curricula. As suggested by the literature and this study, the number of days spent in the workplace does not truly reflect what makes a competent EHP or graduate.

Literature suggests that competency-based assessments may require a change in the curriculum, may be time-consuming, complex to design, and should involve all parties. A solution is an outcomes-oriented competency-based assessment (Matsuzuka 2020), i.e., no change to the curriculum but adapting the WIL component to assess competency.

As competency assessment requires the involvement of all the role-players in WIL for EH students, it is suggested that information be obtained from those supervising the WIL students to determine what competencies they observe unfolding in the students as they have more time with the students during WIL than the academic(s) assessing them, and those responsible for professional credentialling. Currently, the EHP WIL supervisors are not involved in the assessment of the students' competence. This information, together with the results of the LCT Specialization analysis of this study, could provide a complete picture of the range of competencies developed in the EH WIL student and better inform a holistic assessment framework while still meeting the outcomes of the curriculum.

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CHAPTER 4

CAPTURING THE DEVELOPMENT OF PROFESSIONAL COMPETENCIES IN ENVIRONMENTAL HEALTH WIL: PRACTITIONER OBSERVATIONS AND ASSESSMENT IMPLICATIONS

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[1] Please see *Appendix L* for the manuscript round 1 reviewer comments and author responses, and *Appendix M* for the evidence of manuscript submission for round 2 review.

CHAPTER 4

4. CAPTURING THE DEVELOPMENT OF PROFESSIONAL COMPETENCIES IN ENVIRONMENTAL HEALTH WIL: PRACTITIONER OBSERVATIONS AND ASSESSMENT IMPLICATIONS

4.1 Introduction

Work-integrated learning (WIL) supervisors, who spend the most time with the student during the work placement, directly observe and can identify the professional growth, or lack thereof, in the WIL student under their supervision (Jackson, 2018a). Due to their proximity to the student during WIL, the supervisor is suitably situated to observe and provide frequent feedback to WIL students regarding their progress in developing professional growth (McNamara, 2011).

In environmental health (EH) WIL, the supervisor is similarly proximal to the EH WIL student, observing the competencies they progress toward in, amongst others, food inspections, environmental health risk assessments, and developing the attitudes and values required of the practitioner. Chuang et al.'s (2025: 625) adapted definition describes professional competence as "the integration of knowledge, skills, attitudes, and values necessary…" to perform disciplinary-specific roles effectively.

A benefit of WIL is that students gain discipline-specific competencies but fail to convey these amply (Goodwin et al., 2019). Their workplace supervisors consistently assign higher appraisal outcomes for their performance in the workplace that they do in self-assessments (Jackson, 2018b; Nisbet et al., 2022). These are overlooked if assessments do not consider intricacies of the real workplace and weaken the aims of WIL and consequently, competency-based education (CBE) (Garraway, 2022; Gerdera, 2023).

McNamara (2011) suggests using a variety of evidence sources to assess WIL, including that from students themselves, supervisors, and academics, to provide a reliable assessment of WIL. Effective feedback from WIL supervisors can reduce challenges in WIL assessment and guide the assessment to be holistic (McNamara, 2011; Makathini, 2016). This benefits students, as it may present ways to measure or achieve success (Boud et al., 2022). The development of the desired competencies can enhance the development of entrustable professional activities (EPAs) in the student. EPAs are described as developing competence

in an activity or task to the level that the task can be performed independently by the individual (Cate & Schumacher, 2022). The assessment of EPAs can be used in assessing students' progress toward independent practice (Cate & Schumacher, 2022).

Whilst the benefits of WIL are widely described in literature, few studies explore the contribution of the WIL supervisor (McNamara, 2011) in the comprehensive assessment of WIL students or in guiding improvement in future WIL practice.

4.1.1 Study Purpose

The purpose of this study is to describe the competencies developed by Environmental Health (EH) undergraduate students as observed by their EH practitioner (EHP) workplace supervisors during WIL placements. The result of this study informs improvements in the training of EH students to include the assessment of, and progress toward, holistic competencies in EH WIL students and to gauge their readiness for independent practice.

4.1.2 Background

4.1.2.1 Work-Integrated Learning in the Environmental Health Degree

Work-integrated learning (WIL) provides students with practical exposure and prepares them for the world of work (Jepngetich et al., 2019; De St Jorre & Oliver, 2017). Environmental Health (EH) students undergo compulsory WIL, completing 100 days in the workplace. This WIL is monitored, verified, and audited by the Health Professions Council of South Africa's (HPCSA) Professional Board for Environmental Health (PBEH). However, beyond verifying exposure to regulated EH professional activities (Department of Health, 2009), no framework explicitly guides the comprehensive professional competencies required of EHP graduates.

A specific University of Technology (UoT) in South Africa had its first enrolment of students for a new bachelor's degree program in 2017. WIL, as was with the previous EH Diploma curriculum, continued as a program component, with the nearby metropolitan municipality being the main WIL work placement provider. This degree has a curriculum which describes general exit level outcomes but does not clearly specify the competencies required of students, or how these may be measured (SAQA, 2017). The specific competencies required for independent practice are not clearly described, neither does the curriculum provide a framework for how it should be measured.

The EH undergraduate curriculum is geared towards professional registration requirements, i.e. the fulfilment of a specified period in the workplace through its WIL module (HPCSA, 2018). Subsequently, when compared with the core requirements of a competency-based curriculum, and an associated competency based-assessment, the EH undergraduate curriculum is theory focused and merely partially aligns to CBE. CBE in health-related training programs is promoted by the World Health Organization (WHO) as part of their roadmap to effectively deliver core basic public health functions and respond to incidental matters (Hunter et al., 2023). CBE focuses on competency development beyond integration of knowledge and its practical application but integrates development of problem-solving abilities and generic skills in real-life contexts (Janssens et al., 2023). If CBE is not effectively implemented into the training curricula, both supervisors and students may not adequately understand the importance of competency progression needed in the practice (Janssens et al., 2023). The partial alignment of EH curriculum to CBE, e.g. the lack of involvement of industry WIL supervisors, unclear competency descriptions and unclear competency assessment, means that students' eventual independence to perform mandated functions, i.e. EPAs cannot be adequately assessed.

4.1.2.2 Assessing Competencies in WIL Students

Assessing competencies in WIL students is challenging, as academics do not spend prolonged time periods with students during their work placements. Literature suggests that time spent in the workplace is not an accurate criterion for competence (Dunn et al., 2018). Bertram and Rusznyak (2024) echo this finding, stating that students merely gain time as observers but do not necessarily develop a different perspective on the practices and the reasoning behind it.

Although embedded in the EH curriculum, specific competencies beyond knowledge and technical skills remain unclear, and no criteria guide their assessment. EH programs offered by different higher education institutions (HEIs) in South Africa may have varying criteria for meeting embedded competencies and professional board requirements for WIL. Gerding (2020, p. 289) cautions that such varying "educational and credentialling" criteria may result in a poor professional identity and an unrecognized and undervalued contribution to public health.

4.1.2.3 Professional Competence in Environmental Health (EH) WIL

Environmental Health Practitioners (EHPs) play a crucial role in securing healthy environments and managing hazards within communities in South Africa (Shezi et al., 2019). They operate within ever-changing local, regional, and global demands, such as responding to pandemics (Jepngetich et al., 2019; Morse et al., 2020), handling threats associated with climate change

(Shezi et al., 2019) and collaborating within a multidisciplinary municipal health services team (Shezi et al., 2019).

Additionally, EHPs must interpret and understand data (Gerding et al., 2020), apply theoretical and technical knowledge (Dhesi & Lynch, 2015), and have the social disposition to manage societal health outcomes through multiple interventions (Jepngetich et al., 2019). Beyond legislative confines (Dhesi & Lynch, 2015), EHPs must discern between technical and social competencies. Consequently, EHPs require variable competencies beyond technical skills and theoretical knowledge to meet preventative health demands.

4.1.2.4. Challenges in Competency Articulation and Assessment

The WIL supervisors who are ideally situated to identify the desired professional competencies and evaluate the students' progression towards attaining these during WIL, are not involved in its assessment. Literature suggests that assessing professional competence in WIL students requires a collaborative approach to ensure reliability and validity (Jepngetich et al., 2019).

Currently, EHP WIL supervisors provide a summarized evaluation form of EH students at the University of Technology (UoT). This form is designed for easy completion, yet few supervisors submit them after students complete their work placements. WIL supervisors may be hesitant to complete evaluations due to concerns about justifying assigned grades or fear of retribution (Wolf, 2015). When they do partake in evaluations, supervisors may be biased in their assessment of student competence (Jackson, 2018b).

Despite developing a range of professional competencies during WIL placements, students often struggle to articulate their full employability competency range during job interviews (De St Jorre & Oliver, 2017). They often rate themselves lower than their workplace supervisors (Jackson, 2018b). If assessments are not authentic or holistic, the complexities of real-world workplaces may be missed, defeating the aims of competency-based assessment (CBA) (Garraway, 2022). Additionally, the lack of a structured competency assessment in the EH WIL, contributes to poor articulation of competencies and presents challenges in assessing students' readiness for independent practice.

4.1.2.5 Holistic and Authentic Assessment in WIL

Circumventing the hesitancy to partake in student evaluation may involve including all role players in competency attainment—WIL students, academic coordinators, and WIL supervisors (McNamara, 2011). Expectations of all parties must be made clear and aligned with academic outcomes, student goals, and employer expectations (Jackson, 2018b).

Literature suggests that stakeholders, such as industry partners with whom students are placed, need to be part of the assessment team (Ajjawi et al., 2020). Ferns and Zegwaard (2014) echo that workplace supervisors observe students for the full WIL duration and assess how they handle unexpected workplace situations. Ajjawi et al. (2020) suggest that WIL students should also be part of the assessment team. Bilgin et al. (2017) advise that time must be factored in as a resource to ensure valid and reliable assessments of WIL.

4.1.2.6 Entrustable Professional Activities (EPAs) in WIL

The development of desired competencies enhances the development of entrustable professional activities (EPAs) in students. EPAs are described as developing competence in an activity or task to the level that the task can be performed independently (Cate & Schumacher, 2022). The assessment of EPAs can be used to evaluate students' progress toward independent practice (Cate & Schumacher, 2022).

4.1.2.7 The Role of WIL Supervisors in Competency Development

A key benefit of WIL is that students may recognize and adopt behaviours, practices, and actions necessary for professional competence while in the workplace (Gerding et al., 2020). WIL supervisors have a front-row seat in observing the professional competencies acquired or developed by WIL students (Jackson, 2018), unlike academics who assess them remotely. Including workplace supervisors are part and parcel of the core criteria for an effective CBE program and they can identify competencies desired in the practitioner (Janssens et al., 2023). Additionally, they directly observe and can provide real-time evaluation of progression toward independent practice (Ferns & Zegwaard, 2014; Janssens et al. 2023).

This paper proposes that competencies observed in WIL students by their supervisors can inform and contribute to the development of a reliable and valid framework for measuring competencies in EH graduates (Garraway & Reddy, 2016).

4.1.2.8 Implications for Environmental Health Education and Training

To enrich workplace learning experiences for EH students during WIL, clear competence criteria beyond technical and theoretical knowledge must be identified. To align to the CBE the WIL supervisors can identify the competencies the observe in students during WIL and evaluate progress toward independent practice. The purpose of this paper is to present the competencies that EH students develop during WIL as observed by EHP WIL supervisors. The aim of the research is to: i. establish the competencies observed by workplace supervisors in the EH WIL student, using focus group discussions, and ii. analyse the competencies observed using thematic analysis as informed by Braun & Clarke (2006).

4.2 Methodology

This study employed a phenomenological qualitative design, whereby participants' lived experiences, i.e. the professional competencies that WIL supervisors observed developing in the EH students. This approach allowed for gaining in-depth insight of the phenomenon under investigation (Adeniran & Tayo-Ladega , 2024; Gundumogula, 2020).

4.2.1 Research aims

The aims of this research were to:

- identify the competencies observed by workplace supervisors in the EH WIL students through focus group discussions
- analyse the observed competencies through thematic analysis as guided by Braun & Clarke (2006)

4.2.2 Ethics Approval

Ethical clearance from the UoT (Ref. no. 189045701/11/2021) was obtained from the UoT and all its ethical clearance protocols were observed. Permission to interview the relevant municipality's EH WIL supervisors was obtained (Ref. no. 9479).

4.2.3 Theoretical Framework

Considering that learning is shaped by the learner and the social context in which it occurs, those involved, especially the WIL supervisors and students, are well positioned to understand and interpret professional requirements (Maton, 2014). In this context, legitimate knowers are the WIL supervisors and students who learn from them in particular work settings. Recognizing what is being legitimated through teaching, learning, and assessment allows students to perform accordingly and attain success (Maton, 2014). Supervisor observation of students in the workplace, align closely with competency evaluation as their observations facilitate the monitoring of progress toward attaining desired competencies and identify areas necessitating improvement (Makathini, 2016). Actively involving WIL supervisors in defining competencies and evaluating student progress toward competency attainment help mitigating some of the barriers challenging effective competency-based training and -assessment (Janssens et al., 2023).

4.2.4 Participants and Recruitment

The focus group participants were purposely selected EHPs meeting the inclusion criteria of being experienced in supervising undergraduate EH students in the new bachelor's degree at the UoT where the study was undertaken. In contrast to individual interviews, focus groups were useful as it allowed for spontaneous, free and open sharing of opinions (Green et al., 2022). This spontaneity led to the divulging of rich, in-depth, and high quality data and allowed participants to build upon one another's insights (Shabina et al., 2024). Additionally, participants were all employed at the metropolitan municipality where the EH students undergo their WIL. Granted that the results obtained from purposeful sampling is only valid for the population under study (Andrade, 2020), this sampling method ensures that data is meaningful and reflective of genuine perspectives relevant to the specific population under study (Stratton, 2024).

Participants were recruited and invited via direct email to the respective EHP WIL supervisors (N=17) from the municipality where the majority of EH students undertake work placements. The participants are homogenous regarding their duties and roles at the municipality and in supervising EH WIL students. Focus group discussions allowed for easy discussion and enabled participants to share and refine their experiences collectively as an established rapport exists amongst them (Wozniak, 2014). Two possible dates were shared with the participants, and they could select the date and time that would suit them to partake in one of the three anticipated focus group discussions, consisting of five to six participants per group. Once participants confirmed their participation, an email confirming the day, time, and venue was shared. Despite follow-up invitations, only two focus group discussions were conducted, with focus group one consisting of 6 participants and focus group 2 consisting of 4 participants.

4.2.5 Data Collection

As data collection occurred during lock-down, the focus group discussions were held in a seminar room at the UoT which was sufficiently spacious to adhere to the social distancing requirement applicable for gatherings at the time. This venue was deemed convenient as it provided a comfortable setting for participants to converse freely in a non-threatening environment, away from their offices. Two out of three anticipated focus groups discussions were held. The literature is divided on the exact number for focus group discussions, and number of participants per focus groups discussion (Gundumogula, 2020). Undertaking the discussions with two focus groups did not affect the richness of depth of data, as data saturation is possible within the first two focus groups, as found by Guest et al. (2017). This hold especially true if the group is homogenous and the topic is intently defined (Gundumogula, 2020). A semi-structured discussion guide, encouraging open discussion and guiding the

dialogue to specifically focus on the competencies that the EHP WIL supervisors observed in the students during WIL, was used. Each focus group discussion lasted approximately 2 hours and 30 minutes. Focus group discussions proved appropriate as they allowed for small group experience-sharing and open unconstrained discussion (Shabina et al., 2024). Written informed consent, with the option to withdraw from the discussion, was obtained from all participants before commencing the focus groups. The focus group discussion purpose was shared with participants to set the tone for the discussion and create a uniform understanding among them. Questions comprised aspects relevant to professional competencies including skills, values, and attitudes that the WIL supervisors observed developing or unfolding in the EH students. Probing questions that solicited dialogue, e.g. “Can you describe?” or “Please elaborate?,” were used to encourage participation by all. Participants could also pose questions during the discussion to allow for clarity or re-phasing of questions. The discussion was recorded by an electronic recording device. The interviewer jotted notes as the discussion progressed to note issues raised that needed further elaboration. The audio recordings were then saved on an external hard drive, transcribed by the researcher, and verified by the supervisors. All personal identifiers were removed by coding respondents’ answers - in the sequence they responded - per focus group discussion.

4.2.6 Data Analysis

Analysis commenced with iterative readings of transcripts and initial open coding. This was followed by several additional readings of the transcripts, after which the codes were collapsed into categories, and these informed the themes.

The codes were collapsed into categories, codes repeating one another were coalesced as this improved organizing and development of themes.

4.2.7 Ensuring Quality of the Study

4.2.7.1 Researcher positionality

The researcher is acquainted with the participants, due to her role as work-integrated learning (WIL) coordinator for an EH program. This involves engaging with the participants in matters relating to placement and coordination of the WIL for the EH students. The researcher while working in industry, had some of the participants as colleagues working for the same municipality. This familiar professional working relationship eliminated the need to establish rapport with the participants and allowed for an open dialogue between participants.

Due to the relationship with participants, the researcher remained mindful of informant biases (Chavez, 2007) by being flexible and practicing ongoing researcher reflexivity (Holmes, 2020). Minding these guided the researcher to be aware of such biases and subsequently, she occupied the space between insider and researcher (Dwyer and Buckle, 2009).

4.2.7.2 Quality and rigor

To ensure the dependability of the questionnaire guide, a process of ongoing review occurred between the researcher and her research supervisors, leading to its refinement. The supervisors approved of the focus group sizes, estimated duration of - and venue for - the focus group discussion.

The audio recordings and transcripts were shared with the research supervisors after data collection. Initial codes were assigned using the Atlas.ti 9 software (ATLAS.ti Scientific Software Development GmbH, 2022), followed by manual coding. Following iterative readings of transcripts, these initial codes were presented and discussed with the research supervisors. After robust debate and dialogue between researcher and supervisors, codes were categorized, and themes were agreed upon as guided by Braun and Clarke (2006). This peer review process increased credibility due to role-players' different professional backgrounds, and diverse perspectives.

Additionally, transcripts and audio recordings were shared with the respective focus group participants to check the accuracy of transcriptions, relevant to their portion of the discussion. This sharing was done via 'we transfer' whereby each participant received a time-bound link to access the recording and the transcribed document. Participants detected no errors in their respective transcripts. During iterative readings, the researcher discovered minor spelling and grammatical errors which were corrected.

4.3 Results

The thematic analysis revealed the main domains of professional competence development during WIL: knowledge, technical and procedural skills, and professional behaviours, comprised of both professional values and attitudes. These themes form the foundation of EH professional competencies desired and observed unfolding in the student, by the supervisors. These are illustrated in Figure 4.1.

Key for thematic framework

Theme	Sub-theme	Relationship between themes	Relationship between theme and sub-theme(s)

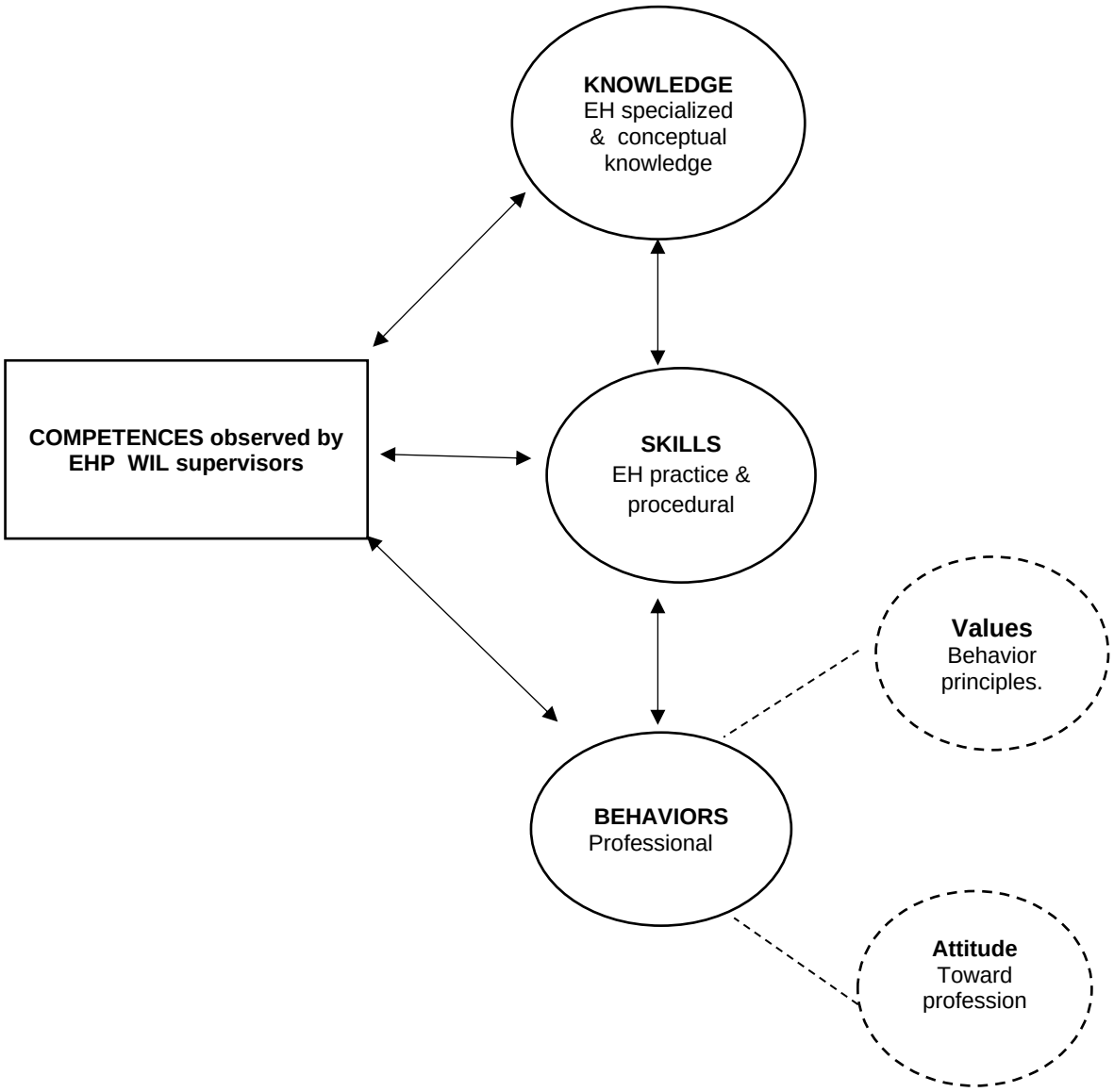

FIGURE 4.1: Thematic framework for the competencies gained by EH WIL students (adapted from Braun & Clarke, 2006).

4.3.1 Knowledge

Participants noted that upon entering the workplace, the students' knowledge comprises explicit, factual and EH discipline specific information. They observed that students possess a huge amount of this knowledge. This included theoretical understanding and technical

knowledge, particularly legislation and regulatory frameworks. Supervisors further observed that much of the knowledge students acquire during WIL is concentrated in the domain of food control, particularly through activities such as premises inspections and assessing regulatory compliance. A participant in FG1 explained that this poses an initial conceptual challenge as a desired competence is that : "…it's important to mention, first of all, the role of the EHP: to unpack that; then you divorce the mandatory issues and the functional issues…" (FG1_EH4). Participants across both focus groups shared, as time progresses, they observe a shift in the perception of students in that they recognize that the possession of explicit knowledge is sufficient in the classroom, but that integration thereof is prioritized in the workplace. A participant explained: "…everything is relevant while you're a student- but when you get into the field not everything is relevant." (FG2_EH7). They further noted that students quickly realize that the application and contextual integration of knowledge is necessary for practicing in the real world.

Understanding what knowledge is relevant, and the contextual function of the EHP emerged as a valued learning outcome. Supervisors explained that students' understanding evolved as they engaged with the complexities of workplace realities and that increased exposure in the workplace strengthens this awareness. They further observed that students learnt that technical knowledge, such as legislation, is not merely to be memorized, but that it should be used as a resource and tool to be interpreted and applied as the EH issue dictates. One participant reflected that students realize: "…it's not as simple … that's when they realize where legislation comes in… it seems very easy to implement… we (as experienced EHPs) forgot our legislation, but we have the regulations on our computer or on our tables…" (FG2_EH7).

4.3.2 Technical and Procedural Skills

This theme describes the students' technical and procedural skills observed by the workplace supervisors during WIL. These includes skills related to EH administrative protocols e.g. those relevant to workflow, following workplace policy- and legislative protocols, and the performance of technical tasks specifically relevant to EH practice.

Participants described how students learn and understand the basic office administration, complaints- handling procedures, and issuing of documents relevant to EH issues. As their experience increases, supervisors become comfortable enough to allow students to interact with members of the public who need to log complaints, either in person, virtually, or via telephone. One supervisor noted

… specifically, when it comes to applying for a certificate of acceptability and business licenses and the lodging of complaints, we have the students that are been helping us with those; as soon as a customer…community member comes to lodge a complaint, they know what to do … (FG1_EH2)

Participants across both groups shared that the students demonstrated good observational skills and that they were meticulous in conducting inspections of premises early on during the WIL. One participant explained: “What I’ve noticed in the students is … they are able to assess - like if you take them on an inspection- at times even better than what the EH is able to” (FG2_EH7) and that students can “… see things what we don’t see …” (FG1_EH3). Good observational skills were consistently described as a desirable attribute in the competent EHP.

Participants reported growth in the students’ report writing skills, following inspections. They described students as being articulate and able to “…and quote the right legislation…” (FG2_EH8. Students were commended for being thorough in conducting inspections, report-writing and citing the relevant legislation:

… when the student writes their reports, there’s a lot of information on there…, to a certain extent, I even feel bad for how I do my work when I have a student with me, because they’re so thorough in their work, they would go through that regulation and write it according to the regulations... (FG2_EH7)

Both groups (FG1 and FG2) described that the students developed or had existing presentation skills. These are desired skills in EH practice and proved valuable in the workplace as the students were entrusted with conducting presentations. As explained by EH2 (FG1): “… presentation-wise, they were excellent!” and “… they develop that confidence in presenting things…” (FG2_EH7).

The supervisors identified procedural skills as critical for competent EHPs, specifically the ability to distinguish what is relevant to the EHP in the organization and what is not. Participants explained: “on a practice level… we need to separate this is not relevant, that is not relevant, … not under your scope of practice” (FG2_EH7). Supervisors noted that students began to develop an understanding of the procedures to follow when referring issues not relevant to EH practice. When asked whether students could make such distinctions, one participant affirmed: “They do! …it goes with the problem-solving; ‘cause you know how to do it, your steps, your SOPs…” (FG2_EH10).

This procedural discernment, desired in competent practitioners, was further illustrated by one supervisors' reflection on being able to balance legal requirements with practical and sound judgement:

I always say, is that: there's two ways of looking at it: Do you apply the letter of the law? If you apply the letter of the law, none of them will comply; then you apply the spirit of the law, not to compromise the hygiene or the best practice. We apply the spirit of the law, otherwise all of them will be out of business…then we can still carry out the visit within the framework of health and hygiene." (FG1_EH4)

4.3.3 Professional Behaviours: Values and Attitudes

4.3.3.1 Values

Supervisors described professional behaviours as the ethical foundations and evolving dispositions that shape how Environmental Health students engage in practice—anchored in values like integrity and empathy and expressed through attitudes such as adaptability and professionalism. The observed professional behaviours are underpinned by attitudes, which are underpinned by values. This relationship is depicted in Figure 4.2, which also presents the full range of professional competencies, with supporting participant quotes, observed in the EH WIL student.

Participants reflected on the values that are desired in the EHP and related those they observed unfolding in the student. Participants identified that assertiveness is valued in the EHP, but that most students struggled with this. They described that the students found it difficult to speak with authority when needed: "…the most difficult part: to talk to someone in an assertive manner…and to not back-off…" (FG1_EH5). This, however, changes as the student develops confidence due to exposure to the workplace and experience over time, as described by EH10 (FG2): "…they're (becoming)… more confident, …they're approachable, and they're more assertive in the office and outside as well". Another aspect that helps the students gain confidence, according to participants (FG1 & FG2), is knowledge relevant to the context: "…because you have to have some knowledge, because if they counter you, you must be able to say, and justify, why you're saying that this is not right and that's not right…" (FG1_EH5). For students who start off shy and afraid, WIL supervisors do observe progress with peers and clients: "…then you see the fourth year they bloom, kind of you know?" (FG2_EH10)

Managing conflict, an emphasized value of behaviour, was also related as short-coming in most students: "…the conflict-handling…I think that's where they need to grow more…" (FG2_EH9). Participants allow students to practice this, depending on the severity of the

situation: “… if there’s conflict, I let them run with it and I see they’re struggling, then I’ll intervene…” (FG1_EH2). Both focus groups emphasized the role of the student’s “personality” (EH3, EH5, EH6, EH7), referring to some students starting with behaviours mimicking a “bull in a China shop” (FG1_EH6). Over time, they develop a more empathetic approach and better judgment. They observe that students learn when to exert the mandated authority and eventually: “… they develop into … mediators and they will know how to control themselves or their tone of voice…” (FG1_EH2).

The ability to communicate effectively, both inside the municipality and with members of the public, was highlighted as a desired competency: “They developed great communication skills; they know how to interact with other departments and different faculties and so forth” (FG1_EH3). Effective communication and acting within the professional code are essential, referred to as “arming” the student:

…we don’t want, you know, to send a student out into the field not armed... And that is what you call your code of conduct... Then arm the student with the Batho Pele principles: openness, frankness, transparency, honesty, credibility, integrity; arm them with that first…(FG1_EH4)

These values comprise professionalism and emotional intelligence. Participants observed that these include practicing ethical behaviours, adhering to codes of conduct, and interacting well with others. Behavior depends on understanding the role of the EHP in different contexts and the profession’s contributions to society. Students must perform beyond legislation and be flexible. The COVID-19 pandemic contextualized this need: “…COVID showed us that there were a lot of added or additional responsibilities... and we delivered …” (FG2_EH9). Flexibility unfolded in the students, as per EH8 (FG2): “… you need to, like offer yourself… So that is what they see…”

4.3.3.2 Attitudes

Participants shared that at the start of their WIL placements, and during the students’ first year of the EH program, they observed the students being overwhelmed, uncertain, and being somewhat disinterested (FG1_EH5; FG2_EH10), as described by a participant: “…they don’t know what to expect…” (FG2_EH10). Some participants felt that one of the main reasons for the initial poor attitude stems from the student not understanding the role of the EHP within society and the municipality. Participants in both focus groups emphasized that getting the

student to understand the role of the EHP in different contexts is important. They described this as something that supervisors must “get right first” (FG1_EH4).

Participants explained that students get to understand what is relevant to EH and what is not during their work placements. They describe that this differentiation develops in the students as time progresses and exposure in the workplace increases, as described in one focus group, the students realize: “… everything is relevant while you’re a student (classroom) - but when you get into the field not everything is relevant” (FG2_EH7; FG2_EH9). This differentiation develops in the student enabling them to “trouble-shoot” (FG1_EH4) in different situations, as explained by EH8 (FG2): “… they get to a shop and then they realize: ‘Okay, book one side now, what’s the problem here? How do I get to that problem? What am I gonna need to solve it?’ You know, so that is what they actually learn*”* (FG2_EH8).

Participants also observed that once the clarity is obtained, positive attitudes are adopted as students begin to understand the EH practitioner's contribution to society and the municipal health objectives. They become optimistic about their future career and growth in the profession, as described by a participant: “…they’re so eager to grow, they will tell you that, maybe after five years or seven years, they see themselves as principal…” (FG2_EH9). This attitude extends to the clients and communities within which they work, and the student learns to “serve with empathy” (FG2_EH10), recognize, accept, and understand diversity (FG2_EH8; FG1_ EH4), and help them develop coping skills for the demands and challenges of the job. EH8 (FG2) explains:

… from first year, up until third or fourth year, they’re able to see, Area A is not the same as Area B [area names withheld], a Muslim is not the same like Hindu for instance; it’s all of those things that makes them better equipped I would say; understanding how to deal with different scenarios” (FG2_EH8).

Through accepting and understanding diversity, the students develop a customer-centric approach in delivering municipal health services, i.e. putting people first (FG1 & FG2), which is also identified as a desired trait that participants observe in the students. The supervisors guide students to adopt a more flexible and empathetic approach depending on the client's situation. Students develop and are shown that their practice is context dependent. This context-sensitive approach to law enforcement was illustrated in a group exchange:

EH4:… it’s sometimes difficult, especially your marginalized areas to apply the law…**EH1**: …some of the students get disappointed when you don’t give the person a fine for non-compliance, but we talk to them (the students)…” **EH3**: You do what’s reasonable for the

clients… **EH5**: But you have to explain that to them… why you don't do that (issue a fine)… **EH1**: Exactly! We do explain that.

Participants explained that the initial attitude of displaying disinterest towards the practice, feeling overwhelmed, and having a misguided sense of authority depended on the individual student's personality, and/or the influence of the EHP supervising them. Some participants describe this personal disposition as unchangeable in some students: "…even at the end of the time they are there, you still get that, so it's personality- or individual-based …" (FG1_EH3). Participants felt that the supervising EHP yields influence, by way of their personalities, attitudes, and how they handle the authority assigned to them, and that this too may influence the students' professional attitude and explains: "…it depends on the individual, and the office environment also has an impact, and the EHP also, and that relationship…" (FG1_EH5). They observe that students may mirror the same inflexible or negative attitude when enacting roles during WIL.

While Figure 4.1 maps the key thematic domains, Figure 4.2 demonstrates how these competencies are interrelated and evolve over time during WIL placement.

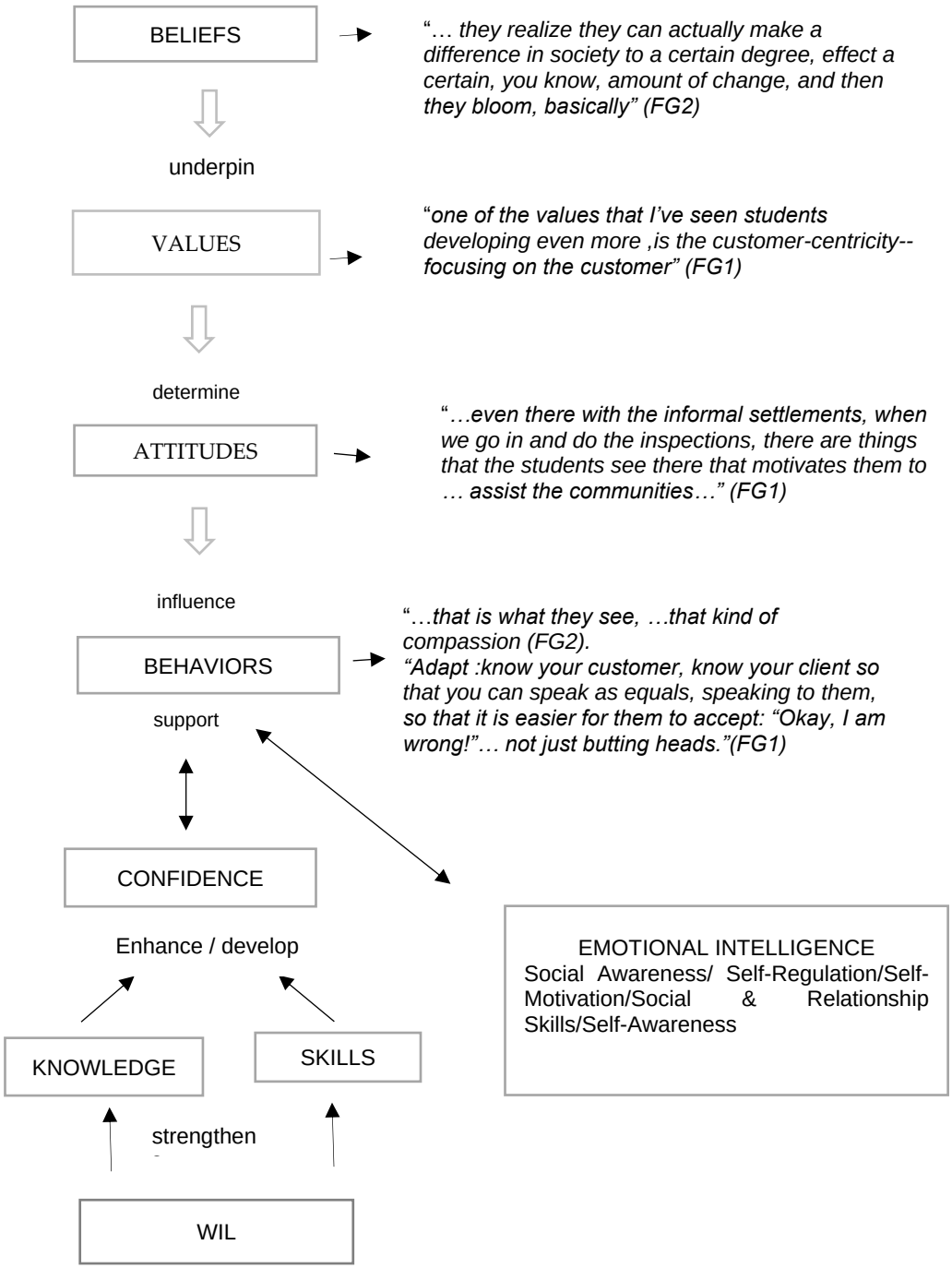

FIGURE 4.2: EHP WIL Supervisor competencies observed and their relationships (adapted from Government of New Zealand, 2015)

These findings reveal a tension between the competencies necessary for successful EH practice and the current assessment of WIL competence by both the university and the professional body. While the EH curriculum articulates exit level outcomes partially aligned with CBE and CBA principles, the findings reveal a disconnect between these intentions and the

professional competencies valued and observed in EH WIL contexts. Supervisors' emphasis on evolving knowledge, technical and procedural skills, and professional behaviours, by way of values, attitudes, and context-sensitive judgement, suggests that many of the competencies students are expected to demonstrate emerge, beyond what is formally assessed or explicitly embedded in curricular standards.

4.4 Discussion

Building on the observed competencies and supervisors' insights, this section explores how WIL contributes to holistic professional development and where misalignments with existing assessment frameworks emerge. Competency-based education (CBE) and competency-based assessment (CBA) place competencies at both the starting point and endpoint of educational design (Janssens et al., 2023). These competencies are directly linked to entrustable professional activities (EPAs) (Cate & Schumacher, 2022), which help determine whether students can safely and independently perform tasks relevant to professional EH practice. Evaluating the acquisition and progression of these underpinning competencies is therefore essential.

To ensure that EH graduates are ready for independent practice, the desired competencies—particularly those identified by WIL supervisors—must be integrated into the curriculum and actively monitored during the students' academic journey. The WIL component offers a unique environment for this, as students engage in real-world scenarios under sustained supervision. Unlike academic staff who engage with students intermittently, WIL supervisors observe student behaviours and growth longitudinally, positioning them as key contributors in competency assessment.

While WIL aligns naturally with CBE/CBA principles, the current curriculum is only partially structured to support this alignment, relying heavily on exit-level outcomes which focus on knowledge and technical skill. This gap limits effective monitoring of student readiness. Involving all role players—particularly EH WIL supervisors—in both the evaluation and feedback processes would help capture students' progress toward performing scope-aligned functions (DOH, 2009). When students demonstrate sustained competence, specific activities may be entrusted to them at appropriate levels.

As visualized in Figure 4.2, the full spectrum of competencies—ranging from foundational values to applied behaviours—unfolds through workplace exposure. This progression reflects the development of contextual judgment, emotional intelligence, and reflective capacity. Involving all role players, especially WIL supervisors, would help move the program closer to fully meeting CBE principles.

This study established the professional competencies that undergraduate EH students develop during WIL, as observed by workplace supervisors. Supervisors reported that students experience holistic growth beyond the integration of theory and technical skill—a finding echoed in broader literature that positions holistic development as critical for 21st-century employability (Morse et al., 2020; Gerding et al., 2020). Workplace exposure cultivates professional identity, supports socialization into the EH profession, and improves employability through enhanced problem-solving, communication, and self-efficacy (Jackson, 2018b).

Additionally, findings confirm a shift in the role of EHPs—from law enforcers to enablers who promote compliance with empathy and contextual understanding (Dhesi & Lynch, 2015). Students observed by WIL supervisors adopted values aligned with this shift: flexibility, cultural responsiveness, and a nuanced approach to legislative enforcement. These relational professional behaviours reflect how students apply emotional intelligence and contextual discretion to meet professional standards.

In the South African context—marked by socioeconomic inequities and a quadruple disease burden—contextual intelligence becomes central to ethical EH practice. Supervisors noted that students who adopted multi-dimensional approaches to client engagement also developed a stronger belief in the profession's value. This belief fostered positive professional identity formation, ultimately boosting student confidence, employability, and career orientation.

Figure 4.2 further illustrates how these competencies are developmentally related, starting with embedded values and evolving into observable behaviours and professional performance. This layered development aligns with CBE logic and affirms that effective graduate preparation requires supporting growth across all competency domains.

4.5 Implications

The findings of this study foreground the need to rethink how professional competencies are taught, monitored, and assessed in EH undergraduate programs. Although WIL provides fertile ground for cultivating behaviours vital to independent practice, these often remain implicit and unassessed due to their relational or contextual nature. As such, students may perceive them as secondary or irrelevant (Bertram & Rusznyak, 2024), even though they are critical for workplace success.

To strengthen alignment with CBE and CBA principles, assessment strategies must include the full range of competencies observed by WIL supervisors—including soft skills, ethical discretion, and context-driven behaviours. Involving supervisors in co-developing assessment criteria and EPA-aligned tools may help surface these often-overlooked behaviours (Janssens

et al., 2023). These tools should reflect the developmental trajectory represented in Figure 4.2 and be designed to track growth throughout the WIL period.

Furthermore, aligning curricula more closely with workplace expectations—especially those related to the EHP's evolving role—will better prepare students for the realities of environmental health practice. Future research should explore how workplace-acquired competencies shape graduate employability and long-term performance, and how these competencies can be better integrated into teaching, learning, and assessment design. To further triangulate findings and enhance the transferability of insights into competency-based assessment practices in Environmental Health, the client perspectives could offer valuable triangulation and this direction for future research is recommended.

4.6 Limitations

This study was conducted at a single University of Technology and engaged a limited number of WIL supervisors in focus group discussions, which may constrain the generalizability of the findings. However, the depth of insight provided by participants offers valuable perspective into the observable development of professional competencies. Given the study's exploratory nature, emphasis was placed on transferability through rich, contextual description and theoretical framing.

Importantly, the findings align with the university's formally stated graduate attributes—specifically, the emphasis on *relational ability* as a core outcome of undergraduate training (University of Technology, 2017). This alignment strengthens the trustworthiness of the observations made by supervisors and grounds the findings within the institution's pedagogical objectives.

The absence of incorporating student and client perspectives is acknowledged as a limitation in this paper. However, while this manuscript presents the findings from the supervisor cohort, a separate part of the broader study focused on Environmental Health students' experiences and self-perceptions of competency development during WIL. That work has been accepted for publication in a different peer-reviewed journal.

4.7 Conclusion

This study demonstrated that EH students develop a holistic set of competencies during WIL, encompassing not only theoretical knowledge and procedural skills but also relational professional behaviours essential for modern EH practice. While academic assessments focus

predominantly on technical competencies, supervisors observed developmental trajectories that extend to contextual judgment, emotional intelligence, and adaptability—particularly important in the socio-environmental realities of South Africa.

The findings reveal a disjuncture between the competencies assessed in formal education and those cultivated in the workplace, suggesting a need to revisit WIL curriculum design. Embedding EPA-informed assessments, co-developed with WIL supervisors, could enable better alignment with CBE principles and ensure that students are prepared for independent, context-sensitive practice. Through such integration, EH education can better meet both professional standards and the complex public health needs of the communities it serves.

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CHAPTER 5

A FRAMEWORK FOR HOLISTIC ASSESSMENT OF PROFESSIONAL COMPETENCIES IN ENVIRONMENTAL HEALTH WIL AT A UNIVERSITY OF TECHNOLOGY

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CHAPTER 5

5. A FRAMEWORK FOR HOLISTIC ASSESSMENT OF PROFESSIONAL COMPETENCIES IN ENVIRONMENTAL HEALTH WIL AT A UNIVERSITY OFTECHNOLOGY

5.1 Introduction

Assessment of students' growth and development in higher education institutions (HEIs) across the globe, have transitioned from mere knowledge and skill 'testing' to consider an extended range of competencies required for employment (Bosco & Ferns, 2014; Gulikers et al., 2004;). Upon programme completion, graduates are expected to have attained competencies beyond theoretical knowledge and technical skill (Dean & East, 2019), to ensure that the institution and its graduates are current, relevant, and responsive to societal demands and 21st century employability requirements (Tushar & Sooraksa, 2023). Desired outcomes for graduates from HEIs, are ensuring that they easily transition from the classroom into the workplace (Adegbite & Govender, 2022) and that they can meet the demands of the workplace with relevant responses in variable contexts. Additionally, graduates are expected to possess a combination of graduate attributes, relevant to their institution and discipline (Oraison et al., 2019). To meet these requirements, most HEIs have included work integrated learning (WIL) as part of their undergraduate programmes (D. Jackson & Dean, 2023). In addition to presenting an authentic learning context (Bosco & Ferns, 2014; Gulikers et al., 2004) WIL holds benefits for various disciplines, HEIs and industry, presented in the literature by, among others Dunn et al. (2018), Rowe et al. (2012), Govender and Taylor (2015) and Ndlovu and Mofokeng (2018).

WIL, defined as: "An umbrella term to describe curricular, pedagogic and assessment practices, across a range of academic disciplines that integrate formal learning and workplace concerns" (CHE, 2011, p. 4), has always been part of University of Technology (UoT) undergraduate programmes in South Africa (SA) (Scholtz, 2020) and is embedded in its curricula to meet the workplace demands. In the WIL modality of work placements, described as a "way of gaining on the job experience in the real world" (Maseko, 2018, p. 1316), WIL may positively contribute to the students' perception of their work-readiness (D. Jackson & Dean, 2023) and provide them with experience and opportunity to learn about professional culture and -discipline (Trede, 2012). Similar WIL benefits even extend to students who are enrolled in generalist undergraduate programmes, such as health sciences at traditional universities (Abery et al., 2015). The benefits are reported to include, e.g., students' understanding of workplace operational processes and the development of soft skills, such as

developing an understanding of the situation in which different communities find themselves (Abery et al., 2015).

WIL affords students with authentic and career-focussed experiences (Dunn et al., 2018; Rowe et al., 2012). The preparedness of graduates may be gauged through the assessment of competencies of undergraduate students and their ability to solve discipline-specific problems (Bosco & Ferns, 2014). Problem solving abilities are desired as a 21st century employability requirement (Tushar & Sooraksa, 2023), and require a full range of competencies, beyond mere application of theoretical knowledge and technical skills (Tushar & Sooraksa, 2023). This is especially true in disciplines where there are not right or wrong solutions to real world problems, but rather desired or suitable outcomes (Stewart et al., 2023). In this instance, WIL aides in developing a combination of analytical and critical thinking skills for decision-making and problem-solving (Gerding et al., 2020a).

Literature confirms that assessing the competencies gained through WIL is difficult, complex, time-consuming, and subject to biases—by way of the assessor (D. Jackson, 2018; Ferns & Zegwaard, 2014). Designing the method and practice to assess competencies reliably and holistically, therefore necessitates employing a variety of assessment methods (Winchester-Seeto & Rowe, 2017) and includes various assessors (Heidari et al., 2019). Von Treuer et al. (2011) suggest probing recent graduates to obtain a clear understanding of the competencies they gained due to their work placement and for opinions of their fulfilment the work placement programme once they are employed. This may assist in determining competencies needed for a specific job, and whether the work placement contributed satisfactorily to the development of the needed competencies (Von Treuer et al., 2011). Boud and Falchikov (2006) regard the student, who is undergoing learning in the workplace, as an important stakeholder in the assessment of their own competence, and thus they can evaluate their own competencies and gauge their competency gaps. Additionally, the supervisor in the workplace, who spends more time with the students during the work placements than those assessing their growth, is merely a bystander in the assessment of competence (J. Jackson et al., 2017; Ajjawi et al., 2020; Ferns & Zegwaard, 2014) for varying reasons, such as supervisory leniency, being subjective, no assessment training and inconsistencies across different workplace settings. However, WIL supervisors can and do prove valuable in the assessment of WIL competence (Bosco & Ferns, 2014; Garraway & Reddy, 2016; Peach et al., 2014) as they are better able to align student development to professional requirements. Ajjawi et al. (2020) emphasise aligning the WIL assessment practice with what students learn in the workplace, to enhance the authenticity of the assessment. Authentic assessment of WIL means the assessment task takes place in high

proximity to the workplace, and the task itself requires active engagement by the student in real world tasks (Bosco & Ferns, 2014). Gaining the student perspective on their experiences in the workplace setting may assist in improving their educational experience and can help in making the assessment more holistic (Billett, 2014).

This article presents a holistic assessment framework for Environmental Health (EH) WIL competency, considering the competencies gained and/or developed during WIL, by way of the work placement modality, and reported by the students themselves, and those observed in the students by their WIL supervisors during the work placements. The theoretical lens used is Legitimation Code Theory (LCT) (Maton, 2014) which guided the data analyses, and organised the results which informed the aspects of the holistic WIL assessment framework for EH competence.

Building on the contextual backdrop illustrated, this study is intentionally situated within a single university of technology, framed as a contextual boundary that enabled focused analysis of assessment practices in Environmental Health education. In the absence of formal WIL assessment guidelines—across the professional body, curriculum, and other institutions—the framework proposed here seeks to strengthen assessment practice at this institution, while offering insights that may inform broader standardisation efforts. Given that all EH programmes register with and are quality assured by the same professional body, the study's findings hold relevance for wider application across accredited programmes.

The specific research question (RQ) asks:

How should assessment practices of workplace-based learning (WBL) be structured to measure undergraduate Environmental Health (EH) student's learning experience holistically?

The sub-research questions (SRQs) ask:

- SRQ1: What competencies do students acquire during work-placements?
- SRQ2: What competencies are reflected in the students' work-place reflection journals?
- SRQ3: Which competencies do the workplace EHP supervisors observe in the students during their work-placement?
- SRQ4: Where should the assessment of competencies developed during workplace learning be oriented on the LCT Specialization plane?

- SRQ5: What does a holistic framework for the assessment of workplace-based learning in the EH programme look like?

5.1.1 Overview of the Environmental Health Profession in South Africa

Environmental Health (EH) practice is an allied health profession, concerned with government's responsibility to ensure a healthy environment for all in South Africa (SA) (RSA, 1996). This role is performed by Environmental Health Practitioners (EHPs) through rendering municipal health services, with the aim of preventing adverse health outcomes for people (Morse et al., 2020; Shezi et al., 2019). The profession requires that practitioners solve EH issues or intervene where hazards in their environment pose a potential risk to human health (Patthanaissaranukool et al., 2020). To achieve this, EHPs employ risk assessment techniques, through hazard identification, -evaluation and -prioritization relative to the extent and severity of the potential or real risk (Shezi et al., 2019). The practice is underpinned by legislation but not confined to its limitations (Dhesi & Lynch, 2016). Due the dynamic and multi-faceted nature of EH (Jepngetich et al., 2019; Morse et al., 2020), the EHP must be able to work as part of a team within EH, with other sectors and disciplines in municipalities, as well as with members of the public which includes whole communities (Shezi et al., 2019). Additionally, EHPs must employ strategies suitable to the socio-economic contexts of SA society (Morse et al., 2020), solve EH problems by employing innovative strategies that comply with legislation, but navigate beyond its confines to reach desired EH outcomes (Rodrigues et al., 2021). Often EHPs are the first point of contact between the aggrieved communities and local government, and thus require a specific competency set to manage the community temperament and solve problems to satisfy the community and achieve environmental health goals (Gerding et al., 2020a). This implies that to work competently, the EHP must have a range of competencies that extends beyond knowledge and skill, but which also includes behavioural dispositions. Behavioural dispositions are the behaviours exhibited in response to stimuli in the workplace. In EH practice, it includes the observance of ethical codes and adhering to acceptable principles of behaviours expected of an EHP in a specific context to attain an appropriate outcome (Stewart et al., 2023).

Despite the many benefits presented by WIL such as enhancing student development and developing a professional identity (D. Jackson, 2018), for the EH programme at a UoT in SA there are no clear proficiency standards for the assessment of competence developed in the student due to the learning occurring in the workplace. Although WIL is embedded in its curriculum (SAQA, 2017), the guidelines and criteria for assessing competencies developed

in EH students in the workplace are not explicitly stated. This EH curriculum clearly states the exit level outcomes and its associated assessment criteria, having the main emphasis on theoretical knowledge and technical skill. Subsequently, the foci of assessments are aligned to the latter competencies. The full range of competencies needed to practice EH successfully, as described by e.g., Shezi et al. (2019), Morse et al. (2020), Rodrigues et al. (2021) and Stewart et al. (2023) are not assessed. The absence of clear competency assessment criteria for WIL present challenges for the EH programme in SA.

5.1.2 Assessments in Work-Integrated Learning

Assessment of the full range of competencies that are required to practice EH in specific contexts is necessary. If exposed—by making it explicit in the training, learning and assessment of students—the holistic competency range required may be appreciated and understood by students as part of their full professional imperatives beyond merely using knowledge and technical skill, e.g., applying appropriate legislation to solve EH issues (Dhesi & Lynch, 2016; Stewart et al., 2023). The holistic growth of students into professionals possessing desired competencies can therefore be achieved by making explicit the implied professional requirements, together with including these in a holistic assessment of competency. Students recognise competencies important to practice EH during their work placements and subsequently try to acquire and/or develop these (Boud & Falchikov, 2006; Von Treuer et al., 2011). Additionally, the EH practitioners who supervise the students, and who spend more time with them in the workplace during WIL, can provide valuable feedback as it pertains to desired competencies for successful EH practice, and that which they observe unfolding in the students during WIL (D. Jackson, 2018).

The assessment of competencies developed due to workplace learning remains challenging for a variety of reasons, and these challenges span global regions and disciplines. The following section presents an overview of these challenges.

5.1.3 General Challenges Associated with WIL Assessment

Assessing WIL in academic programs proves difficult due to factors such as the validity and reliability of assessment methods (Ferns & Zegwaard, 2014), the time-consuming nature of conducting developmental type of assessments, e.g., formative, (Palermo et al., 2015) and having to individualize assessments, either due to the diverse contexts in which students are assessed, or where group assessment of learning is not possible (Winchester-Seeto & Rowe,

2017). The tasks associated with programmes that have a WIL component, regardless of modality, such as coordinating placements, fostering relationships with industry, and ensuring an acceptable quality in the workplace learning experience for the student, has been found to increase the WIL academics' workloads (Bilgin et al., 2017). Contributing to WIL assessment complexity are that real-world problems can be complicated and therefore do not have a straight-forward right or wrong answer (Bilgin et al., 2022).

The issues with WIL assessment, albeit diverse, affect several HE programmes for e.g., Schonell and Macklin (2019) and Rusznyak and Österling (2024) report a lack of standardised assessment criteria for WIL in teacher education programmes across Australia and in South Africa respectively, and in undergraduate law degrees also in Australia (McNamara, 2013).

Although students expect the development of professional behaviours, meaning how to behave in a professional setting, to be developed by HEIs (Assamoi, 2015), the workplace plays a greater role in its development. Subsequently WIL contributes to improvements in all competencies (Pennaforte, 2016), yet this holistic growth is infrequently part of assessment of competence.

In their study to enhance WIL through collaboration between with some SA and Irish HEIs, Winberg et al. (2022), informs that for both countries relationships with partners are important for the success of WIL, yet, , assessment is a "contentious issue" (Winberg et al., 2022, p. 473) for both as, in practice, in the assessment the academic remains dominant in rewarding a final decision on student performance, despite formal or informal agreement for sharing the WIL load. Apart from academics, all WIL role-layers must be part of the WIL assessment, starting with its design, to enhance its authenticity (Ajjawi et al., 2020), i.e., students themselves, peers, workplace supervisors and/or mentors. Mäkelä (2022, p. 170) reports that collaborative inputs in the creation and design of all aspects of WIL contributes to a "multivocality" which enhances "more authentic assignment types and ensures their trustworthy assessment". During the workplace learning experience, students are often aware of, and able to identify, gaps in their professional development (Heidari et al., 2019) and work towards attaining these (D. Jackson, 2018; Gerding et al., 2020b). If included as part of the assessment team, the WIL role players prove valuable in WIL competency assessment, as variable assessors may aide in contributing to the reliability and validity of the assessment (Bilgin et al., 2017). Using numerous assessors may eliminate the misalignment between competencies encouraged in academia and industry as reported by Omid et al. (2021) and Assamoi (2015), to include the holistic competency range to achieve EH goals.

5.1.4 Challenges Associated with Environmental Health WIL Assessment

The issues related in the previous section affects the EH programmes globally (Rodrigues et al., 2021) as well as in South Africa. Dunn et al. (2018) reports of a lack of standardised assessments and WIL practices, in EH programmes offered in Australia. Knechtges and Kelley (2015) similarly reported the latter for EH programmes in the United States of America (USA). Omid et al. (2021) reports shortcomings in competencies in new graduates in Iran necessary to meet sustainable development goals. Walekhwa et al. (2022) report similar shortcoming for Ugandan graduates due to a lack of consideration—in the training—of key competencies required for acceptable EH service delivery.

In South Africa, the WIL component in EH programmes offered by the HEIs differ by way of WIL modalities and assessment practices. To enhance EH WIL management across HEIs offering it, the discipline's professional council, via their professional board for environmental health, strictly monitors WIL in the EH programmes. The education, training and registration committee of this board ensures that their requirements for undergraduate training are met through monitoring and evaluation of all matters relating to training EHP undergraduate students. Subsequently, EHP undergraduate students enrolled for the 4-year degree must complete compulsory WIL, some of which are embedded in the curricula and some not. The board's verification and audit criteria include completion of a minimum one hundred days, or 600 hours of exposure to the EHP duties (HPCSA, 2018) as stipulated in the professional scope of practice (DOH, 2009). This monitoring includes a mid-year verification of WIL completed for each student in their final year, as well as an audit of student WIL portfolios of evidence (POEs). Contrary to the suggestion that competency frameworks be developed by its professional councils, such as is the case for nursing (Lepre et al., 2021), this is not so for the EH profession in SA, or elsewhere (Knechtges & Kelley, 2015). Instead, for the WIL part of the EH pro-gramme, the professional board focus is on the management of WIL in the undergraduate programmes at the HEIs offering it ((Health Professions Council of South Africa (HPCSA) Education Committee, 2018).

The lack of a standard framework, and explicit criteria for competency assessment in EH across institutions offering the programme, presents a void in the development of the full potential of the student (Dunn et al., 2018). This may mean that the competencies students recognise, acquire, or enhance during WIL, could be disregarded as necessary for holistic and competent performance in all areas of their professional training (Nyanjom et al., 2023). They

may develop a skewed professional identity (Gerding et al., 2020b) and be misguided of their competence due to the focus on mere exposures to items of the professional scope and time spent in the workplace, which is not an adequate measure of competence (Dunn et al., 2018).

5.1.5 Commonly Used Assessment Practices in Medical and Allied Health Professions

Literature suggests that to adequately assess technical competencies in medical and allied health professions, an Observed Structure Clinical Examination (OSCE) could be used (Solà-Pola et al., 2020; Harden, 1988). Although OSCEs are acclaimed in assessing clinical skills, their structured nature and associated limitations in validity, reliability and objectivity make them a less favoured method for assessing EH WIL competence (Schuwirth & Van Der Vleuten, 2003; Dewan et al., 2024). OSCEs may miss essential competencies, such as analytical reasoning and practitioner disposition (Schoenmakers & Wens, 2014), which are vital in EH WIL. Unless specifically taught and deliberately included, some competencies may go unassessed (Lai et al., 2022; Witheridge et al., 2019).

The Miller Pyramid (Al-Eraky & Marei, 2016) aims to address limitations in competency assessment by including practitioner behaviour in real-life contexts. However, professional identity formation and collaborative workplace behaviours are not explicitly considered. Simulations and conditioned problem-solving tasks are valuable, particularly for sensitive or ethically challenging issues (Drisko, 2015) but may fall short in capturing workplace realities.

The nature of EH work often deals with “wicked problems,” i.e., problems that have no clear right or wrong answer, but rather desirable or suitable solutions depending on context (Stewart et al., 2023). This necessitates assessment approaches that can accommodate variability, real-world constraints, and practitioner judgement—elements that simulated assessments are limited in capturing.

In contrast, the five-dimensional framework by Gulikers et al. (2004) is better suited to authentic assessment of holistic competencies. It considers actual workplace contexts, resources, and social collaboration. Assessors include the student, WIL supervisor, academic and, where relevant, peers— dimensions echoed by Bosco and Ferns (2014) and consistent with the WIL component in University of Technology programmes (Scholtz, 2020).

The aforementioned assessment practices reveal limitations in adequately capturing the full range of competencies required for competent EH practice. These insights informed the rationale for adopting a contextually responsive assessment framework that aligns with the authentic and dynamic nature of EH WIL. Drawing on the five-dimensional model proposed by Gulikers et al. (2004), this study proposes an approach that integrates real-world task design, collaborative work, and stakeholder informed evaluations, involving multiple sources. The framework responds to the inherent complexities of EH practice—including practitioner judgement, values and relational behaviours—as such competencies unfold within authentic and unpredictable work environments. These real-world settings require contextually appropriate solutions (Stewart et al., 2023). The conceptual structure of this framework, along with its alignment to the study's theoretical framing and practical intent, is elaborated further in the paper.

5.2 Materials and Methods

This research employed a qualitative, phenomenological study design which provides in-depth and nuanced perspectives of the research participants (Rahman, 2017). In this research context, it is the acquired, developed, and unfolding professional competencies as experienced by the students during the work placement and observed by their EHP WIL supervisors. The participants could thus provide "legitimate insight" into their lived experiences (Maton & Chen, 2017, p. 47).

The methods followed for recruitment and selection of participants, and data collection were aligned to each of the sub-research questions (SRQs). To facilitate readability and clarity of the approach followed, the mentioned sections will be presented per SRQ.

5.2.1 Sub-Research Question 1 (SRQ1)

5.2.1.1. Student Participants

Purposive population sampling was used to select participants to obtain data for the SRQ 1 and SRQ2. Participants met the inclusion criteria if they had fulfilled the EH professional board's requirements for WIL in the undergraduate professional degree, at a UoT in Cape Town, SA. These participants could vividly express their workplace experiences. Thus, at the time of data collection, one cohort of senior students (N = 21), i.e., those in their 4th year and one cohort of recent EH graduates (N = 7), met the inclusion criteria. It was necessary to

include alumni (AL), as they formed the first cohort who completed WIL in the professional degree. Only the WIL reflection journals of those who volunteered to participate in the study were used for document analyses. All participants met the inclusion criteria and individualised demographic data was not considered for this study. Demographic data were not collected, as the study centred on professional behaviours, workplace-based experiences, and competency development within authentic EH WIL contexts. The analysis foregrounded relational and contextual behaviour patterns over individual characteristics.

Sequential numbers, aligned to the interview order were assigned for anonymity, e.g., senior students were assigned the code SS and alumni were assigned the code AL, followed by a number signifying the interview sequence. Reflection journals (RJ) for each participant were coded similarly, by adding their interview code, example RJ_SS1, RJ_AL2, etc. This is illustrated in Table 5.1.

Table 5.1: In-depth interview participant break-down and examples of codes used (Daries et al., 2025a)

Data Source		
Students (Number of in-Depth Interviews)		**Documents (Number of Documents Reviewed)**
Senior Students (SS) (15)	**Alumni (AL) (06)**	**Reflection Journals (RJ) (21)**
Example: Senior student 1 = SS1	Example: Alumnus 1 = AL1	Example: Reflection journal of senior student 1 = RJ_SS1 Reflection journal of alumnus 1 = RJ_AL1

Key:

SS: Senior Student/AL: Alumnus (1)/RJ: Reflection journal. 1: example of sequential number aligned to sequence of participant interviewed, or corresponding document analysed

5.2.1.2. SRQ1 Data Collection

Ethics approval, to interview students enrolled at the time of data collection, and to access the WIL reflection journals, was obtained from the dean of the faculty concerned (Ethics approval Reference no: 189045701/11/2021).

Subsequently, participants were invited via an announcement on the respective WhatsApp groups (Prof Prac 4, 2021; PFP 4, 2020) and on the UoT's secure learner management system (LMS), Blackboard ultra, version 3900.4.0.

Data was collected through individual, once-off semi-structured in-depth interviews, at a date, time and on a virtual platform chosen by the participant. Interviews were conducted and audio-recorded on Microsoft Teams (2021) and/or Blackboard Ultra (Blackboard help, 2021). Both

in-depth interview and document analysis were guided by the following questions:

- What skills have you developed during your work placement?
- What knowledge have you acquired during your work placement?
- What values unfolded in you during this experience?
- What attitudes were you encouraged to develop during your work placement?

Interviews lasted an average time of 45 min. After each interview, the recorded data was downloaded and saved on an external hard-drive and on a cloud-based data saving platform.

5.2.2 Sub-Research Question 2 (SRQ2)

5.2.2.1. Practitioner Participants

The focus group (FG) participants were purposely selected and comprised all EHPs who hold the portfolio of WIL coordinator at a municipality in Cape Town, SA (N = 17), and who supervised EH undergraduate students during work placements. Focus group discussions were used as this allowed for open, in-depth, and unconstrained discussion by the participants. EHP WIL supervisors were homogenous in their duties at the municipality and in their roles in supervising EH students during their work placements. To ensure analytic transparency while upholding ethical standards, anonymised codes were assigned to participants during transcription and analysis. These internal identifiers do not link to publicly available data but were used to maintain traceability between verbatim quotations and their respective stakeholder groups. For example, Focus Group 1 (FG1) consisted of six participants, identified as EHP1 through EHP6. Similarly, Focus Group 2 (FG2) comprised four participants, coded as EHP7 through EHP10. These codes support thematic coherence and enable readers to interpret quotations within context, without compromising participant confidentiality, as illustrated in Table 5. 2.

Table 5.2: Focus group participant breakdown and examples of codes used (Daries et al., 2025a)

Data Source	
Environmental Health Practitioner Workplace Supervisors	
Focus group discussion 1 (no. of Participants)	**Focus group discussion 2 (no. of participants)**
Focus group 1: FG1 (6)	Focus group 2: FG2 (4)
Environmental Health Practitioner workplace supervisor(s) 1–6: EHP1–EHP6	Environmental Health Practitioner workplace supervisor(s) 7–10: EHP7–EHP10
Example from text: EHP1_FG1	Example from text: EHP7_FG2

5.2.2.2. SRQ2 Data Collection

Permission to interview the EHPs was requested and granted via the municipality's research request portal (Reference no. 9479). All EHP WIL portfolio holders (N = 17) were given an overview of the research of the study and invited to participate in the study by direct email. Possible dates and times were shared for the respective FG discussions, allowing participants to select the date and time that would suit them best. It was anticipated that 3 FGs would be held. After conducting 2 FG discussions, FG1 and FG2, two follow-up invitations were extended to participants who did not respond to the first invite, and no further replies were received to participate.

Participants met with the FG facilitator in a seminar room at the UoT housing the research study, as it was deemed comfortable and provided for free and open discussion without the distraction of duties at their offices (Shabina et al., 2024). The total number of participants were 6 for FG1 and 4 for FG 2, which was considered adequate as participants were experienced in their WIL supervisory roles, knowledgeable on the subject, and, as advised by literature, small numbers of participants can yield valuable insights (Gundumogula & Gundumogula, 2020).

Written consent was obtained from each participant before the start of the FG discussion. Participants could withdraw from the FG at any time, or have data shared by them in the FG omitted from the results—on their request—during, or after the discussions. The FG discussion was guided by the following questions:

- What skills did you observe the students develop during the work placement?
- What knowledge did you observe the students acquire during the work placement?
- What values did you observe unfolding in the students during the work placement?
- What attitudes did you observe students develop during the work placement?

The discussions were recorded with an electronic recording device. The facilitator made notes whilst the discussion was underway to probe issues relevant to the study which required further discussion and elaboration. On completion of each FG, the data was downloaded onto an external hard-drive and saved on a cloud-based data saving platform.

5.2.3. Sub-Research Question 4 (SRQ4)

This SRQ was informed by the results obtained from the results of the foregoing SRQs 1–3.

5.2.4. Sub-Research Question 5

This SRQ was informed by the synthesis of the SRQs 1–4.

5.2.5. Data Analysis

To establish themes, all audio-recorded data were firstly transcribed, followed by several iterative readings to become familiar with the data and then applying initial open coding (Saldanha, 2016). Atlas.ti 9 software (ATLAS.ti Scientific Software Development GmbH, 2022), based in Berlin, Germany, was used to organise the data, assign the initial codes mentioned, collapse the codes into categories and further develop the initial themes. This process was repeated manually, by colour coding patterns and similarities in the transcripts, recording them in a notebook, developing categories and collapsing it into themes (Braun & Clarke, 2006). This assisted in substantiating the themes derived. The entire process of code establishment and theme derivation was shared and discussed with the research supervisors. After discussion and debate, the themes derived were agreed upon by the student and research supervisors.

The LCT Specialization translation device, developed during the planning phase of the study, was used to guide the thematic analysis. This is described in the following section.

5.2.6 Analytical Framework: Using the Legitimation Code Theory (LCT) Specialisation Dimension

The thematic analysis was guided by the Legitimation Code Theory's (LCT) Specialization dimension (Maton, 2014). LCT is a practical theory, underpinned by the work of Basil Bernstein (Bernstein, 1999, cited in Georgiou et al., 2022, p. 4). Bernstein splits knowledge into two structures, namely hierarchical knowledge structures, whereby knowledge is built vertically, from basic to complex, e.g., mathematics which commences with basic concepts and extends to learning and understanding complex mathematical theories; and, horizontal knowledge structures, whereby knowledge is compartmentalised, comprising different knowledge fields, e.g., as in humanities disciplines (Bernstein, 1999, cited in Georgiou et al., 2022, p. 4). LCT can dissect knowledge practices (Maton, 2014) through using one, or several LCT dimensions as theoretical lens (Winberg et al., 2018). The LCT Specialization dimension, suited to this study, unpacks practices by organising it in terms of how knowledge is structured and legitimised, i.e., its epistemic relations (ER), 'what you know' and its social relations (SR) i.e., 'who you are' (Maton, 2014). Orientations of a practice will always have both epistemic

relations (ER), and social relations (SR), but the relative strength may be weaker or stronger toward a specific relation.

The LCT Specialization dimension can expose the codes of legitimation, i.e., knowledge structures, foregrounded by the legitimate knowers/participants. By developing and applying a Specialization translation device to the data, the LCT Specialization codes of legitimation are revealed. When plotted on the Specialization plane, the relative strength to either the ER or SR unfolds. In this research, it provides insight into what counts as competent in EH practice, from the perspectives of the EH WIL students and their supervisors.

The Specialization translation device was applied to the data to interpret the evolving themes and plot their position on the Specialization plane, thus creating a "dialogue between data and theory" (Maton & Chen, 2017, p. 27). The translation device was guided by words and phrases, emphasising or down-playing competencies in the responses and/or discussions, thus revealing what is legitimised as competence to practice EH by the WIL students and their supervisors. Interviews and FG discussions were conducted in English, which is not the first language of most respondents. The translation device was adapted to include different expressions of emphasis, or downplay in responses and/or discussions, such as tone, colloquialisms, and nuances. When applied to the data, the competencies could be situated in a particular quadrant on the Specialization plane, referred to as "codes of legitimation" (Maton, 2014, p. 72). These codes of legitimation, in the context of this research, refers to the orientation of the competencies that were emphasised, or downplayed, as legitimate by the participants. When illustrated on the LCT Specialization plane, themes could be situated it in a quadrant as follows:

- a *knowledge* code, whereby the competencies legitimised by participants are relatively stronger in its epistemic relations (ER) than in its social relations (SR)
- a *knower* code, whereby the legitimised competencies are relatively stronger in its social relations than in its epistemic relations
- a *relativist* code, whereby the legitimised competencies are relatively weaker in both the epistemic relations and the social relations, or
- an *elite* code, whereby the legitimised competencies are relatively strong in both the epistemic relations and the social relations.

The Specialization plane and its codes, with relative relations of strength and/or weakness, to either the ER and/or the SR, is illustrated in Figure 5.1.

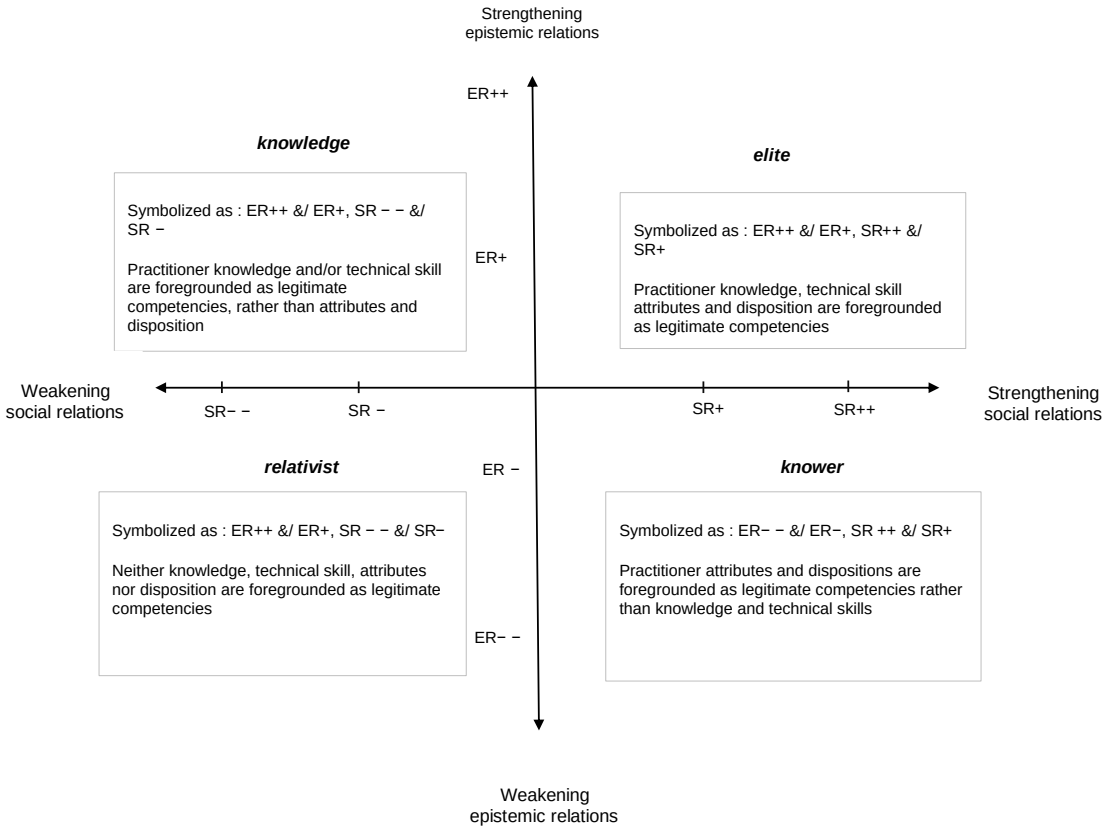

Figure 5.1. The LCT Specialization dimension and its codes (adapted from Maton, 2014).

5.2.7. Ethical Considerations

Ethical clearance and permission to undertake the study was obtained from the UoT ethics committee for student participants. Permission to interview EHP WIL supervisors was obtained from their employer organisation. Written and verbal informed consent was obtained from all participants, after explaining the purpose, process of data collection and procedure of the study. Participants were ensured of confidentiality and anonymity. Additionally, participants could opt to withdraw from the study at any point.

5.2.8 Researcher Positionality

Researcher positionality, e.g., their relationship with participants and insider knowledge of the issue under study, presents a limitation in qualitative research (Holmes, 2020). This required the researcher to recognise how their perspective may influence the study (Johnson et al., 2020). The researcher, due to her role as EH WIL coordinator and lecturer, had a vantage position of the issue under study. This proved a benefit to the study (Fleming & Zegwaard, 2018), as the researcher has comprehensive understanding of the issue being investigated. Familiarity between researcher and participants due to the existing working relationship, means that rapport was already established. This proved valuable as it allowed for open

dialogue and comfortable interviews (Holmes, 2020). The researcher recognised and remained mindful that these aspects may introduce biases and consequently exercised continual reflexivity (Holmes, 2020; Chavez, 2008) and being flexible enough to omit data not relevant to the objectives of the study (Holmes, 2020), but which interviewees felt comfortable enough to share.

Ongoing peer review was undertaken between the principal researcher and her two research supervisors, involving reciprocal discussion and debate during the entire research process, including the design of the interview question- and focus group discussion guides to ensure dependability. This involved similar dialogue and debate concerning data analysis, coding, and theme establishment. Member-checking was undertaken by sharing audio-recordings and transcripts with participants to check accuracy and identify corrections where relevant. Amendments were made to the transcripts especially where dialogue was unclear and could be clarified by the respective participants. Additionally, some grammatical errors were discovered and corrected during iterative readings of the transcripts. This entire approach enhanced credibility and confirmability, as themes agreed upon were arrived at through a process of interpreter-triangulation and the researcher was guided and advised by experienced supervisors with varying backgrounds.

5.3 Results

This section presents the findings and is followed by the discussion in which the significance and relevance are presented. As the EHP workplace supervisor groups are homogenous in their roles in supervising students, no distinction is made between the focus groups in this section.

The findings revealed competencies across knowledge, skills, and behaviours underpinned by values and attitudes, necessary for competent EH practice. However, to move beyond merely describing what students and supervisors reported or observed, the data was interpreted using the Legitimation Code Theory's (LCT) Specialization dimension. This theoretical lens enabled the identification of the basis upon which competencies were legitimised—either through what the students know (epistemic relations) or who they are (social relations). Using this framework, the study situated EH practice within an elite code, signified by ER++ and SR++, as both knowledge and knower dimensions were foregrounded with equal strength. This classification transcends thematic description, offering a structured analytical positioning of competencies necessary for professional success within the discipline. Using the LCT Specialization dimension revealed legitimacy patterns within EH practice. The following section plots these onto the Specialization plane.

5.3.1. Orientation and Relative Strength of Competencies on the Specialization Plane

SRQs 1–3 revealed that knowledge, skills, and behaviours, underpinned by values and attitudes, are required to practice EH successfully.

In this context, knowledge relates to facts or information (Schmidmaier et al., 2013), specific to EH practice, and includes both theoretical and technical knowledge, i.e., knowing the legislation and its associated technical requirements in different EH contexts. Knowledge of the legislation gained in the workplace was foregrounded and emphasised as “the most important” (SS11) by one participant. This was echoed by the EH workplace supervisors who emphasised knowledge of the role of the EHP, as aligned to the mandated scope of the profession (DOH, 2009), and in rendering municipal health services, as something that they teach and observe developing in the students “first of all” (EHP4).

In this study context, defining ‘skills’ is adapted from Lamri and Lubart (2023) and includes soft skills, e.g., communication-, problem-solving- and team-work skills, technical skills specific to the discipline, e.g., taking food and/or water samples, and interpreting sampling results, transferable skills, i.e., critical-, analytical- and organisational skills. Participants foregrounded skills, in its entirety, as necessary for competence to practice EH in various contexts. One student described the development and enhancement of detailed inspection procedures as “crucial” (RJ_SS6). The EHP supervisors too observed the broad skills range developing in the students, describing these as important to “get right first” (EHP4).

Professional behaviours are described as the principles of behaviour exhibited through the conduct, attitude and actions deemed acceptable and appropriate in a professional setting (Louwen et al., 2023). Values, i.e., standards that guide behaviour and beliefs, i.e., what individuals accept to be true or real, underpin attitude and the interplay between these in turn influences behaviours (Nazirova & Borbala, 2024). Behaviours in the context of this paper, considers and includes values and attitudes, and forms part of one theme. Acceptable professional behaviours, were foregrounded by all participants, as expressed by a participant:

…being calm and patient and… always, like especially whether someone is angry with you or speaking in a foul manner; never, like speak in such a manner. You [the practitioner] should always speak professionally and be professional and be patient and calm… (SS8)

The findings for SRQ 4, are depicted in Figure 5.2 which illustrates the orientation of the themes, i.e., competencies, on the LCT Specialization plane.

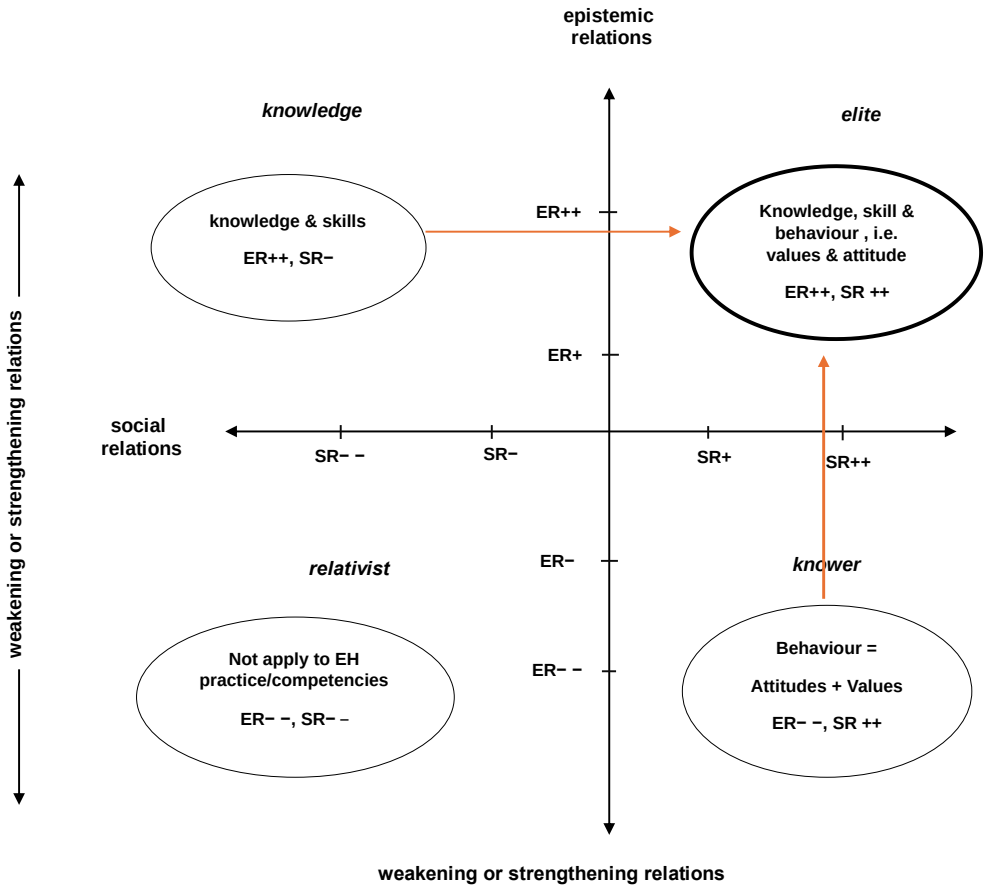

Figure 5.2: Competencies foregrounded by EH WIL students and EHP WIL supervisors as essential for achieving EH goals (adapted from Daries et al., 2025b)

Figure 5.2 shows that competencies legitimised by EH WIL students and EHP supervisors align with the elite quadrant (ER++, SR++) on the LCT Specialization plane, reflecting a dual emphasis on disciplinary knowledge and relational competence essential for holistic, context-sensitive EH practice.

The analyses furthermore unveiled a tension existing between the basis of achievement used by the role-players assessing WIL. This tension revealed shifts in the EH students' competency emphasis within varied contexts, i.e., between what is essential for success in: the workplace, the classroom—by way of current WIL assessment focus-, and the professional credentialling criteria. The student shifts their focus to align and adhere to requirements for achievement—as recognised by them—in the different contexts.

Despite the tension and subsequent shift in student focus, they do recognise, the holistic competencies to practice EH successfully, as confirmed by their workplace supervisors. These professional behaviours include emotional intelligence and its traits, whereby the students modify behaviours as the context dictates. This is explained by a participant in the student

interviews, whereby the participant expressed empathy for the client *(the specialization relation is included in square brackets merely to illustrate orientation to either ER or SR and is not part of the interview feedback; relative strength is omitted)*:

Today I learned that being calm [SR] in all situations, no matter what the situation [ER] is—even if you are being insulted—it's important as we have to come to an understanding [SR]with people and work with them well [ER] as EHPs. (RJ_SS9)

This sentiment was echoed by the EHP WIL supervisors, describing how the EH students demonstrate self-regulation, critical and analytical skills, and social awareness skills during WIL:

I think what they gain there is being able to understand—even though you know all the legislation possible [ER], you're still going to be put in a situation where …I still need to think for myself [SR]… (EH8)

The abovementioned statements, from the student and the EH WIL supervisor group informs that a combination of knowledge, skills, attitude, and values, i.e., behaviours, are required to reach a desirable EH outcome, i.e., ER++, SR++.

The tension uncovered by the LCT Specialization analyses further informs that current assessment of competence should be structured to include criteria for the full range of professional competencies, consisting of a combination of knowledge, skills, and behaviours, the latter encompassing values and attitudes, as the EH discipline is located in the *elite* code, i.e., relatively strong epistemic relations (ER++) and relatively strong social relations (SR++) are required for competence to practice EH successfully. These were emphasised in the findings from interviews with the EH WIL students and the WIL EHPs supervising them.

Additionally, Tables 5.3 and 5.4 describes how the knower and knowledge codes were foregrounded by both the students and EHP WIL supervisors, to locate the profession in the *elite* code. Each table illustrate the use of the translation device, qualifying words, and phrases by participants to foreground and/or downplay the ER in Table 5.3, and the SR in Table 4, and examples of these by quotes from the data.

5.3.2. An Assessment Framework for EH WIL Competence

The tasks performed during the EH students' work placements allow them to participate in real-world challenges, reflect on their learning and evaluate their progress. This meets criteria for being "highly authentic" (Bosco & Ferns, 2014), especially for students in their senior years, namely year 3 and 4 of the degree. The EH workplace presents an authentic setting and is considered a reliable and credible context for assessing workplace competencies (Gulikers et al., 2004; Bosco & Ferns, 2014). The limiting aspect in EH WIL assessment is that industry does not currently contribute to the assessment of EH WIL students. The criteria and proficiency indicators are not explicit for WIL competency assessment. Although assessing learning and competence development through WIL is tricky (Bilgin et al., 2022), the workplace presents an opportunity in which all role-players, i.e., students, HEI and industry could partake in competency assessment (Bosco & Ferns, 2014).

Table 5.3: Epistemic relations foregrounded with examples from the data (adapted from Daries et al., 2025b)

Relation-ship Strength	Epistemic Relations (ER)	Competencies Informed by the LCT Specialization Analysis	
	Relative Strength of an Identified Competence	**Student Reported Competencies with Examples from the Data**	**EHP WIL Supervisor Observed Competencies with Examples from the Data**
Strengthening relations ↕ **Weakening relations**	ER++: express strong emphasis, e.g., vital, crucial, very important or essential	*"I think I would say that knowing your scope is very important…" (SS10)*	*"…it's important to mention, first of all, the role of the EHP to unpack that…by law, you are obliged to do certain things that's mandatory…"* *(EH5)*
	ER+: express importance but not a strong emphasis, e.g., important, required, favoured, or valued	*"The stuff like conducting inspections and going out with the EHP's, the practical work, it helped a lot! I mean that was more important actually. I wouldn't say more important, but equally as important as the knowledge we obtain at campus." (AL4)*	"*I do feel that they do get to a point where they gain confidence on how to apply the legislation…. with the students now, the more exposure they get, more confident they get." (EH9)*
	ER− express no emphasis, e.g., trivial, no role or not relevant	*"Having a relationship with your colleagues helps you learn about things you didn't know about, enquire about things you do not understand, all helping you improve and increase your competence as an individual."* (RJ_SS10)	*"Yes, you have your legislation, but not everything is that black-and-white. Sometimes you're gonna have to like, bend a bit and you're gonna have to like, re-write your script actually…" (*EH8)
	ER− −: express strong down-play, e.g., not needed at all, does not matter, or plays no role	"*The first thing is that, in environmental health we have to put people first. That's the first thing."* (SS2)	"*We don't want, you know, to send a student out into the field not armed, and to us in the [area name withheld] its: professionalism first… with us professionalism is high on the priority list." (EH4)*

Contrary to the limitations of OSCEs, which assesses only some competencies in a simulated setting, with simulated patients (Dewan et al., 2024), the variability in the workplace setting presents more favourable for assessing holistic competencies, as it requires interaction with real clients (Bilgin et al., 2022).

Dissimilarly to Gulikers et al. (2004) findings, the total context, i.e., physical, and social, was foregrounded as important in EH practice, in addition to the disposition of the practitioner. Therefore, social context must be included in the framework for authentic assessment of holistic competence in EH, which adds an additional authentic layer.

The 5-dimensional assessment framework proposed by Gulikers et al. (2004), a competency-based assessment framework, such as that described by Cano et al. (2023) and the criteria for assessment in an authentic setting described by Bosco and Ferns (2014) meets the requirements for credibility, of the South African Qualifications Authority (SAQA, 2017), and the UoT that serves as the research site. These credibility criteria are validity, reliability, replicability, and integrity, i.e., relevance to the 'task' (Gu-likers et al., 2004; Bosco & Ferns, 2014; SAQA, 2017; Cano et al., 2023).

Table 5.4: Social relations foregrounded with examples from the data (adapted from Daries et al., 2025b)

Relation-ship Strength	Social Relations (SR)	Competencies Informed by the LCT Specialization Analysis	
	Relative Strength of an Identified Competency	**Student Reported Competencies with Examples from the Data**	**EHP WIL Supervisor Observed Competencies with Examples from the Data**
Strengthening relations ↕ **Weakening relations**	SR++: express strong emphasis, e.g., vital, crucial, very important or essential	*"I was never a patient person! But I guess as you learn and grow over the years, you see that being patient is very important… now, when you get to a workplace, you remember all those things and you try to apply them… So, patience is very important." (AL5)*	*"…eventually they develop into that …they become mediators, and they will know how to control themselves or their tone of voice…" (EH2)*
	SR+: express importance but not strong emphasis, e.g., important, required, favoured, or valued	*"You must have the right manner or approach of how you deal with people… you shouldn't treat people as if you are doing them a favour, or want to show them: I'm better than you, or undermining people" (SS1)*	*"There's different…diverse people, in diverse areas and dynamics? So, at the end of the day, …yeah, what I see grow is their service orientation…. to add value, actually; just not to enforce and to walk away." (EH10)*
	SR−: express no emphasis, e.g., trivial, no role or not relevant	*"I have also learnt that it is important to know and be sure about the legislation." (RJ_SS5)*	*"…they're so thorough in their work, they would go through that regulation and write it according to the regulations and so on…" (EH7)*
	SR−−: express strong down-play, e.g., not needed at all, does not matter, or plays no role	*I think the most important knowledge that I've gained is from the legislation because they outline our scope of practice in a way that they act as a guidance in order for us to execute the job correctly. (ss11)*	*"By the 2nd year, you know I feel a bit, sometimes, upset when they can't give me at least the short title of one or two pieces of legislation…" (EH4)*

The learning and teaching of holistic competencies must align to the assessment of holistic competencies, meaning either to student performance in the workplace, e.g., doing a presentation to raise awareness about a health issue to an audience, and/or producing a product, e.g., writing an inspection report. The EH context (issue) in which the assessment is conducted will inform and guide the assessment outcome(s), proficiency level and following action. It is therefore necessary to include routine formative and summative assessments scaffolded in levels of complexity and aligned to the various levels of study.

Bosco and Ferns (2014) argue that escalations in: proximity to the workplace; engagement in social and physical workplace contexts; scholarly demands and student self-reflection; and involvement of industry in the assessment increases the authenticity of the assessment task. This authenticity criteria exists in the EH WIL component.

Due to the multi-faceted nature of EH practice and variety of issues addressed as per the scope of the profession (DOH, 2009) the student, during their work placement, together with their WIL supervisors may identify an EH issue, context where a professional gap exists, which is necessary to develop the full range of competencies needed to be proficient in the discipline. This is recommended from year 2, as level one of the programme consists mostly of foundation non-EH specific courses (modules) e.g., mathematics, chemistry, and physics. The purpose of WIL in year one at this UoT is, in summary, to expose students to an authentic professional work environment so that they may understand what the work of the EHP entails.

Results, i.e., performance or products (Gulikers et al., 2004) will be aligned to exit level outcomes as well as course level outcomes. In this example, the outcomes will be scaffolded between levels of study but result in assessment of competence in a particular area/issue of the scope of the EH profession (DOH, 2009). As ethics features strongly in each level of the qualification, students will be expected to reflect on, document and present the ethical behaviours they upheld throughout their WIL.

To consolidate the findings and illustrate how each sub-research question informed the development of the assessment framework, Table 5 presents a structured mapping of data sources and emergent competencies

Table 5.5: Mapping of sub-research questions, sources, and main findings (Daries et al., 2025a)

Sub-Research Question (SRQ)	Data Source	Main Finding(s)
SRQ1: Student reported competencies acquired during WIL	Structured individual interview transcripts with senior students (SS) and recent alumni (AL)	Students foreground relational and context-sensitive behaviours, knowledge application, technical skills, and collaboration
SRQ2: Competencies reflected in student journal	WIL reflection journals (RJ)	Students foreground behaviours, ethics and professionalism and application of knowledge and technical skill
SRQ3: Competencies observed in students during WIL	EHP WIL supervisors focus group discussion transcripts	Supervisors foreground relational and context-sensitive behaviours, stake-holder engagement and -communication, knowledge, and technical skill
SRQ4: Orientation of competencies on LCT Specialization plane	Visual mapping of results from SRQ1, 2 and 3	The holistic competencies identified across SRQ1, SRQ2, and SRQ3 align with an elite code orientation on the LCT Specialization plane, reflecting strong epistemic relations (ER) and strong social relations (SR) within EH practice.
Holistic framework for EH WIL assessment	Synthesised results	Findings across all data sources support a multi-dimensional framework integrating knowledge, technical skill and professional behaviours, incl. attitudes and values for entrusting activities aligned with independent practice

The mapping illustrated in Table 5.5 directly informed the development of the Holistic Assessment Framework (Table5 5.6), which integrates these competencies into a structured model for evaluating student readiness for independent professional practice. The assessment framework, together with proficiency indicators is presented in Table 6, with an extension to the table to present the assessment types, the role-players involved, and their respective roles in the assessment of holistic competencies.

Literature suggests that to eliminate subjective biases, a clear understanding must be agreed upon by all involved in assessing progress (Bosco & Ferns, 2014; Gulikers et al., 2004). It is therefore necessary to define the criteria, describe and clarify it and increase reliability and validity by using multiple role-players. This for the EH context this means that the WIL

supervisor, academic assessing the student, and the student themselves, as well as the collaborative contexts needed to solve EH problems/issue are important aspects to be part of the assessment process and practice (Bosco & Ferns, 2014; Gulikers et al., 2004; Boud & Falchikov, 2006; Von Treuer et al., 2011).

Rubrics and assessment criteria provide clarity to students and EH WIL supervisors, and it helps them understand how and what will be assessed (Bilgin et al., 2022). It is therefore best to share the assessment criteria, together with its descriptions with all role players before the actual assessment(s). As EH practice competence falls within the elite quadrant of the LCT Specialization plane, the criteria must reflect indicators relating to both knowledge, skill, and dispositions relevant to the context (EH issue) being assessed.

Table 5.6: Holistic EH WIL competency assessment framework, assessment role-players and their roles (Daries et al., 2025a)

Assessment Domain			Performance Indicator
Competency/ Dimension	**Description**	**Example**	
Knowledge	Knowledge relevant to the EH profession, incl. specific legislation, best practices, and procedures	Knowledge of appropriate legislation relevant to food premises inspections	Basic/Foundational Elementary knowledge of legislation Intermediate Application of relevant legislation in routine/typical EH daily tasks Advanced Accurate knowledge, i.e., practice and procedural, is applied and integrated in a variety of EH contexts and supports innovative problem-solving.
Skill	Relevant EH knowledge is applied, and analytical ability is demonstrated when performing technical tasks and in the assessment of environmental health contexts and when solving problems	Performs water sampling, following procedures prescribed by relevant legislation and interprets results.	Basic/Foundational Task performed is guided by supervisor. Intermediate Task is performed independently, and results are evaluated against relevant legislation, guidelines, codes, and/or standards Advanced Task is performed independently and aligned to relevant procedural requirements. Accurately assesses an EH issue, applies relevant knowledge, technical and analytical skills to solve problem(s) in an innovative and creative manner, and communicates clearly and effectively.
Professionalism - value: accepted principles of behaviours - attitude: opinion or view of the EH profession	Upholds ethical codes of conduct and acceptable professional behaviours across all EH contexts	Demonstrates ethical and professional conduct when interacting in diverse setting, with members of the public, colleagues, and other professions.	Basic/Elementary Aligns and/or adjusts behaviour to conform with ethical codes, and expected professionalism under guidance Intermediate Self-adjusts behaviour to uphold acceptable EH standards of professional behaviours and independently makes ethical decisions across all contexts Advanced Independently makes ethical decisions, adjusts behaviour to be professional and foster relationships and collaboration across all EH contexts

Assessment	* Formative (Developmental: Progress Toward Competency Achievement Assessment)	Summative (Assessment of Competency Achieved)
Assessor	**Role (Evaluator/Monitor/Feedback)**	**Role (Grades/Judges)**
Student	• Self-evaluation of strengths & competency gaps • Develop a progress plan • Regular self-evaluation • Monitoring of progress • Discussion with WIL supervisor & or WIL academic(s)	**N/A
WIL Supervisor	• Direct observation of student's performance/completion of tasks in specific context • Feedback to student on progress • Feedback to WIL academic(s)	Assesses through feedback on student's final products &/performance
Peers	Direct observation of student of performance with feedback as an individual or in a group setting	**N/A
Academic(s)	• Monitor(s) student self-evaluation & progress plan • Evaluates progress as informed by supervisor • Provides feedback on progress to student & WIL supervisors	Assessment of final POE, WIL reflection journal and WIL presentation, as relevant
Professional council	• Monitor WIL in the programme against clear quality criteria for meeting competency standards and credentialling criteria • Feedback to UoT	Audit & verify final WIL students POEs (assessed) against clear credentialling criteria &/quality indicators

* Formative assessment includes 360-degree feedback methods from several sources, e.g., peers, clients, EHP workplace supervisors and academics, and the student being assessed/evaluated.
** N/A- not apply/applicable as assessor plays no role in the assessment

5.4 Discussion

This paper sought to present a framework for the holistic assessment of professional competencies required for successful environmental health practice. The framework presents the competencies legitimised by EH WIL students and their workplace supervisors. These form the basis of achievement in EH practice. The assessment framework organises it in a simplistic manner, so that both industry, students and academics may synergistically pursue competencies through teaching, learning and acquisition thereof during WIL. This study confirms findings by Bosco and Ferns (2014), in that WIL provides an authentic setting for workplace learning and the assessment of competencies that students develop in the workplace developed due to the highly authentic setting and proximity to real tasks that students engage with.

The findings inform that the competent EH practitioner must be able to apply relevant knowledge, skills and behaviours as is needed for efficient EH service delivery in the 21st century (Stewart et al., 2023; Omid et al., 2021; Walekhwa et al., 2022) and as the South African, and African context requires (Morse et al., 2020; Shezi et al., 2019). The tension uncovered fuels a shift in focus between the aspects legitimated for classroom success, professional credentialling, and workplace competence. This is a common consequence where competence criteria and or aspects other than theoretical and technical knowledge are not explicit in a curriculum and its associated assessment criteria (Rusznyak & Bertram, 2021).

To address the tension uncovered the literature suggests revising the part of the curriculum that is lacking by way of an outcomes-oriented competency-based assessment (Matsuzuka, 2020). This means that instead of revising the entire curriculum, only the EH WIL component, and its assessment can be revised to include both the knowledge and knower competencies in the assessment. Indeed, the UoT concerned expects these as part of graduate attributes, specifically relevant to ‘Relational’- and ‘Ethical capabilities’ (University of Technology, 2017). To fully assess all the competencies needed to meet the EH goals, simulations may merely assess technical competencies for EH, but not competencies needed to meet those involving critical and analytical thinking, as the real-life context, including the temperament of clients,

context, and resources available cannot be simulated (Dewan et al., 2024). Authentic assessments i.e., those which mirror actual issues, with all its associated limitations, challenges and contexts are presented in EH WIL, providing an ideal backdrop in which students' competencies may be practiced and assessed (Wesselink et al., 2017). WIL provides.

Literature regarding competency assessment suggests the scaffolding of assessment criteria, from simple to complex (Garraway, 2022; Gulikers et al., 2004) as part of holistic assessments. WIL in the EH programme allows for this due to its structure consisting of varying work placement periods per study year.

Using Gulikers et al. (2004) 5-dimensional assessment framework specifically for EH competency assessment is most suitable as its WIL component comfortably integrates the dimensions and eliminates the weaknesses of e.g., having WIL presented as one continuous block in only part of the qualification. Adopting a comprehensive assessment framework for competency assessment is pertinent to meet the dynamic EH discipline-related challenges, highlighted by, amongst others, Morse et al. (2020) in EH practice in RSA, Patthanaissaranukool et al. (2020) Thailand, Walekwha et al. (2022) Uganda and Omid et al. (2021) in Iran. Subsequently, having a valid assessment framework for the professional EH competencies can better suite graduates for meeting the requirements of employers and demands for employability success in the 21st century and enhance the delivery of municipal health services.

5.5 Recommendations

To enhance development of holistic competencies in the EH graduates, meet the institutional graduate attributes and respond adequately to 21st century demands—meaning, future-proof the profession—it is recommended that that a comprehensive evaluation of the EH programme be undertaken to better establish where WIL, together with its assessment, could and should be embedded in the entire programme. This implies participation of all EH programme lecturers, beyond the WIL role-players described in this article, and especially those teaching discipline—specific courses. The guidelines suggested by Bosco and Ferns (2014), together with the credibility and proficiency criteria suggested in this article can serve as the basis of such evaluation and dialogue.

Future research recommendations are to: Explore/determine where authentic assessments can be located throughout the EH undergraduate programme in addition to the WIL component; explore the how the holistic competencies are developed in the EH students by for example , using the LCT Semantics dimension and best practice in EH to evidence student learning and holistic competence development. While this study focuses on preparing undergraduates for professional practice through the assessment of entrustable professional activities (EPAs), the emerging role of EPAs in Environmental Health (EH) practice may warrant further investigation, particularly in relation to their implementation and long-term impact within competency frameworks.

5.6 Conclusions

The strength and longevity of academic programmes lie in their stand-out qualities, among which WIL remains a defining feature of UoT training. Its value in shaping, strengthening and ultimately future-proofing the Environmental Health profession has far-reaching implications. This study set out to explore how WIL assessment should be structured to holistically assess EH student professional development. Using LCT's Specialization dimension, the findings revealed that professional competency comprises both epistemic and social relations—placing EH practice firmly within the *elite* code. The results, summarised in Table 5, highlighted competencies developed and observed during WIL—across knowledge, skills, and behaviours—that were legitimised by students and their workplace supervisors. These informed the development of a five-dimensional assessment framework foregrounding real-

world task design, collaborative workplace engagement, conceptual transparency, credibility criteria, and alignment with entrustable professional activities (EPAs). If adequately assessed and rewarded, these competencies may serve as a cornerstone in preparing students for independent professional practice, and in doing so, future-proof the EH profession.

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CHAPTER 6

6. DISCUSSION, CONCLUSION AND RECOMMENDATIONS

6.1 Introduction

This chapter synthesises the outcome of the study, focussing on the main issues highlighted by this research, describing the issues and the reasons, as uncovered by this study for their existence. This section will also describe the proposed solution(s) and its associated benefits and furthermore describe the anticipated challenges. The limitations of the study are described. This chapter concludes in presenting recommendations for future research which may explore and further contribute to teaching, learning and assessment into environmental health student development, work-integrated learning (WIL) and longevity of the environmental health profession.

6.2 Issues uncovered by the research

The assessment of work-integrated learning remains notoriously challenging for various disciplines in higher education across the globe (Ferns and Zegwaard, 2014). Some of the challenges are directly related to the desired core competencies not being clearly identified and/or described for the specific discipline, either in the curriculum, profession or by way of its credentialling criteria. As a result, the assessment of the full range of competencies, essential for achieving the goals of the discipline/profession, remains limited, often due to the academic programme's assessment criteria and competency indicators not being clearly defined and not explicit in the curriculum. In the Environmental Health (EH) undergraduate programme, the assessment challenges too are driven by credentialling criteria that are limited to time-based exposures to the various duties in the mandated scope of practice. Neither competency descriptions nor proficiency criteria are explicitly defined beyond these.

The main research question addressed, namely: to develop a holistic framework for the assessment of competence in the Environmental Health work-integrated learning undergraduate students, revealed significant findings relevant to the broad professional competency range developed by the students during WIL. The findings of this study, as guided by the Legitimation Code Theory's (LCT) Specialization dimension (Maton, 2014) revealed that, Environmental Health (EH) undergraduate students, from a University of Technology (UoT) in South Africa, develop competencies beyond mere understanding of the integration

of academic knowledge and the development and refinement of technical skills during work-integrated learning placements—i.e. beyond the current focus of the academic assessment. The LCT Specialization dimension assisted in identifying exactly which competencies are legitimised in EH practice, from the EH WIL students' perspective, as related by them in in-depth interviews and manifested in their WIL reflection journals. These competencies were echoed and confirmed in the observations of their WIL workplace Environmental Health Practitioner (EHP) supervisors, and were indeed confirmed as desired competencies to achieve the goals of EH practice

The LCT Specialization analysis further revealed an existing tension between the credentialling criteria for professional independent EH practice, i.e. what is legitimised by the professional body, the classroom-based assessment, and what is essential for meeting the workplace EH goals. Consequently, to attain success in the different contexts, i.e. classroom and workplace, the students shift their focus as the contexts requires. Currently, the classroom assessment focus is on theoretical knowledge and technical skill meaning that the specialised knowledge component of the profession is foregrounded situating the EH profession in a *knowledge* code. Concomitantly, the professional credentialling focus is on the management of WIL in the EH undergraduate programme and foregrounding the WIL student's time-based exposures to mandated functions (South Africa (SA): Department of Health (SA: DOH, 2009), thereby situating the credentialling criteria in a *relativist code*.

Notably the LCT Specialization analysis revealed that the full competency range for successful EH practice consists of theoretical knowledge, technical skill, and professional behaviours, which is comprised of professional- attitudes and -values. Thus, the LCT Specialization analysis, situates EH in an *elite* code, meaning that the competencies for successful EH practice are relatively stronger in its epistemic relations (ER++) and relatively stronger in its social relations (SR++), thus foregrounding both ER and SR as necessary for achieving success in EH practice. Notably, the current assessment of WIL in the EH programme is limited in that the full range of competencies, necessary for achievement in the profession, are not assessed.

The assessment gaps revealed by this research further extends, beyond the identified limitations namely, *what* is assessed, including the assessment topics, assessment criteria and proficiency levels of achievement, to *whom* the assessors should include, i.e. assessment role-players and their assessment profiles. EH WIL supervisors spend more time with the

student during the work placement. During the work placement they guide, advise, mentor and nurture the student to reach the professional competencies required to be successful in the EH profession. Thus, they directly observe the professional growth taking place in the student during the work-placement. Additionally, they identify short-comings and gaps in the students' competencies and guide them on how to reduce the shortcoming(s) and guide them on way to attain these. This means they have an enhanced understanding the professional growth shortcomings in the EH WIL student. Recent literature supports this finding (Ferns et al., 2025) in that WIL supervisors enhance and guide the development of day-to-day workplace competencies in students they supervise. Despite their crucial role in student growth and development of holistic competencies, they do not form part of the WIL assessment role-players.

Additionally, during work placements, the EH students themselves identify what is required for the achievement of EH professional goals due to observing and interacting with WIL supervisors and peers. They quickly recognise and become aware of their professional shortcomings as evidenced in their WIL reflections. Subsequently, the student set goals for themselves and work on reducing and/or eliminating their professional shortcomings under the guidance of EH WIL supervisors and peers in the workplace. Despite this, the students' self-assessment, progress evaluation and achievements are not included in the current WIL assessment of competence. Peer support, by fellow-students in the workplace, i.e. during WIL- is important as student provide advice and aide one another in developing competencies required for a profession during WIL (Rowe et al., 2023), yet, this is not, and should be considered in comprehensive learning, teaching and assessment of WIL (Penman et al., 2024). Currently, the neither the WIL students' feedback on their self-evaluation of progress, nor the feedback of their peers, are considered in assessing WIL competency development and acquisition.

This study sought to develop a holistic assessment framework for the full range of competencies developed by Environmental Health undergraduate students undergoing work-integrated learning. These competencies were informed by the EH WIL students, their WIL reflection journals and the EHP WIL supervisors' observations.

6.3 Implications and Relevance of the research outcomes

The limitations in the EH WIL assessment, as identified in the section above, exists due to varying issues. These issues are presented in the following sections, together with its implications for the assessment of WIL in the EH programme. Moreover, the LCT Specialization analysis informs that current EH WIL competency assessment criteria are situated across codes on the Specialization plane, depending on who is conducting the assessment. These are used as the springboard for discussing the implications relevant to the variability in achieving WIL assessment success.

6.3.1 Environmental health as a knowledge code: limited, unclear and implicit assessment criteria for the assessment of work-integrated learning in the EH undergraduate curriculum

Assessment criteria and its associated competency indicators are not clear and not directly aligned to WIL in the EH curriculum. This means that the WIL assessment focus remains on theoretical knowledge and technical skill. Success and achievement in WIL, and the associated competencies desired to navigate given situations in the workplace are not clear. The perpetual assessment of WIL focussing only on the theoretical and technical skill component, places EH in a *knowledge* code, with relatively stronger epistemic relations (ER++) and relatively weaker social relations (SR─ ─) stronger.

6.3.1.1 Implications of assessing Environmental Health competencies as a knowledge code

Should EH competence assessment remains as situated in a *knowledge* code, the professional and social dispositions needed for achieving the EH goals are missed. Dhesi and Lynch (2016) forewarned of this, cautioning that environmental health practitioners (EHPs) must be able to operate beyond the legislative confines. As mentioned by Stewart et al. (2023) the real-world EH challenges quite often do not have an academic answer, but rather, solving it requires a suitable solution. This implies that the EHP must be able to approach EH problems and issues utilising the necessary professional dispositions, including emotional intelligence traits, to achieve an acceptable outcome beyond that which is specified by the

technical requirements of legislation (Whiley et al., 2019; Smith et al., 2021). The behaviours informed by the emotional intelligence traits are very necessary for EH success and for meeting 21st century employability criteria (Tushar and Sharooksa, 2023). Possessing the professional disposition in combination with knowledge is especially necessary in the South African context, where large portions of clients live in poverty, unemployment (Shezi, et al. 2019), and are unsatisfied with municipal service delivery a, situation which often has the EHP at the receiving end of client frustration , requiring a social rather than a legislative intervention (Walker et al., 2014; Morse et al., 2020). Consequently, EH cannot be assessed as merely situated in a *knowledge* code. Practice on the ground dictates the combination of knowledge, skills and behavioural dispositions of the practitioner (Dunn et al., 2018; Bhandari et al., 2020; Omid et al., 2021). The EHP must be conscious of and remain ethical and professional while performing work within a legal framework (Gerding, 2020). This is aligned to the South African framework—the EH norms and standards—which specifies monitoring, evaluating and rendering of EH services across different contexts, requiring the EHP to achieve "voluntary compliance" (SA: DOH, 2015:13) from its clients, and not merely using the legislative framework as the driver of the profession (Whiley et al., 2019). The competencies, additional to that of a knowledge code, is depicted in table 5.6—chapter 5—which describes the holistic framework for holistic competency assessment of EH WIL. The table presents the additional dispositional traits as competency dimensions relevant to the EH profession and describe these together with criteria as well as proficiency levels.

6.3.2 Environmental Health as a relativist code: misdirected and insufficient credentialling criteria required by its professional board.

The credentialling criteria focusses on the management of WIL across higher education institutions offering the qualification. This comprises a mid-year verification by the professional board, to assess the progress toward the accumulation of the minimum hours and/or days accumulated by each student by their final study year, i.e. 4th year. Additionally, a full audit occurs at the end of each academic year where the POEs of final year EH students are scrutinised for meeting the time requirement and evidence of exposure to the functions specified in the regulated scope of the EH profession (SA: DOH, 2009). The literature caution that time spent in the workplace and measuring exposures remains merely that (Dunn et al.,

2018; Rusznyak, 2018) and does not provide adequate evidence of competence development and/or its acquisition.

6.3.2.1 Implications of assessing Environmental Health competencies as a relativist code

If the focus of remains on the management of WIL in the EH programmes, EH as a discipline is situated in a *relativist code* on the LCT Specialization plane, meaning relatively weaker epistemic relations (ER– –) and relatively weaker social relations (SR– –). This implies that neither knowledge nor knower dispositions are required for competence to practice EH and meet its goals of preventative healthcare. Contrastingly, the literature is amassed with findings confirming that successful EH practice requires competencies relating to both knowledge (ER++) and knower (SR++) requirements. Notably this is the case for in South Africa as, for example, identified by Morse et al. (2020) and Shezi et al. (2019), and, amongst others, for Australia (Dunn et al., 2018), Iran (Omid et al., 2021), Thailand (Patthanaissaranukool et al. 2020), India (Bhandari et al. 2020) and Uganda, (Walekwha et al., 2022). The findings of this research echo and confirm that a combination of theoretical knowledge, technical skill, and professional behaviours, consisting of professional attitudes and values, are necessary for achievement in EH.

Recognising and understanding holistic competencies is useful in focussing the developmental needs of the EH cadre. Missing these essential competencies may result in a haphazard professional identity and undervaluing the profession's role and contribution to protecting public health (Gerding et al., 2020). It may also result in risks to society, employers and the profession (Jackson, 2015). Jackson (2017) and, more recently Rowe et al. (2023), confirm that WIL provides the student with an insight of the professional identity, and this indeed assist them in deciding how that would manifest for their future-professional selves.

Furthermore, understating the competencies desired in, and possessed by successful EH practitioners, and minimising or even excluding it in the assessment of EH students, may further amplify a lack in interest in the profession and fuel a waning EH workforce, as is already reported in the United States of America (USA) (ibid.) Indeed, Fernandes and Rawatlal (2024) describes that clearly stating the competencies required in a particular discipline may spark interest in that profession.

Importantly, registration as Independent Environmental Health Practitioner (IEHP) with its professional board, is a goal UoTs, offering the programme has for its EH graduates and of the EH qualification. Registration ultimately signifies that the graduate is competent and can be entrusted with the mandated functions, duties and roles prescribed by relevant legislation, among which the SA National Health Act, no. 63 of 2003 (RSA, 2003), the SA Health Professions' act, number 56 of 1974 (RSA, 1976) and the South African Constitution (RSA, 1996). Thus, independent practice registration, is underpinned by assigning entrustable professional activities (EPAs) to the EHP which is underpinned by the achievement of competency performance indicators. These performance indicators are described in the holistic assessment framework, proposed in figure 5.6 (Chapter 5), which offers a structured approach to assessing competence development and describes proficiency levels, to the extent that professional tasks or activities may be entrusted to the student, i.e. they are able to perform the task independently and without supervision (ten Cate and Schumacher, 2022).

Thus, foregrounding the full critical competency range essential for the EH professional and the development of explicit proficiency standards, may serve as advocate for the profession, and thereby contribute to future proofing it (Whiley et al., 2019). At the same time, ensuring that independent practice credentialling criteria shifts to include actual competency dimensions and attain desired proficiency level, as suggested in the holistic assessment framework--and not merely through monitoring time and exposure to mandated functions and duties--may provide a sure measure of entrusting preventative public health duties to independent EHPs. Thus, entrusting registered independent EHPs due to possession of competencies directly aligned to EPAs.

6.3.3 Environmental Health as an elitist profession: actuality of assessing holistic professional competencies to reach EH goals

The LCT Specialization analysis situates the EH profession in an *elite* code, meaning it is relatively stronger in its epistemic relations (ER++) and relatively stronger in its social relations (SR++). This legitimises the combination of knowledge, and knower dispositions as essential for competence to practice EH successfully. This finding aligns with the graduate attributes, namely technological ability and foresight, resilience and problem-solving capability, relational capability and ethical capability of the UoT which served as site for this study. It is therefore

important that the full range of competencies be the focus of teaching, learning and assessment across the range of contexts to which the student is exposed.

Foregrounding-, making explicit-, and being able to articulate the full competency range of the EHP can be used to stimulate interest in the profession. Furthermore, highlighting its dynamic and adaptive nature, can serve as a strategically robust measure to aid the sustainability of EH. Additionally, clarifying its role in public health protection and risk exposure reduction remains crucial (Whiley et al., 2019).

6.3.3.1 Implications of not assessing Environmental Health competencies as an elitist code

Focussing on merely the knowledge and technical skill is not sufficient to reach the discipline-specific goals of the EH profession, i.e. goals that are steeped in professional ethics, social justice and advocacy for SA citizens' Constitutional (RSA, 1996) right, to a healthy environment and the improvement of the environment in which communities live. Failing to integrate and foreground the full competency range as equally important may result in practitioners having a skewed professional identity (Gerding et al., 2020) and may not clearly be able to navigate the specific issues of EH (Stewart et al., 2023). Literature confirms findings of this study in that the EH profession is poorly understood and under-valued (Whiley et al., 2019) and interest in the profession in is waning (Gerding et al., 2020). Consequently, the profession remains unknown, poorly understood and its role in, and contribution to public health protection is often minimised by other allied health professions (Whiley et al., 2019). Despite changes to EH practice focus, to manage emerging diseases and respond to the impacts of climate change, reported for EH in in Australia in the late 1990's, literature confirms that EH confined, and is viewed as a means of implementing legislative enforcement (Smith et al., 2021). On of the reason for this is ascribed to its goal not being fiercely represented by its professional bodies, such as local government EH committees and association (ibid.).

The full range of competencies must be explicit and emphasised as a stand-out feature of the profession. Dunn et al. (2024) highlights the competency range need in EH practice, reporting that EHPs self-report the use and application of a holistic competency range beyond legislative limitations, knowledge and technical skill, but to include aspects of professional

behaviours and attitudes, to reach EH goals. Thus, in other professions where legitimised competencies are situated in both a knowledge and knower code, the emphasis thereof, as too for EH, must feature strongly in teaching, learning and assessment in all contexts of the training.

The class-room space provides a secure- and lower-risk environment for students in which to practice these essential proficiencies, especially in unpredictable, potentially tense and ethically delicate contexts. Work-integrated learning provides an authentic context in which students experience all the facets of the practice, together with the nuances, limitations, challenges presented by the physical and social context. It serves as the ideal platform in which to 'test-drive'- under the safety offered through the EHP WIL supervisors, the competencies lacking, or which students are not confident about.

6.3.4 Exclusion of all EH WIL role-players in the assessment of competencies developed and/or acquired during WIL

The workplace presents an authentic environment in which students learn how to identify, recognise and adopt behaviours essential to navigate the challenges in the real world of work (Gerding et al., 2020; Scholtz, 2020). Workplace supervisors witness first-hand the professional growth occurring in the student under their supervision, and not the academic assessing them (Jackson et al., 2017; Ajjawi et al., 2020; Ferns and Zegwaard, 2014).

The students, who are capable of self-assessment and reporting their own progress for practice achievement (Boud and Falchikov, 2006) are not, and should be, part of the WIL competency assessment. Ajjawi et al. (2024) confirms the role of students in recognising and understanding what is required of them in the workplace, and their ability to judge whether an assessment is valid to their authentic WIL learning experiences. Furthermore, peers—in this case fellow EH WIL students — play a crucial role in collaboration, evaluation and feedback on competency development in professional and practical learning experiences (Ibarra-Sáiz et al., 2020). Indeed, the latter authors (ibid.) encourages the agentic role of students in learning and assessment—through critiquing their own work and that of their peers—and not merely being passive by-standers in a lecturer-centred learning experience.

6.3.4.1 Implications of excluding all Environmental Health WIL role-players from the holistic assessment of competencies

Excluding the EH role-players may result in essential competencies being missed in the assessment of WIL. Indeed, the LCT Specialization analysis confirmed varying success measures foregrounded in current EH assessment and the existence of tension between requirements assessed for class-room achievement and workplace achievement. This results in the students shifting between Specialization codes as the context dictates.

If excluded, and no role is played by the students, their WIL supervisors and the academics, the reliability and validity of the WIL competency assessment may be lacking (Von Treuer et al., 2011). Therefore, the inputs of all role-players, including students must be considered in identifying and describing relevant and clear criteria for assessment of holistic and authentic competencies (Ajjawi et al., 2024; Ferns et al., 2025). Involving all role players can improve the effectiveness and quality of the assessment, improve graduate suitability for employability (Mabungela and Mtiki, 2024) and thereby enhance assessment reliability and validity (Ajjawi et al., 2024.

Ensuring participation by all role-players in the assessment of holistic competencies, in an authentic environment, with explicit competencies and clear criteria, i.e. proficiency levels, may enhance confidence in achieving independent practice accreditation. Concomitantly the higher the level of proficiency achieved in a particular EH assessment context, the closer it brings the student to reaching entrustability. As such, figure 6.1 was developed to illustrate how the assessment framework for holistic competency assessment of EH WIL students' competencies, as presented in Chapter 5, and its role in attaining EPAs for independent EHPs are linked.

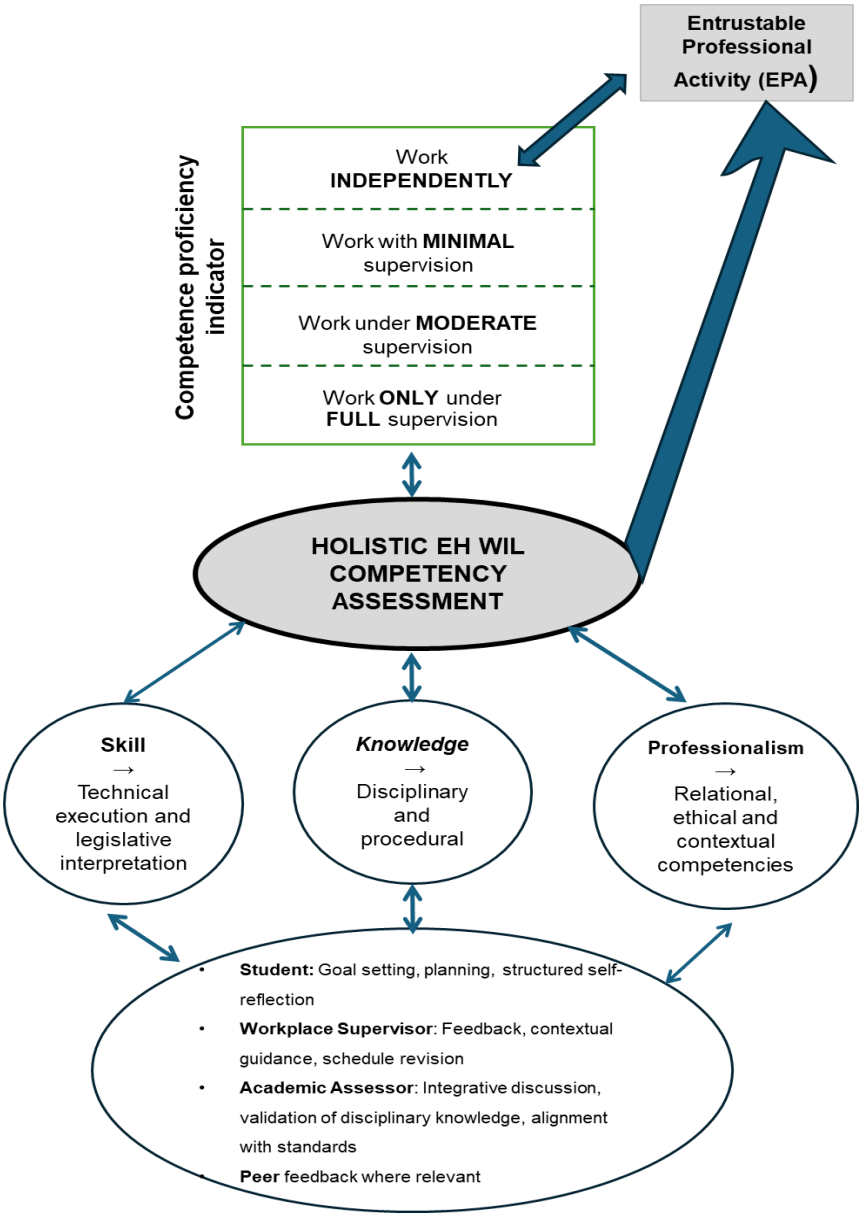

Figure 6.1: The role of the holistic EH WIL assessment framework of and its value in EPA readiness (adapted from Daries et al., 2025)

As can be observed in figure 6.1, the holistic framework is flexible by way of its proficiency levels, and, depending on the proficiency detail required for a particular competence, can be adapted as the context requires.

6.4 Surprising findings/Unexpected findings and its implication for the future of EH education and training

Despite the use and integration of technology being a desired 21st century employability criteria, this was not a prominent feature in the study findings. A surprising find was the limited foregrounding on the use of information technology and being computer literate as a competency in EH practice. Few, i.e. 2 respondents from the student groups, merely mentioned learning how to use of the municipality's digital system for capturing complaints and, in one instance a student respondent mentioned having to learn how to use software in developing materials for a health promotion poster. The lack of foregrounding the use of technology could be due to student closely mimicking their EH WIL supervisors and disregarding the ability to use it as a competency criterion in EH. No responses from the EH WIL supervisor groups mentioned the use of technology or being computer literate at all during the focus group discussions. Reasons for this could be possible resource limitations due to budgetary deficits, an ageing and technology- resistant work-force reliant on pen-and paper modalities, a technology skills gap due to the ageing workforce and limited interaction with data-management and information systems by the EHPs (McCormick et al., 2020). Contrastingly, Gerding et al (2020) identify the use technology and information systems as a core competency, and as important in advancing the EH workforce. The management of public health information, through routinely collected data and its interpretation by using, amongst others, relevant technological advancements, may assist the profession in managing existing and emerging EH challenges (ibid.). This shortcoming in the use and of application of technology, to guide decision-making in EH practice, is a short-coming and skills-gap that can and should be addressed through ongoing workforce training and development in these areas (McCormick et al., 2020; Martin and Latshaw, 2020).

6.5 Significance and contribution of the research

Various assessment frameworks commonly used for competency assessment of medical- and allied health profession were considered for suitability for the EH profession. The assessment framework presented by this research, and directed by the works of Gulikers et al. (2004) is

considered best suited to the EH WIL assessment needs, as it encompasses the requirements for credibility and quality criteria of competency-based assessments (Cano et al., 2023), the assessment credibility requirements of the South African Qualifications Authority (SAQA) (2017), the UoT's policy requirements for learning, teaching and assessments (CPUT, 2022) - the latter two are aligned to the requirements of the South African: Department of Higher Education and Training (SA: DHET) (2010), in South Africa. Contrary to Gulikers' et al. findings (2004), the context, i.e. physical and social context was highlighted as important in EH practice, and so too the disposition of the practitioner in that social context and must be included in the framework for authentic assessment of holistic competence in EH, which adds an additional authentic layer—thereby enhancing its credibility.

The framework fills a gap identified in EH programmes across the globe, e.g. in the USA (Knechtges and Kelly, 2015) and Australia (Dunn, 2018) and can be easily adapted to suite different contexts faced by practitioners in the EH workplace, as well as for other professions that have knowledge and knower dispositions as key performance requirements. Foregrounding the essential and holistic knowledge and knower professional qualities may very well eliminate the shortcomings identified in new EH graduates, e.g. those identified by Omid et al. (2021) in Iranian EH graduates and by Walekwha et al. (2022) in Ugandan EH graduates. Additionally, emphasising these competencies in teaching, learning and assessment of WIL in undergraduate programmes may prevent students from ignoring competent performance in all components of their training (Nyanjom et al., 2023).

The flexibility of the framework makes it both easily adaptable for several contexts, extending its use as relevant beyond mere EH WIL competency assessment. It can therefore by adapted and used in the classroom e.g. by academic assessor(s) during formative and summative assessments; in the work place e.g. by EHP WIL supervisors in formative evaluation activities and progress monitoring; in the workplace and classroom by the EH WIL student, e.g. when self-assessing their progress during EH WIL or in a theoretical course; and it can be used by their peers, in the classroom and workplace when giving feedback on observed competencies to one another.

Undergraduate programmes without WIL as a programme component, may find the initial development and implementation of the holistic assessment framework to be challenging (Wesselink et al., 2017). As WIL is a well-established component in the EH programme, and in UoTs in SA, revising and re-designing the entire curriculum is not necessary. The current format thereof in the EH programme, together with the existing relationships forged with industry, and those supervising WIL EH students, may serve as a propellent for the acceptance and the buy-in of the assessment framework and its implementation by all the WIL role-players. As suggested but the literature, scaffolding of the assessment, from less to more complex throughout the different levels of study is possible due to the way that WIL is structured in the EH undergraduate programme. Other disciplines, e.g. in pre-service teacher education and training, whereby Rusznyak (2018) reports a conflation of professionalism with only knowledge, or only the dispositions of the teacher, may adapt the holistic competency framework. Thus, the framework, too, allows for assessment of competencies in varying contexts with differing degrees of real-life challenges. This is due to the framework allowing for assessment of competencies in varying contexts with different degrees of real-life challenges. This flexibility of the holistic framework enables its use in other disciplines situated in an elitist code on the LCT Specialization plane, but where ambiguity and uncertainty are present by way of unclear and implicit competency descriptions necessary for achievement of disciplinary goals, as described above.

The professional body role of monitoring quality in the programme can be further strengthened by ensuring graduates whom they provide credentialling to, are competent to practice. Thus, equally important, the framework can be adapted and applied when assessing competency proficiency and align it to professional credentialling, i.e. the registration as independent EHP means the individual meets proficiency standards and can be entrusted with professional activities in the execution of duties, with its professional body. This in turn may limit risks to the professional council and EH board by ensuring that those recognised and accredited as independent EH practitioners are indeed worthy of its credentialling.

Highlighting the full range of competencies of the EHPs may future proof the profession against becoming redundant, as human dispositions and human behavioural sense, e.g. the emotional intelligence traits identified by this research, and which is needed to navigate problems beyond a mere right or wrong answer cannot be replaced by any current artificial intelligence.

6.6 Limitations

This study focussed on assessment of WIL in one UoT and one municipality rendering municipal health services. However, as the offering is quality-controlled for content in teaching, learning and assessment by the same professional board, these limitations are reduced and may be applied to all EH programmes across SA, and as described, to EH programmes - and other disciplines experiencing similar assessment challenges and situated in an elitist code on the LCT Specialization plane, where both knowledge and knower attributes is relevant for competence.

6.7 Recommendations

The following recommendations emanated from the research findings:

- The proposed holistic assessment framework must be promoted amongst all role-players (professional credentialling body, academics, WIL supervisor/s, WIL student and peers) to obtain a sense of its practicability and, where gaps are identified, to amend it.

- The full range of competencies for professional EH practice spans the entire EH undergraduate programme, and not merely the work-placement component. These

competencies must be highlighted in teaching, learning and assessment throughout all parts of the EH programme.

- It is worthwhile exploring how and where additional opportunity for authentic and holistic assessment of the competencies could best be situated in the other components (subjects) of the EH programme.

6.8 Recommendations for future research

Guided by the findings of this study, recommendations for future research to strengthen scholarship, practice and reduce gaps presented in EH training not only in in South Africa, but the African continent, not addressed by this research are presented below:

- Establish *how* students develop the identified competencies and perhaps use the LCT Semantics dimension (Maton, 2014) as guide for establishing these.

- It would also be worthwhile to explore whether stakeholders, e.g. academics, WIL supervisors, professional body and students, identify with their roles described in the proposed assessment framework and/or whether their roles should be revised to better suite their capacity.

- To further benefit the EH profession in RSA, it is recommended that a similar research study should be undertaken across the seven HEIs that offer the EH qualification in South Africa, to determine whether there are significant differences in professional competencies foregrounded relative to the respective WIL modalities.

The EH training in RSA lacks in discussions on how entrustable professional activities (EPAs) should inform EH training. The professional credentialling criteria for EHPs, from graduate- to independent practitioner registration, by its professional body, can be further supported by clear competency criteria, attained during undergraduate training. Despite EPAs being widely applied in medical and allied health professions' training, and its expanding adoption in other fields, there is a literature void in exploring the relevance or adoption of EPAs in EH contexts. This is particularly urgent given the increasing complexity of environmental health practice,

marked by global health threats, climate change, and diverse community needs (Shezi et al., 2019; Morse et al., 2020). This study briefly illustrates how clearly and explicitly defined competencies my feed into EPAs. In conclusion for future reasearch, it is suggested that:

- The role of competency achievement in all EH practice contexts be explored for its alignment to entrustability and its role in accreditation for independent practice by the EH professional registration body.

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Access to: *Chapter 6 Turnitin report*

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Appendix A: Semi-structured interview guide

SEMI-STRUCTURED INDIVIDUAL INTERVIEW GUIDE

SENIOR ENVIRONMENTAL HEALTH STUDENTS AND ALUMNI

TITLE: Assessment of authentic learning and workplace competence during work integrated learning in the undergraduate environmental health program

FACULTY: Applied Sciences

DEPARTMENT: Environmental and Occupational Studies

RESEARCHER: Louella M. Daries (*née* Solomons)

RESEARCH SUPERVISORS: Principal: Assoc. Prof. L. Reddy/Co-Supervisor: Dr. L. Hudson

GUIDING QUESTIONS:

1. What skills have you developed during your work-placement?
2. What knowledge have you acquired during your work-placement?
3. What values unfolded in you during this experience?
4. What attitudes were you encouraged to develop during your work-placement?

Appendix B: Document Analysis guide

Cape Peninsula University of Technology

DOCUMENT ANALYSIS GUIDE

WORKPLACE-BASED LEARNING STUDENT REFLECTION JOURNALS

TITLE: Assessment of authentic learning and workplace competence during work integrated learning in the undergraduate environmental health program

FACULTY: Applied Sciences

DEPARTMENT: Environmental and Occupational Studies

RESEARCHER: Louella M. Daries (*née* Solomons)

RESEARCH SUPERVISORS: Principal: Assoc. Prof. L. Reddy/Co-Supervisor: Dr. L. Hudson

DOCUMENT REVIEW GUIDE

Documents were analysed for relevant texts relating to the following written expressions:

1. Skills developed by the student during their work-placement
2. Knowledge acquired by the student during work-placement
3. Values unfolding in the student during the work-placement experience
4. Attitudes the student was encouraged to develop during the work-placement

Appendix C: Focus group discussion guide

FOCUS GROUP DISCUSSION Interview Guide

ENVIRONMENTAL HEALTH PRACTITIONER as WORKPLACE-BASED LEARNING SUPERVISOR

TITLE: Assessment of authentic learning and workplace competence during work integrated learning in the undergraduate environmental health program

FACULTY: Applied Sciences

DEPARTMENT: Environmental and Occupational Studies

RESEARCHER: Louella M. Daries (*née* Solomons)

RESEARCH SUPERVISORS: Principal: Assoc. Prof. L. Reddy/Co-Supervisor: Dr. L. Hudson

GUIDING QUESTIONS:

1. What skills have you observed in the student during work-placement?
2. What knowledge is acquired by the student during work-placement?
3. What values unfolded in in the student during the work-placement experience?
4. What attitudes do students develop during the work-placement?

Appendix D: Consent form

Cape Peninsula University of Technology

CONSENT FORM FOR PARTICIPATION IN A RESEARCH STUDY

TITLE: Assessment of authentic learning and workplace competence during work integrated learning in the undergraduate environmental health programme

FACULTY: Applied Sciences

DEPARTMENT: Environmental and Occupational Studies

RESEARCHER: Louella M. Daries (*née* Solomons)

RESEARCH SUPERVISORS: Principal: Assoc. Prof. L. Reddy/Co-Supervisor: Dr. L. Hudson

Description of the research and your participation

You are invited to participate in a research study conducted by Louella Daries (Ms). The aim of this study is to develop a holistic framework for the assessment of competence in Environmental Health (EH) Workplace-Based Learning.

Risks and discomforts

There are no known risks associated with this research.

Potential benefits

The potential benefits are 3-fold in that his research could aide in:

1. Identifying competencies that students develop during workplace-based learning so that the identified competencies may be assessed holistically.
2. Establish the competencies acquired by the workplace-based students as observed by the workplace EH supervisor should be part of assessing the student holistically.
3. Development of a holistic assessment framework to fairly assess the student's competence for practice.

Protection of confidentiality

Anonymity and privacy will be protected by all means. Your identity will not be revealed in any publication resulting from this study. In compliance with the POPIA, Act no. 4 of 2013 (RSA, 2013) documents will be stored on the CPUT premises in an accessed controlled space and destroyed as soon as the aim of the study is reached.

Voluntary participation

Your participation in this research study is voluntary. You may choose not to participate, and you may withdraw your consent to participate at any time. You will not be penalized in any way should you decide not to participate or to withdraw from this study.

Contact information

If you have any questions or concerns about this study or if any problems arise, please contact Louella Daries, in Room 3.34 in the Science Building at CPUT, District 6 Campus, Zonnebloem at: 021 460 3702 or email: dariesl@cput.ac.za.

For ethical concerns about this study, you may contact the Faculty of Applied Sciences Ethics Committee:

Prof Felix Nchu

Email: nchuf@cput.ac.za

Telephone: 021 959 6473

Consent

I have read this consent form and give my consent to participate in this study.

Participant's signature: _____ Date: _____

Witness signature: _____ Date: _____

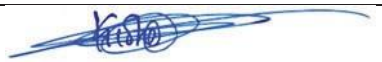
Researcher's signature _____ Date: _____

Appendix E: Permission request- Faculty Level

Cape Peninsula University of Technology

Statement of Permission

Data/Sample collection permission is required for this study.

Reference no.	189045701/11/2021
Surname & name	Solomons, L.
Staff Number	189045701
Program	PHD in Environmental Health
Title	Assessment of authentic learning and workplace competence during Work Integrated Learning in the undergraduate Environmental Health Program.
Supervisor(s)	Prof LALINI REDDY
FRC Signature	
Date	November 17, 2021

To: Professor J. Kioko

Dean: Faculty of Applied

Science District 6 Campus

Zonnebloem

16 September 2021

Dear Professor Kioko

REQUEST: PERMISSION TO USE ENROLLED ENVIRONMENTAL HEALTH SENIOR STUDENTS IN DATA COLLECTION FOR PhD RESEARCH

I am a student registered for the qualification: PhD in Environmental Health.

The title of my research is: “Assessment of authentic learning and workplace competence during work integrated learning in the undergraduate environmental health program”

The aim of this study is to develop a holistic framework for the assessment of competence in the Environmental Health workplace-based learning.

One my study objectives entails having to conduct in-depth interviews with senior students enrolled for the degree: Bachelor of Environmental Health and alumni who have completed the degree during the 2020 academic year.

I therefore request permission to use the enrolled senior students and alumni as participants in this study. I will request informed consent from all participants and participants will be anonymized in the publications resulting from the study, including the thesis, where applicable.

Should you need any additional information, please feel free to contact

me.

Thanking you,

Louella M. Daries (nee Solomons)

Student Number: 189 045 701

Email: dariesl@cput.ac.za

Mobile: 082 782 7243 Dear Ms. Daries,

Permission id granted, subject to the pescribed ethical

clearance. All the best with the study!

Prof J Kioko

Dean: Applied
Sciences 18 Oct
2021

Appendix F: Permission to conduct research at the University

Cape Peninsula University of Technology

Office of the Deputy Vice-Chancellor: Research, Technology Innovation & Partnerships
Bellville Campus P O Box 1906
Bellville 7535
Tel: 021-959 6242

15 November 2021

Ms. Louella Maria Daries (née Solomons) Staff No: 189045701
PHD in Environmental Health
Department of Environmental Studies Faculty of Applied Sciences
Cape Peninsula University of Technology

Dear Ms Daries (née Solomons)

RE: PERMISSION TO CONDUCT RESEARCH AT CPUT

The Institutional Ethics Committee received your application entitled: ""*Assessment of authentic learning and workplace competence during work integrated learning in the undergraduate environmental health program*" together with the dossier of supporting documents.

Faculty Ethics Committee Approval Date: 08 November 2021

Faculty Ethics Committee Approval Reference No: 189045701/11/2021

Permission is herewith granted for you to do research at the Cape Peninsula University of Technology.

Wishing you the best in your study. Sincerely

Dr D Phaho
Deputy Vice-Chancellor: RTIP
Cape Peninsula University of Technology

Appendix G: Approval of research request from Municipality

CITY OF CAPE TOWN
ISIXEKO SASEKAPA
STAD KAAPSTAD

CITY HEALTH

Dr Natacha Berkowitz
Epidemiologist: City Health

T: 021 400 6864 **F**: 021 421 4894
E: Natacha.Berkowitz@capetown.gov.za

Ref: 9479 2022-01-05

RE: ASSESSMENT OF AUTHENTIC LEARNING AND WORKPLACE COMPETENCE DURING WORK INTEGRATED LEARNING IN THE UNDERGRADUATE ENVIRONMENTAL HEALTH PROGRAM

Dear Mrs LOUELLA DARIES

Your research request has been approved as per your protocol. Please refer to the subsequent pages for the approval of any facilities or focus areas requested. Approval comments on any proposed impact on City Health resources are also provided.

Programme Manager Environmental Health (City Health):

Contact Person: Bettie Leedo

Tel/Cell: 021 444 1739/021 514 4153

Email: Bettie.Leedo@capetown.gov.za

Please note the following:

1. All individual information obtained must be kept confidential.
2. Access to the clinic and its patients must be arranged with the relevant Manager such that normal activities are not disrupted.
3. A copy of the final report must be uploaded to https://web1.capetown.gov.za/web1/mars/ProjectClosure/UploadReport/0/9479, within 6 months of its completion and feedback must also be given to the clinics involved.
4. Your project has been given an ID Number (9479). Please use this in any future correspondence with us.
5. No monetary incentives to be paid to clients on the City Health premises
6. If this research gives rise to a publication , please submit a draft before publication for City Health comment and include a disclaimer in the publication that "the research findings and recommendations do not represent an official view of the City of Cape Town "
7. As the research is approved as per submitted protocol, any changes to the protocol need to be submitted and approved by City Health prior to implementation.
8. We are currently not approving research for joint authority facilities (Dirkie Uys, Durbanville, Heideveld, Kasselsvlei, Nolungile, Nyanga, Parow, Ravensmead, Scottsdene) as they are in the process of being consolidated into one authority.

Thank you for your co-operation and please contact me if you require any further information or assistance.

Kind Regards
Dr Natacha Berkowitz Epidemiologist: City Health

Appendix H: Ethics approval letter

P.O. Box 1906 · Bellville 7535 South Africa ·Tel: +27 21 953 8677 (Bellville), +27 21 460 4213 (Cape Town)

Conditional Ethics Approval Letter **Reference no: 189045701/11/2021**

Office of the Chairperson **Research Ethics Committee**	**Faculty of Applied Sciences**

On 08 November 2021, the Faculty Research Ethics Committee of the Faculty of Applied Sciences, in accordance with CPUT's Unit of Research Integrity, has granted conditional ethics approval to Solomons, L. for research activities related to a project to be undertaken for a degree (PHD in Environmental Health) at the Cape Peninsula University of Technology.

Title of project:	Assessment of authentic learning and workplace competence during Work Integrated Learning in the undergraduate Environmental Health Program.

The conditions for this ethics approval are:

1. CPUT is kept anonymous in all reports, including publications and conference presentations emanating from this research project.
2. The results and reports emanating from this research project must be provided to the Faculty Research Ethics Committee of Applied Sciences, CPUT prior to dissemination (in whatever format) to ensure no identification of CPUT.
3. This permission is granted for the duration of the study.
4. Research activities are restricted to those detailed in the research proposal.
5. The research team must comply with conditions outlined in AppSci/ASFREC/2015/1.1 v1, CODE OF ETHICS, ETHICAL VALUES AND GUIDELINES FOR RESEARCHERS.

	08/11/2021
Signed: Chairperson: Research Ethics Committee	**Date**

Appendix I: LCT Specialization translation device

LCT SPECIALIZATION TRANSLATION DEVICE

TITLE: Assessment of authentic learning and workplace competence during work integrated learning in the undergraduate environmental health program

DEPARTMENT: Environmental and Occupational Studies

RESEARCHER: Louella M. Daries (*née* Solomons)

RESEARCH SUPERVISORS: Principal: Assoc. Prof. L. Reddy/Co-Supervisor: Dr. L. Hudson

Please see following pages for details on the LCT Specialization translation device.

LEGITIMATION CODE THEORY (LCT) SPECIALIZATION TRANSLATION DEVICE FOR EPISTEMIC RELATIONS (ER)			
Epistemic Relations (ER) **Includes:**	***IDENTIFIER*** *(practices included in/omitted from interviews, discussions or reflection journals)*	**Relative strength in relation to a specific competency**	

• Knowledge: specialised EH knowledge
  ○ knowledge needed for executing EH duties, i.e. 'what to do,' and
  ○ underpinned by theoretical and technical knowledge
 	
• Skills: Process & procedural knowledge
  ○ Actions/steps necessary for the performance of practice-related work tasks (under-pinned by specialised knowledge) (Schmidmaier et al., 2013; Franz et al., 2022)
	• procedure,
	• principles
	• technical knowledge,
	• knowing legislation
	• skills development e.g. taking samples
	• conducting inspections
	• pest/vector control
	• surveillance
	• hygiene monitoring
	• hazardous chemical control
	• pollution control measures
	• hazard identification
	• risk assessment
	• legislative compliance monitoring
	• skills acquisition is deliberate, e.g. interpreting legislation
	• effort to enhances technical skills over time
		Strengthening epistemic relations
		
		↕
		
		Weakening epistemic relations
			ER++: to express strong emphasis, e.g.
			vital, crucial, very important, essential
			key, number one, first thing, very well, extremely important
			
			ER+: express importance but not strong emphasis
			important, required, favoured, valued
			needed, necessary, must
			
			ER−: to express no emphasis, e.g.
			Trivial, no role, not relevant
			not important
			
			ER−−: to express strong down-play, e.g.
			not needed at all, does not matter/plays no role
			not a must, not necessary

QUALIFIERS/DESCRIPTIVE WORDS

++
Descriptive words/nuances to express "strong emphasis" (list not exclusive)

+
Descriptive words/nuances to express "importance" (list not exclusive)

––
Descriptive words/nuances to express "nonessential role" (list not exclusive)

–
Descriptive words/nuances to express "non-importance" (list not exclusive)

LEGITIMATION CODE THEORY (LCT) SPECIALIZATION TRANSLATION DEVICE FOR SOCIAL RELATIONS (SR)

Social Relations (SR) **Includes:**	***IDENTIFIER*** *(practices included in/omitted from interviews, discussions or reflection journals)*	**Relative strength in relation to a specific competency**	

• Values: relational/ social interactions
  ○ principles of behaviour that are valued in EH practice
 	
• Attitudes: practitioner attitude
  ○ Attitude/way participants feel towards the profession/practice
	• respect
	• empathy
	• compassion
	• kindness
	• punctuality
	• principled/ethical
	• respect
	• team-player
	• professionalism
	• ethical
	• respect resources
	• follows instructions
	• follow-up with clients
	• provide feedback to client
	• engage
	• people skills
		Strengthening social relations
		
		↕
		
		Weakening social relations
			SR++: to express strong emphasis, e.g.
			vital, crucial, very important, essential
			key, number one, first thing, very well, extremely important
			
			SR+: express importance but not strong emphasis
			important, required, favoured, valued
			needed, necessary, must
			
			SR−: to express no emphasis, e.g.
			Trivial, no role, not relevant
			not needed, not important
			
			SR−−: to express strong down-play, e.g.
			not needed at all, does not matter/plays no role, not a must, not necessary

QUALIFIERS/DESCRIPTIVE WORDS

++
Descriptive words/nuances to express "strong emphasis" (list not exclusive)

+
Descriptive words/nuances to express "importance" (list not exclusive)

––
Descriptive words/nuances to express "nonessential role" (list not exclusive)

–
Descriptive words/nuances to express "non-importance" (list not exclusive)

Appendix J: SAJHE Article acceptance notification

From: SAJHE Administrator
To: Louella Daries; Lalini Reddy; Lizel Hudson
Subject: [EXTERNAL] [SAJHE] Editor Decision
Date: Thursday, 22 August 2024 15:34:50
Attachments: B-B-ARTICLE 1_TEXT_ed.docx
B-REF LIST.docx
B-B-AUTHOR DETAILS_ed.docx

You don't often get email from sajhe@sun.ac.za. Learn why this is important
This message originated from outside your organization

LOUELLA DARIES, LALINI REDDY, LIZEL HUDSON:

We have reached a decision regarding your submission to South African Journal of Higher Education, "STUDENT PERCEPTIONS OF COMPETENCIES GAINED DURING ENVIRONMENTAL HEALTH WORK-INTEGRATED LEARNING: A GUIDE FOR HOLISTIC ASSESSMENT ".

Our decision is: Accept Submission
a) To retain the integrity of both author and journal, your paper will be submitted on a Turnitin platform (similarity index). 15% Similarity is the acceptable average. For example, in many cases doctoral work is used verbatim. If your source is above the 15%, we will notify you accordingly. We advise that this matter be addressed considering that the DHET subsidy is gained for both the study and article, this would imply that you need to paraphrase your main position, by using some varying words to explain a similar concept or argument already made elsewhere.
b) Thank you for your patience while we place your article in a future issue (Volume number and year). We will confirm the publication issue in the prefix of your title. Login on your profile to take note of the issue in which your article will be published.
c) Visit our web page (homepage @ announcements) where future publication dates will be confirmed.
d) Please take note that the production editor will be in contact with the author *in the 2 – 3 weeks prior to the publication date* - to confirm the final layout before publication.
e) This journal charges page fees for publications. The managing editor will forward the invoice for page fees payable by the author once the final layout has been confirmed by the copy editor.

***Please take note of the following:**

-Grammar and language editing is the sole responsibility of the author(s).

-The journal is only responsible for layout and reference checking.

Congratulations on the acceptance of your article in *South African Journal of Higher Education*.

SAJHE Administrator
sajhe@sun.ac.za

Appendix K: SAJHE article publication information and editor permission for use of author accepted manuscript

From: South African Journal of Higher Education [sajhe@sun.ac.za]
To: Louella Daries
Subject: [EXTERNAL] RE: ENQUIRY: ARTICLE 6608
Date: Wednesday, 06 November 2024 16:53:59
Attachments: image001.png

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Messages

Note

Dear Author(s)

Your manuscript is scheduled to be published in Volume 40 of 2026.

The Editorial Team will schedule the various issues in January of 2026.

We will confirm the publication issue in the prefix of your title e.g. (Vol.40_4_6608)

Please take note that the publication date is subject to change.

Visit our web page (homepage @ announcements) where future publications dates will be confirmed (publication dates might change).

The production editor will contact you 8-10 weeks prior to the publication date to finalize the layout of the article. You will receive the invoice for the page fees on or after the publication, as we will await the confirmation of the production editor to confirm the final number of pages to be published.

This journal charge page fees for publications. The managing editor will forward the invoice for page fees payable to the author once the final layout has been confirmed by the copy editor. Page fees for 2026 are currently set at R490 per page – but are subject to change.

Thank you for submitting your manuscript to the South African Journal of Higher Education.

SAJHE Managing Editor

https://www.journals.ac.za/sajhe/index

From: Waghid, Yusef [yw@sun.ac.za]
To: South African Journal of Higher Education [sajhe@sun.ac.za]
Cc: Louella Daries
Subject: [EXTERNAL] Re: REQUEST TO SAJHE EDITOR FOR USE OF AUTHOR ACCEPTED MANUSCRIPT (AAM) IN THESIS DUE FOR EXAMINATION
Date: Friday, 19 September 2025 14:33:32

This message originated from outside your organization

Dear Louella

Of course you can refer to and use the SAJHE publication towards your PhD studies. Good luck with your effort.

Yours sincerely

Yusef Waghid, DEd, PhD, DPhil
Emeritus Professor | Philosophy of Education
Books / Google Scholar / Orcid
signature_3689746683

From: South African Journal of Higher Education [sajhe@sun.ac.za] <sajhe@sun.ac.za>
Sent: Friday, September 19, 2025 12:35:06 PM
To: Waghid, Yusef [yw@sun.ac.za] <YW@sun.ac.za>
Cc: Louella Daries <dariesl@cput.ac.za>
Subject: FW: REQUEST TO SAJHE EDITOR FOR USE OF AUTHOR ACCEPTED MANUSCRIPT (AAM) IN THESIS DUE FOR EXAMINATION

Dear Editor-in-Chief
For your attention.
SAJHE Support Team

From: Louella Daries <DariesL@cput.ac.za>
Sent: 18 September 2025 16:57
To: South African Journal of Higher Education [sajhe@sun.ac.za] <sajhe@sun.ac.za>; De Beer, Anel [au1@sun.ac.za] <au1@sun.ac.za>
Subject: REQUEST TO SAJHE EDITOR FOR USE OF AUTHOR ACCEPTED MANUSCRIPT (AAM) IN THESIS DUE FOR EXAMINATION

CAUTION: This email originated from outside the Stellenbosch University network. Do not click links or open attachments unless you recognize the sender and know the content is safe.

Dear Prof. Waghid

I am preparing a thesis by publication for submission to Cape Peninsula University of Technology, and I would like to include my accepted article titled "***STUDENT PERCEPTIONS OF COMPETENCIES GAINED DURING ENVIRONMENTAL HEALTH WORK INTEGRATED LEARNING: A GUIDE FOR HOLISTIC ASSESSMENT***", accepted for publication in the *South African Journal of Higher Education, Volume 40_4_6608 (January 2026)*.

The thesis will be submitted for examination by shortly, in the week of 22 September 2025 and may be deposited in the university's open-access repository thereafter. I kindly request written permission to include the Author Accepted Manuscript (AAM) in the thesis. Proper citation and acknowledgment of the journal will be provided. If the thesis is passed by the examiners, I endeavour to request that the thesis publication be delayed until such time that the journal publication is released.

Please let me know if there are any other conditions or preferred wording to include before including the article for in the thesis for examination.

Sincerely,

Louella Daries

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Vrywaringsklousule

Appendix L: IJWIL 1st Round reviewer comments and author responses to reviewer comments

To: Dr David Drewery
David Drewery, Ph.D.
Editor: International Journal for Work-Integrated Learning
dwdrewery@uwaterloo.ca

01 July 2025

RESPONSE TO EDITOR'S AND REVIEWERS' COMMENTS

Dear Dr. David Drewer

We would like to thank you for the opportunity to revise and improve our paper/ manuscript with title: *Capturing the Development of Professional Competencies in Environmental Health WIL: Practitioner Observations and Assessment Implications*

We are particularly grateful for the very detailed and extensive feedback.

In addressing the comments and suggestions, we carefully revised and made the suggested changes to the paper.

Please find our responses to the comments and suggestions, from both Reviewer 1 and Reviewer 2 , in the table below and kindly let us know whether there are any other issues that we need to address.

With thanks,

Louella Daries Communicating author: dariesl@cput.ac.za
Cape Peninsula University of Technology (CPUT)
Faculty of Applied Science- Department of Environmental & Occupational Studies

Co-Authors: Dr Lizel Hudson, and Associate . Prof. Lalini Reddy.

Summary of reviewer comments:/…

REVIEWER A	
GENERAL COMMENT/SUGGESTION/CRITIQUE	RESPONSE

• Key issue is confusion about the central focus of the paper
• The authors claim to focus on professional competencies. If that was the case, I would expect to see a list of competencies that these health students developed—teamwork, time management, technical skills such as reading a patient chart, and so on
• But that's not what the paper presents.
  o Instead, it describes how health supervisors believed beliefs, values, and attitudes shape students' behaviours/skills (this part is foggy) during WIL.
  o The whole premise of the paper is confusing. If this is to be published in IJWIL,
  o the authors need to critically examine
  ▪ their data,
  ▪ the story they are trying to tell,
  ▪ why that's important to our collective understanding of WIL, and
  ▪ how it might affect WIL practice.
• I think the paper may eventually present useful insights. But right now the main point of the paper is too obscure. I don't really know what is important and what is unimportant.
• Return to the "so what?" of the paper and go from there.
	This important feedback is appreciated by the authors. In response, we revisited the framing of the study and revised the abstract, introduction, and discussion to present a clearer line of argument. The central focus, i.e. how EHP supervisors observe emerging professional competencies not captured by current WIL assessment, has been strengthened. We now explicitly position these findings within broader discussions on EPA-informed, competency-based assessment in WIL.

INTRODUCTION • there is really no introduction. • The introduction should tell the reader about what they're about to read and why it matters—briefly. • This paper starts by jumping into the lit review.	The need for a clearer introduction is acknowledged. Subsequently this section was revised and rewritten accordingly. The revised introduction now includes a concise definition of "professional competencies," and draws on key sources from health professions education to contextualize the importance of

	competency-based education (CBE) in WIL. These adjustments aim to strengthen the conceptual underpinning of the manuscript and provide a relevant framing for the study's aims.
FINDINGS • confirm whether all figures are necessary. • Fig 1 seems unnecessary to me. • Fig 2 seems less important than Fig 3. • Figs 2 and 3 also present slightly different relationships, e.g., between values, attitudes, and behaviors. Double check.	This comment called for revising the need of all figures- resulting in removing redundant ones. The broader concern, directed the revisiting of the Findings section to strengthen the narrative text accompanying the visual data. The revised section now provides clearer thematic explanations, improved integration of participant quotations, and more direct links between the themes and the study's conceptual framework. These changes aim to ensure that the findings are independently robust and not overly reliant on visual representations for interpretation.

REVIEWER B	
GENERAL COMMENT/SUGGESTION/CRITIQUE	RESPONSE
• Omission of: o the lack of definition of "professional competencies" o recognition of the considerable literature on competency-based education for health professionals, o assessment of health professionals' professionalism and assessment of entrustable professional activities	Thank you for highlighting this omission. We have now incorporated a concise definition of professional competencies in the Introduction, referencing key literature in competency-based education (CBE) and entrustable professional activities (EPAs). These concepts now provide an explicit conceptual foundation for the study's aims and analysis.
ABSTRACT The Abstract appears adequate upon first reading; however, the content is not consistent with the text that follows in the body of the manuscript	Thank you for this observation. The abstract was to more accurately reflect the scope, methodological design, findings, and implications presented in the manuscript. The revised version now highlights the study's alignment with EPA frameworks and the call for more holistic assessment of professional competencies in EH WIL.
INTRODUCTION	Thank you for this helpful observation. The introduction was revised to include a

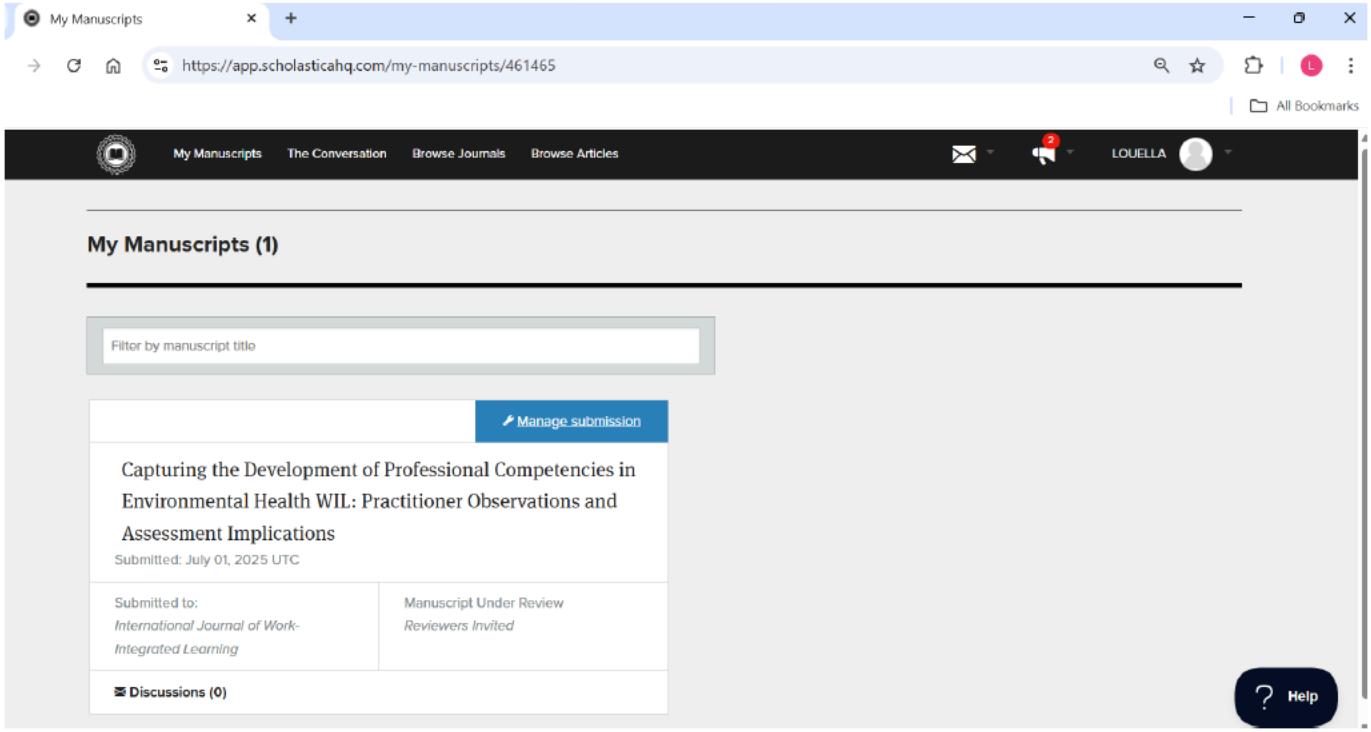
• Unfortunately, the authors do not provide a definition of health "professional competencies", • nor do they cite any of the extensive literature on competency-based education of health professionals. • This lack of recognition that the health professions education literature has been promoting competency-based education for over two decades is a serious omission in the Introduction section	working definition of professional competencies, underpinned by relevant recent literature. In particular, we draw on the work of Garraway (2022), Janssens et al., (2023) and Hunter et al. (2023) to contextualize competency development within specific disciplines and Environmental Health and WIL settings. These sources were selected for their alignment with contemporary approaches to competency-based education and their relevance to the applied, relational dimensions of workplace learning. Their inclusion aims to establish a clear conceptual foundation for the study. It is hoped that this demonstrates recognition of the longstanding movement toward competency-based frameworks in health education.
LIT REVIEW: • relevant literature in relation to EHP education and WIL is cited • lack of drawing on the literature to define health "professional competencies" or acknowledgement of the extensive health professional education literature on competency-based education. • In addition, there is no reference to Entrustable Professional Activities (EPA) and the growing literature that justifies the use of EPAs in the assessment of health professional students and trainees. • Also, the authors have not referenced the literature on assessment of professionalism in health professions education.	This guidance is appreciated and has provided valuable direction. The literature review has been expanded to include definitions and theoretical perspectives of professional competencies as discussed in the health professions education literature. Furthermore, relevant literature on Entrustable Professional Activities (EPAs) and the assessment of professionalism was integrated to enhance the alignment of principles between our findings and current competency-based assessment approaches. The literature review was revised to incorporate relevant scholarship on the assessment of professionalism within health professions education. This includes recent work that explores both formal and informal mechanisms of assessment—such as the influence of the hidden curriculum—as well as frameworks that position professionalism as a core competency in EH education
METHODOLOGY • The Method section specifies the aims of the research as being to establish	The Method section was revised to clarify the qualitative design and its alignment with the exploratory nature of the study.

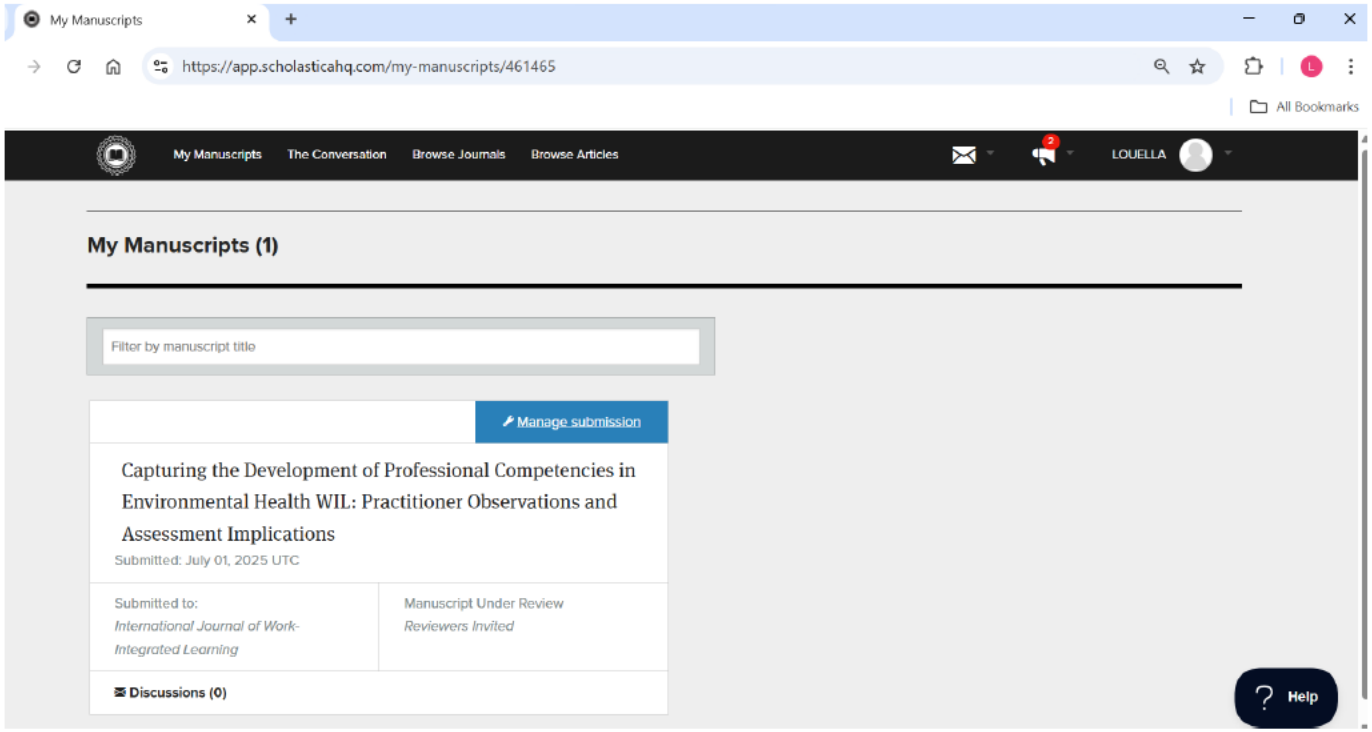
competencies observed by EHP workplace supervisors and analyze the competencies using thematic analysis.
• There are multiple concerns regarding this research method beginning with:
  o a lack of definition of "professional competencies".
  o Data collection consisted of two focus groups with a total of 10 participants, which would seem to be inadequate to achieve the stated aims. Essentially, the authors have not provided sufficient explanation or justification for their contention that this study design is suitable to achieve the stated aims of the research.
  o only gathered data from EHP supervisors and did not gather data from WIL students or from the clients of the environmental health practitioners. Both these perspectives would likely add value and contribute to a systematic approach designed to fulfil the study aims. (limitation)
	The primary aim was to gain insight into the perspectives of EHP supervisors regarding the professional competencies demonstrated by students during WIL. This supervisor-focused lens was chosen to address a gap in the literature around workplace-based observations of student performance in Environmental Health contexts.
	It is acknowledged that the sample was limited to two focus groups with ten participants; however, these individuals were purposively selected based on their supervisory roles and extensive experience, providing rich, practice-oriented perspectives. Methodological literature supporting small, focused qualitative samples has been cited in the revised text- these acknowledge thematic saturation even after 2 focus groups. The literature is divided on the numbers of focus group to conduct as well as the amount of participants needed for rich data. In particular, a study "Exploring patient-reported outcomes following percutaneous coronary intervention: A qualitative study" by Ayton et al., published in *Health Expectations* in 2017, explicitly notes that some focus groups included as few as two participants.
	
	The value of incorporating client perspectives and is explicitly acknowledged in the limitations section.
	Recommendations are included for further expansion of multi-stakeholders, such as clients, to further triangulate findings and enhance the transferability of insights into competency-based assessment practices in Environmental Health. A separate part of the broader study focused on Environmental Health students' experiences and self-perceptions of competency development during WIL and is not part of the purpose of this paper.

FINDINGS • The figures and tables are adequate; however, they do not make up for the limitations of the text in the Method or Findings sections	The broader concern directed the revisiting of the Findings section to strengthen the narrative text accompanying the visual data. The revised section now provides clearer thematic explanations, improved integration of participant quotations, and more direct links between the themes and the study's conceptual framework. These changes aim to ensure that the findings are independently robust and not overly reliant on visual representations for interpretation.
DISCUSSION: • lacks substance • The Discussion and Conclusion sections do not relate study findings to the established literature on health professions competency or professionalism. • Also, the Discussion would be enhanced by recognition of and exploring the potential for EPAs in the assessment of EHP professional competencies. • On the other hand, these sections seem to conflate "employability criteria" with "professional competencies". • In the second last paragraph, the authors mention "soft skills" without having referenced the literature on the "Hidden Curriculum" in health professions education. • Finally, the Limitations section is inadequate and incomplete given the	The reviewer's concern is acknowledged, and similar feedback was provided regarding the previous sections. As outlined in our earlier response, both sections have been substantially revised to ensure conceptual depth and stronger integration with established literature. Thank you for this comment. As noted in an earlier response, the Discussion and Conclusion were revised to better relate the study findings to current literature on competency-based education and professional behaviors in allied- health professions training. This suggestion is appreciated. As previously mentioned, the revised Discussion now integrates recent literature on Entrustable Professional Activities (EPAs) and reflects on their potential value for structuring competency-based assessment within Environmental Health WIL. Indeed, this needed distinction. The relevant text was revised and now clarifies the differentiation between employability attributes and discipline-specific professional competencies; hopefully, it now ensures conceptual precision throughout the manuscript This was addressed by contextualizing the development of relational and behavioural

shortcomings in this research noted previously. • Also, there is no mention of further research that might follow from the study reported in this article.	competencies commonly associated with "soft skills." The Limitations section has been expanded, as noted in an earlier response, to reflect methodological constraints and to propose directions for further research
CONCLUSION lacks substance	The Conclusion section is revised to provide a more substantive synthesis of the study's core findings, with clear articulation of their implications for competency-based assessment in Environmental Health WIL. The revised conclusion now highlights the potential for aligning observed professional competencies with Entrustable Professional Activities (EPAs) and calls for future research and curriculum reform to support holistic, workplace-informed assessment practices. This enhancement aims to strengthen the manuscript's contribution and leave the reader with a clearer sense of its relevance and impact.

Appendix M: Evidence of IJWIL manuscript submitted for round 2 review

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Filter by manuscript title
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Capturing the Development of Professional Competencies in Environmental Health WIL: Practitioner Observations and Assessment Implications
Submitted: July 01, 2025 UTC
Submitted to:
International Journal of Work-Integrated Learning
Manuscript Under Review
Reviewers Invited
Discussions (0)
Help

Appendix N: MDPI Education Science certificate of acceptance

education sciences

an Open Access Journal by MDPI

IMPACT FACTOR 2.6

CITESCORE 5.5

CERTIFICATE OF ACCEPTANCE

The certificate of acceptance for the manuscript (**education-3649162**) titled:

A framework for holistic assessment of professional competencies in Environmental Health WIL at a University of Technology

Authored by:

LOUELLA M. DARIES; LIZEL S. HUDSON; LALINI REDDY

was accepted in *Educ. Sci.* (ISSN 2227-7102) on 25 August 2025

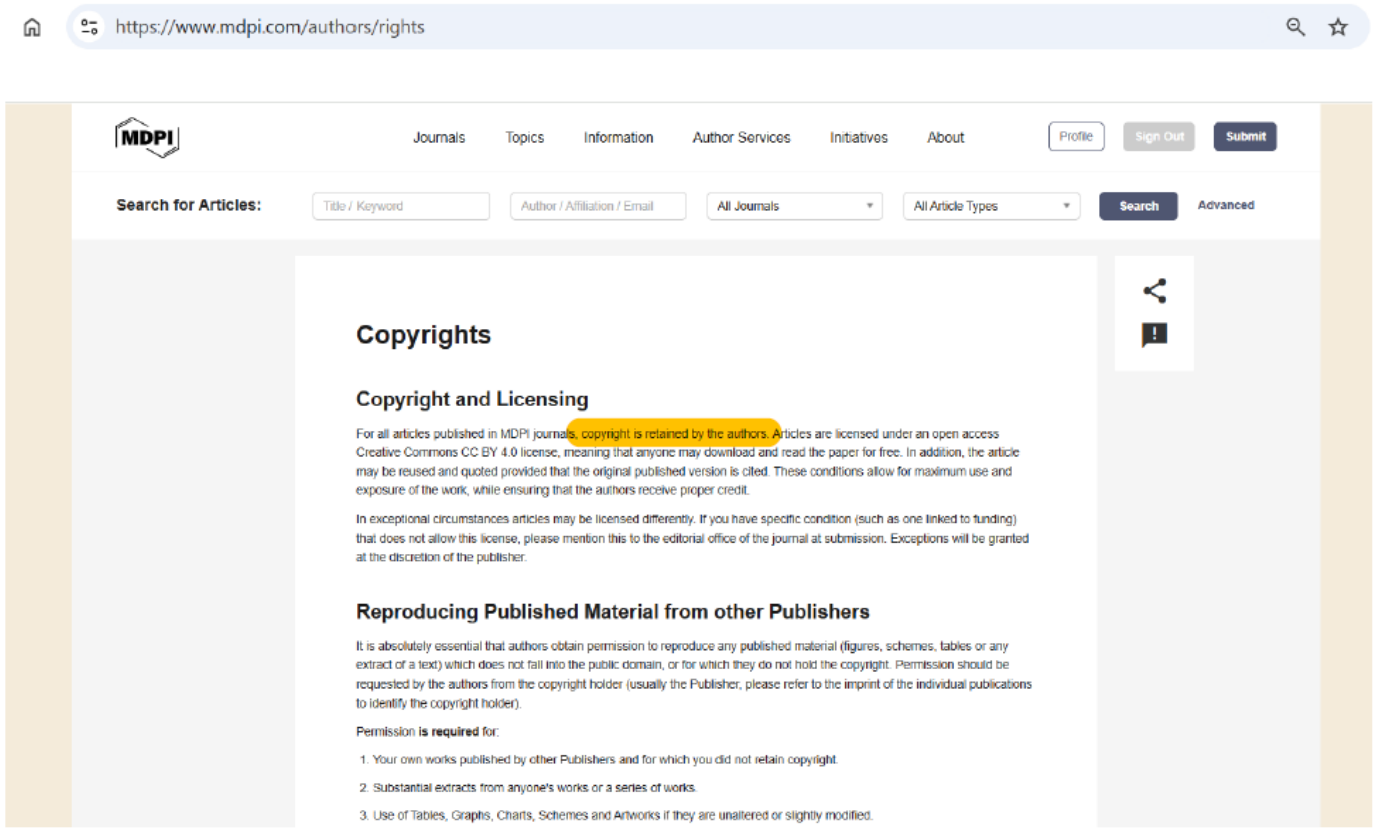
MDPI

Basel, September 2025

S. Tochev

Stefan Tochev
Chief Executive Officer

Appendix O: MDPI Creative commons copyrights-excerpt



APPENDIX P: MDPI Education Sciences published article

This manuscript has been accepted for publication in Education Sciences (ISSN 2227-7102), during August 2025. The final published version (Daries, Hudson and Reddy, 2025) is appended. It is presented it in the journal's formatting style. The DOI link to the final published version is presented in the detailed citation for the article, as published.

Citation: Daries, L.M., Hudson, L.S., & Reddy, L. (2025). A framework for holistic assessment of professional competencies in Environmental Health WIL at a University of Technology. Education Sciences, 15(10), 1387. https://doi.org/10.3390/educsci15101387. (Accepted for publication on 25 August 2025, published on 17 October 2025 in *Education Sciences)*.

This appendix is included to support and contextualize the broader research presented in this thesis.

A version of the accepted article, in pdf format, is available by clicking on the following link: *Appendix_P*

Appendix Q: South African Journal of Higher Education (SAJHE)-published article

The manuscript by Daries, L.M., Hudson, L.S., and Reddy, L. (2025), titled "Student perceptions of competencies gained during Environmental Health work-integrated learning: A guide for holistic assessment", has been accepted for publication in the South African Journal of Higher Education on 22 August 2024. This final published version, with changes to the title, (Daries, Hudson and Reddy, 2025) is appended.

The DOI link to the final published version is presented in the detailed citation for the article, as published.

Citation: Daries, L.M., Hudson, L. and Reddy, L. 2025. Exploring competencies of Environmental Health students in South Africa: insights from work-integrated learning. South African Journal of Higher Education, 39(6): 85-112. https://dx.doi.org/10.20853/39-6-6608 (Accepted for publication on 22 August 2024, published on 29 November 2025)

Its inclusion in this thesis, serves, to complement and reinforce the broader research focus on competency development within Work-Integrated Learning (WIL) in Environmental Health education. The study offers valuable insights into student perspectives on professional growth and provides a foundation for developing more holistic assessment frameworks in higher education contexts.

Permission for use of the author accepted copy of the manuscript for examination purposes was obtained. The un-copy-edited version of the accepted author manuscript appears in Chapter 3 and was included in the thesis for examination purposes and to illustrate its contribution of the thesis and is presented in the format aligned with the journal.

Access to the final published version of the article is available by clicking on the following link: *Appendix Q*

Appendix R: International Journal of Work-Integrated Learning (IJWIL)

Manuscript Under Review

The following manuscript by Daries, L.M., Hudson, L. and Reddy, L. (2025), titled *"Capturing the development of professional competencies in Environmental Health WIL: Practitioner observations and assessment implications"*, was submitted to the *International Journal of Work-Integrated Learning* on 01 July 2025. It is currently undergoing round 2 of double-blind peer review**.**

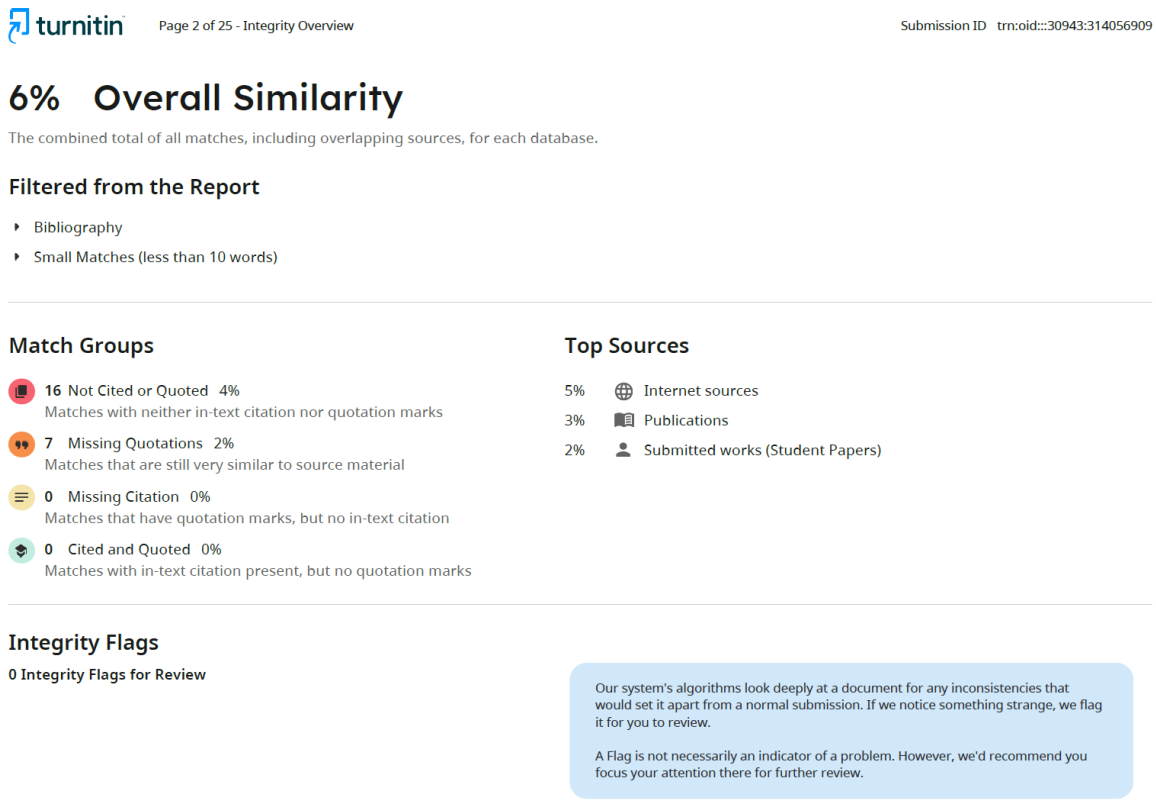
This version is presented in its original submission format as it has not been copy-edited, nor accepted for publication. To align to the journal requirements for the blind review, author names are excluded from the manuscript as submitted to IJWIL.

The manuscript is linked in pdf version and included in this thesis to illustrate further scholarly context, knowledge contribution and -significance. The manuscript presents the WIL supervisor perspectives on emerging professional competencies that they observed and evaluated in real-world settings. This additionally contributes to the evolving dialogue on holistic assessment of WIL competencies in higher education.

The original version of the article (Chapter 4), in pdf format, is available by clicking on the following link: *Appendix_R*

Appendix S: Turnitin reports per thesis chapter

Screenshot of Chapter 1: Turnitin Report



turnitin Page 2 of 25 - Integrity Overview Submission ID trn:oid:::30943:314056909

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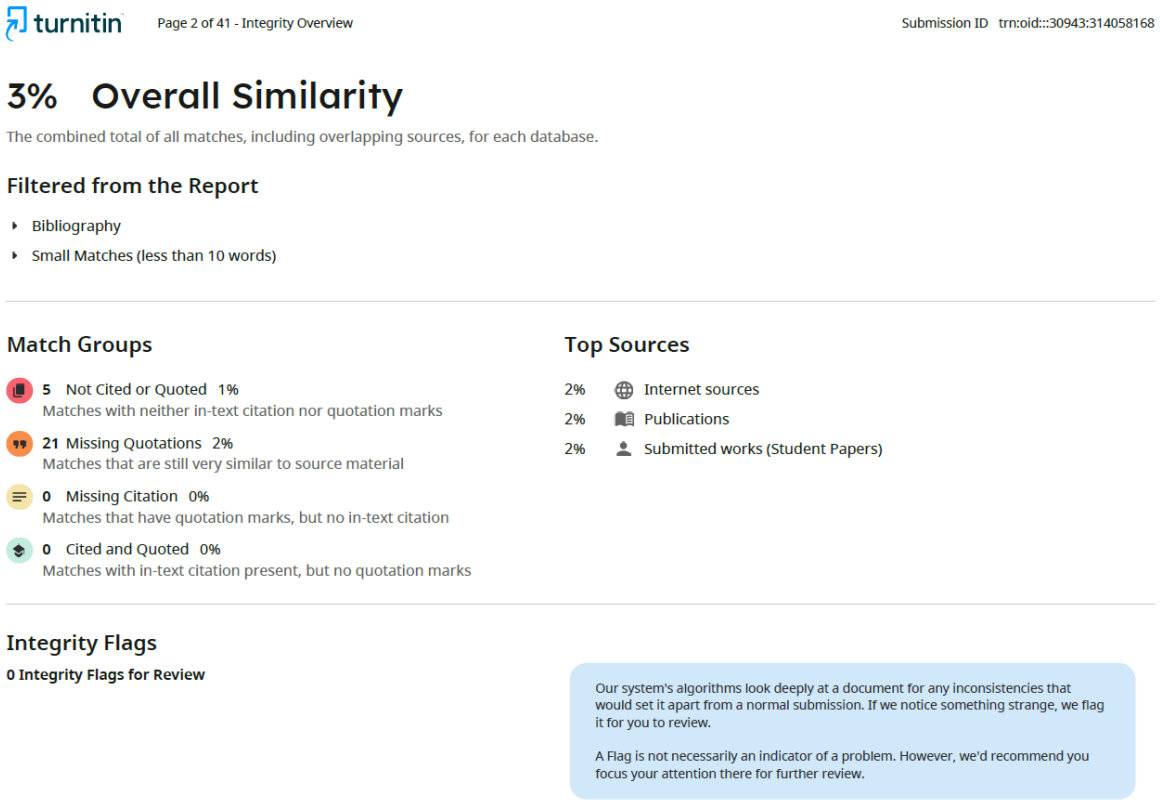

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21 Missing Quotations 2%
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0 Missing Citation 0%
Matches that have quotation marks, but no in-text citation

0 Cited and Quoted 0%
Matches with in-text citation present, but no quotation marks

Top Sources

2% Internet sources
2% Publications
2% Submitted works (Student Papers)

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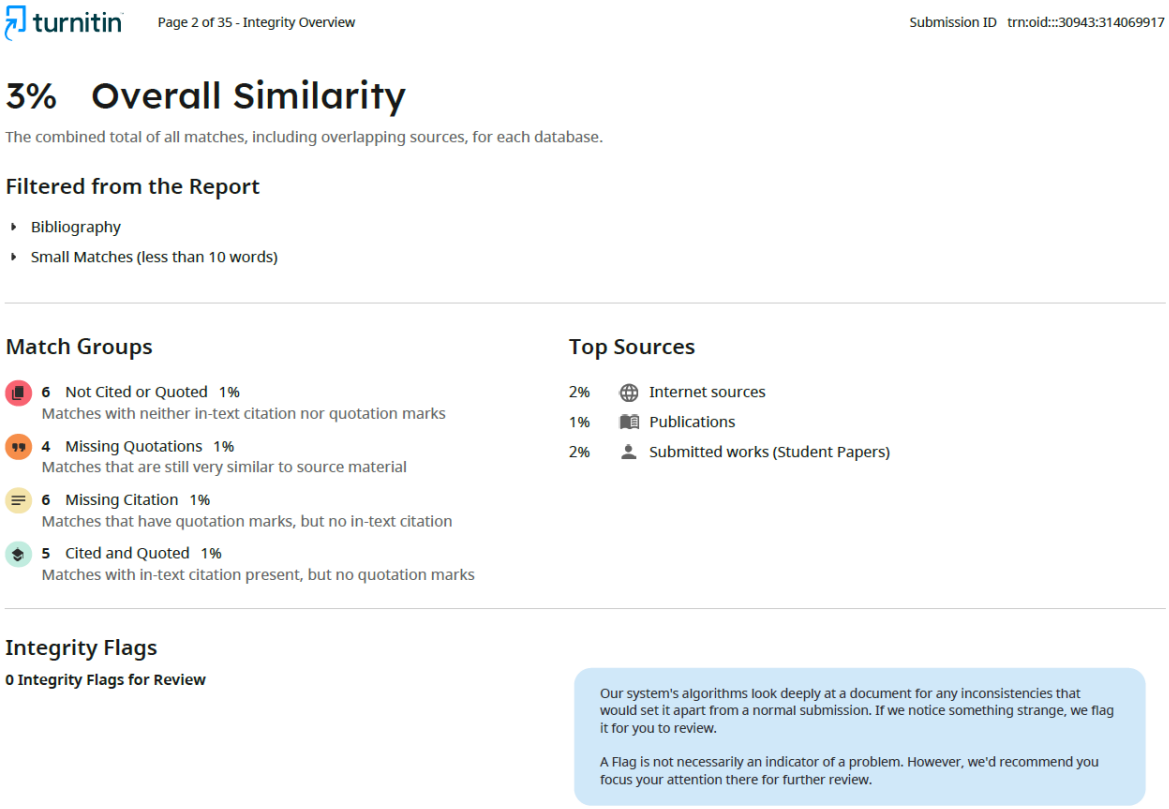
Screenshot of Chapter 3 Turnitin Report



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Match Groups

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  Matches with neither in-text citation nor quotation marks
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  Matches that are still very similar to source material
- **6** Missing Citation 1%
  Matches that have quotation marks, but no in-text citation
- **5** Cited and Quoted 1%
  Matches with in-text citation present, but no quotation marks

Top Sources

2% Internet sources
1% Publications
2% Submitted works (Student Papers)

Integrity Flags

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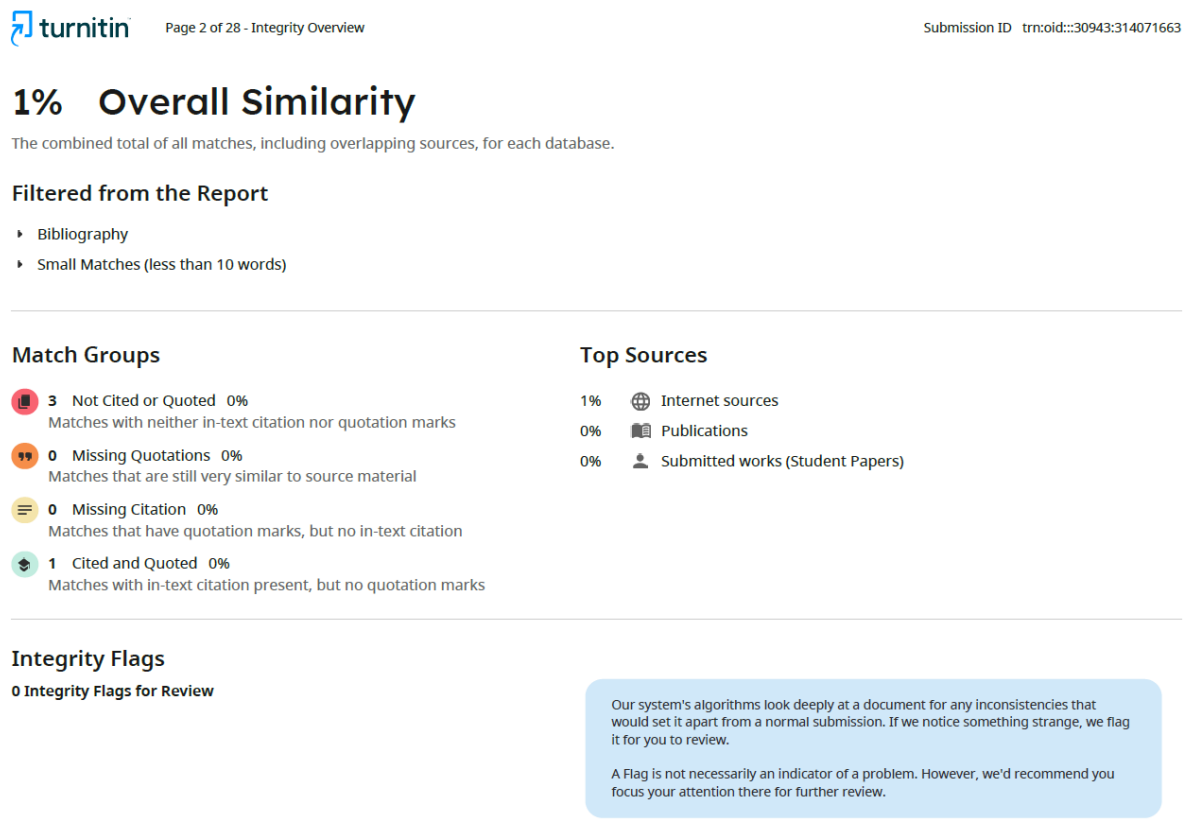
Screenshot of Chapter 4 Turnitin Report



turnitin Page 2 of 28 - Integrity Overview Submission ID trn:oid:::30943:314071663

1% Overall Similarity

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Match Groups

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0 Missing Quotations 0%
Matches that are still very similar to source material

0 Missing Citation 0%
Matches that have quotation marks, but no in-text citation

1 Cited and Quoted 0%
Matches with in-text citation present, but no quotation marks

Top Sources

1% Internet sources
0% Publications
0% Submitted works (Student Papers)

Integrity Flags

0 Integrity Flags for Review

Our system's algorithms look deeply at a document for any inconsistencies that would set it apart from a normal submission. If we notice something strange, we flag it for you to review.

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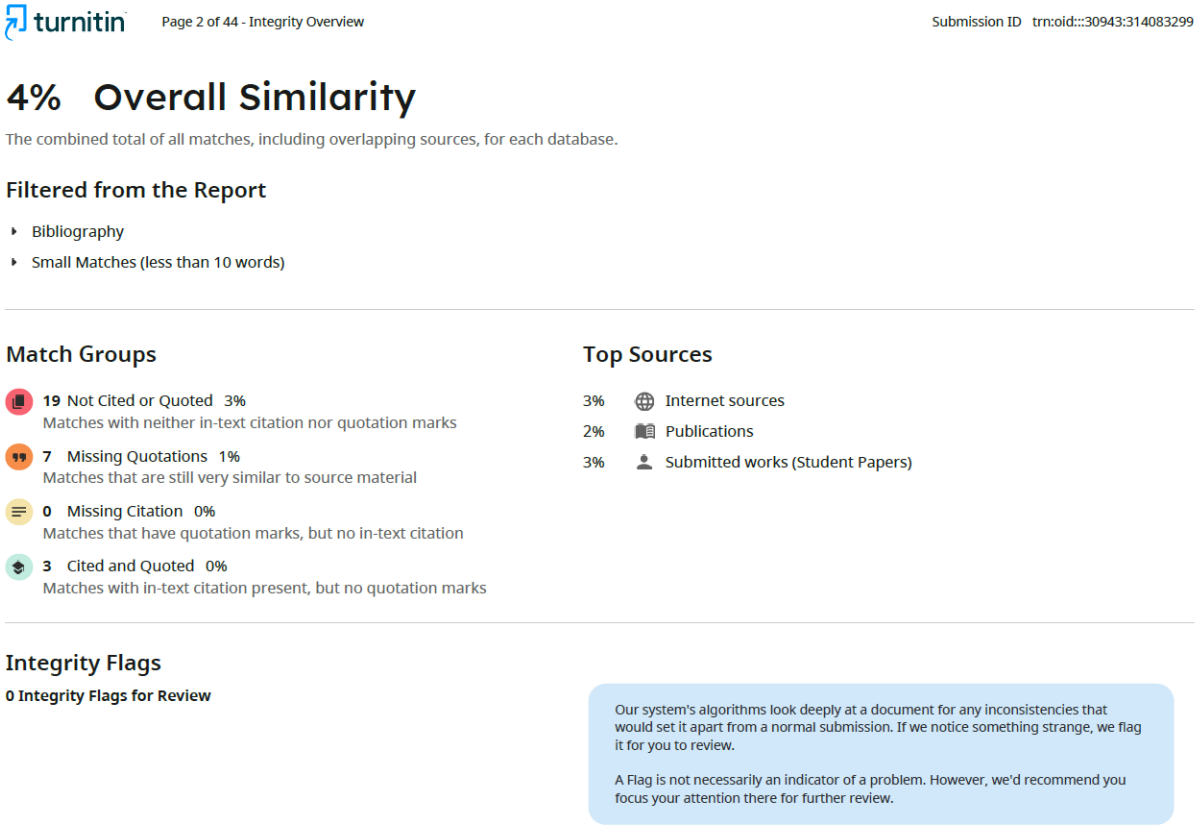
Screenshot of Chapter 5 Turnitin Report



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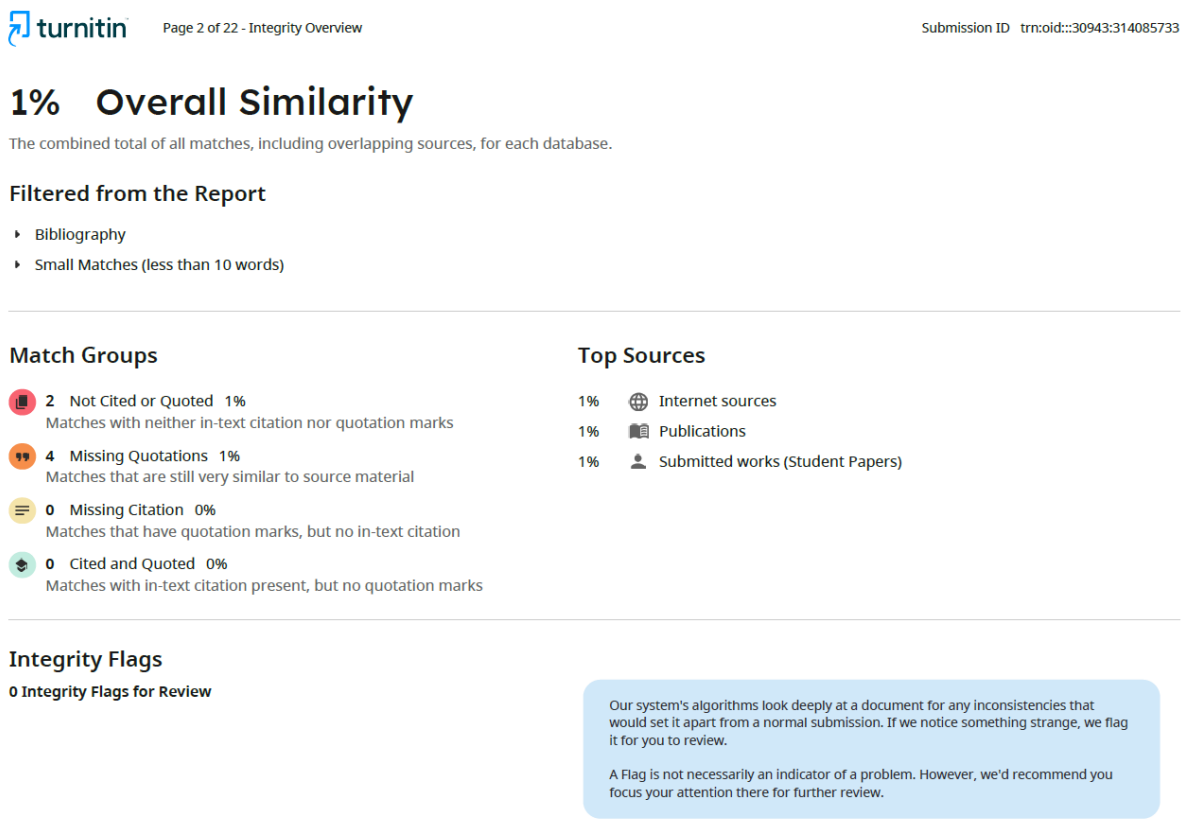

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Appendix T: Co-Author Statement for Article 1- SAJHE

Cape Peninsula University of Technology

Co-author statement in respect of the MTech or DTech thesis made by:

Paper/manuscript (authors, title, journal):

Daries, LM; Reddy, L; Hudson, LSA. EXPLORING COMPETENCIES OF ENVIRONMENTAL HEALTH STUDENTS IN SOUTH AFRICA: INSIGHTS FROM WORK-INTEGRATED LEARNING; SOUTH AFRICAN JOURNAL OF HIGHER EDUCATION

The undersigned who is:

X corresponding author

☐ co-author

on the paper/manuscript above, hereby confirms that Louella M. Daries has contributed to the work as stated below:

1. **Intellectual input:**

☐ less than 25% ☐25 - 50 % ☐50 - 75% X 75 - 100%

Comments:

_____

2. **Experimental results** (indicate contribution to individual figures, tables and supplementary data):

☐ less than 25% 25 - 50 % ☐ 50 - 75% X 75 - 100%

Comments:

_____

3. **Writing process:**

☐ less than 25% ☐25 - 50 % ☐ 50 - 75% X 75 - 100%

Comments:

_____

LOUELLA M. DARIES 10 OCTOBER 2025

Written Name Date

Signature

Cape Peninsula University of Technology

Co-author statement in respect of the MTech or DTech thesis made by:

Paper/manuscript (authors, title, journal):

Daries, LM; Reddy, L; Hudson, LSA. EXPLORING COMPETENCIES OF ENVIRONMENTAL HEALTH STUDENTS IN SOUTH AFRICA: INSIGHTS FROM WORK-INTEGRATED LEARNING; SOUTH AFRICAN JOURNAL OF HIGHER EDUCATION

The undersigned who is:

☐ corresponding author

X co-author

on the paper/manuscript above, hereby confirms that Lizel Hudson has contributed to the work as stated below:

1. Intellectual input:

☐ less than 25% X 25 - 50 % ☐ 50 - 75% ☐ 75 - 100%

Comments:

---

2. Experimental results (indicate contribution to individual figures, tables and supplementary data):

☐ less than 25% X 25 - 50 % ☐ 50 - 75% ☐ 75 - 100%

Comments:

---

3. Writing process:

☐ less than 25% X 25 - 50 % ☐ 50 - 75% ☐ 75 - 100%

Comments:

Lizel Hudson — 01 September 2025

Written Name — Date

Signature

Cape Peninsula
University of Technology

Co-author statement in respect of the MTech or DTech thesis made by:

Paper/manuscript (authors, title, journal):

Daries, LM; Reddy, L; Hudson, LSA. EXPLORING COMPETENCIES OF ENVIRONMENTAL HEALTH STUDENTS IN SOUTH AFRICA: INSIGHTS FROM WORK-INTEGRATED LEARNING; SOUTH AFRICAN JOURNAL OF HIGHER EDUCATION

The undersigned who is:

☐ corresponding author

X co-author

on the paper/manuscript above, hereby confirms that Lalini Reddy has contributed to the work as stated below:

Intellectual input:

☐ less than 25% X 25 - 50 % ☐ 50 - 75% ☐ 75 - 100%

Comments:

1. **Experimental results** (indicate contribution to individual figures, tables and supplementary data):

☐ less than 25% X 25 - 50 % ☐ 50 - 75% ☐ 75 - 100%

Comments:

Writing process:

☐ less than 25% X 25 - 50 % ☐ 50 - 75% ☐ 75 - 100%

Comments: _____

Lalini Reddy — 10 October 2025

Written Name — Date

Signature

Appendix U: Co-Author Statement for Article 2- IJWIL

Cape Peninsula
University of Technology

Co-author statement in respect of the MTech or DTech thesis made by:

Paper/manuscript (authors, title, journal):

Daries, LM; Hudson, LSA; Reddy, L. CAPTURING THE DEVELOPMENT OF PROFESSIONAL COMPETENCIES IN ENVIRONMENTAL HEALTH WIL: PRACTITIONER OBSERVATIONS AND ASSESSMENT IMPLICATIONS; INTERNATIONAL JOURNAL FOR WORK-INTEGRATED LEARNING

The undersigned who is:

X corresponding author

☐ co-author

on the paper/manuscript above, hereby confirms that Louella M. Daries has contributed to the work as stated below:

1. Intellectual input:

☐ less than 25% ☐25 - 50 % ☐ 50 - 75% X 75 - 100%

Comments:

_____

2. Experimental results (indicate contribution to individual figures, tables and supplementary data):

☐ less than 25% ☐25 - 50 % ☐ 50 - 75% X 75 - 100%

Comments:

_____

3. Writing process:

☐ less than 25% ☐25 - 50 % ☐ 50 - 75% X 75 - 100%

Comments:

_____

LOUELLA M. DARIES 10 OCTOBER 2025

Written Name Date

Signature

Cape Peninsula University of Technology

Co-author statement in respect of the MTech or DTech thesis made by:

Paper/manuscript (authors, title, journal):

Daries, LM; Hudson, LSA; Reddy, L. CAPTURING THE DEVELOPMENT OF PROFESSIONAL COMPETENCIES IN ENVIRONMENTAL HEALTH WIL: PRACTITIONER OBSERVATIONS AND ASSESSMENT IMPLICATIONS; INTERNATIONAL JOURNAL FOR WORK-INTEGRATED LEARNING

The undersigned who is:

☐ corresponding author

X co-author

on the paper/manuscript above, hereby confirms that Lizel Hudson has contributed to the work as stated below:

1. Intellectual input:

☐ less than 25% X 25 - 50 % ☐ 50 - 75% ☐ 75 - 100%

Comments:

_____

2. Experimental results (indicate contribution to individual figures, tables and supplementary data):

☐ less than 25% X 25 - 50 % ☐ 50 - 75% ☐ 75 - 100%

Comments:

_____

3. Writing process:

☐ less than 25% X 25 - 50 % ☐ 50 - 75% ☐ 75 - 100%

Comments:

_____

Lizel Hudson — 01 September 2025

Written Name — Date

Signature

Cape Peninsula
University of Technology

Co-author statement in respect of the MTech or DTech thesis made by:

Paper/manuscript (authors, title, journal):
Daries, LM; Hudson, LSA; Reddy, L. CAPTURING THE DEVELOPMENT OF PROFESSIONAL COMPETENCIES IN ENVIRONMENTAL HEALTH WIL: PRACTITIONER OBSERVATIONS AND ASSESSMENT IMPLICATIONS; INTERNATIONAL JOURNAL FOR WORK-INTEGRATED LEARNING

The undersigned who is:

☐ corresponding author

X co-author

on the paper/manuscript above, hereby confirms that Lalini Reddy has contributed to the work as stated below:

Intellectual input:

☐ less than 25% X 25 - 50 % ☐ 50 - 75% ☐ 75 - 100%

Comments:

1. **Experimental results** (indicate contribution to individual figures, tables and supplementary data):

☐ less than 25% X 25 - 50 % ☐ 50 - 75% ☐ 75 - 100%

Comments:

Writing process:

☐ less than 25% X 25 - 50 % ☐ 50 - 75% ☐ 75 - 100%

Comments:

Lalini Reddy — 10 October 2025

Written Name — Date

Signature

Appendix V: Co-Author Statement for Article 3 - MDPI EDSC

Cape Peninsula
University of Technology

Co-author statement in respect of the MTech or DTech thesis made by:

Paper/manuscript (authors, title, journal):
Daries, LM; Hudson, LSA; Reddy, L. A FRAMEWORK FOR HOLISTIC ASSESSMENT OF PROFESSIONAL COMPETENCIES IN ENVIRONMENTAL HEALTH WIL AT A UNIVERSITY OF TECHNOLOGY; EDUCATION SCIENCE

The undersigned who is:

X corresponding author

☐ co-author

on the paper/manuscript above, hereby confirms that Louella M. Daries has contributed to the work as stated below:

4. Intellectual input:

☐ less than 25% ☐25 - 50 % ☐ 50 - 75% X 75 - 100%

Comments:

_____

5. Experimental results (indicate contribution to individual figures, tables and supplementary data):

☐ less than 25% ☐25 - 50 % ☐ 50 - 75% X 75 - 100%

Comments:

_____

6. Writing process:

☐ less than 25% ☐ 25 - 50 % ☐ 50 - 75% X 75 - 100%

Comments:

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LOUELLA M. DARIES 10 OCTOBER 2025

Written Name Date

Signature

Cape Peninsula
University of Technology

Co-author statement in respect of the MTech or DTech thesis made by:

Paper/manuscript (authors, title, journal):
Daries, LM; Hudson, LSA; Reddy, L. A FRAMEWORK FOR HOLISTIC ASSESSMENT OF PROFESSIONAL COMPETENCIES IN ENVIRONMENTAL HEALTH WIL AT A UNIVERSITY OF TECHNOLOGY; EDUCATION SCIENCE

The undersigned who is:

☐ corresponding author

X co-author

on the paper/manuscript above, hereby confirms that Lizel Hudson has contributed to the work as stated below:

1. Intellectual input:

☐ less than 25% X 25 - 50 % ☐ 50 - 75% ☐ 75 - 100%

Comments:

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2. Experimental results (indicate contribution to individual figures, tables and supplementary data):

☐ less than 25% X 25 - 50 % ☐ 50 - 75% ☐ 75 - 100%

Comments:

_____

3. Writing process:

☐ less than 25% X 25 - 50 % ☐ 50 - 75% ☐ 75 - 100%

Comments:

_____

Lizel Hudson 01 September 2025

Written Name Date

Signature

Cape Peninsula
University of Technology

Co-author statement in respect of the MTech or DTech thesis made by:

Paper/manuscript (authors, title, journal):

Daries, LM; Hudson, LSA; Reddy, L. A FRAMEWORK FOR HOLISTIC ASSESSMENT OF PROFESSIONAL COMPETENCIES IN ENVIRONMENTAL HEALTH WIL AT A UNIVERSITY OF TECHNOLOGY; EDUCATION SCIENCE

The undersigned who is:

☐ corresponding author

X co-author

on the paper/manuscript above, hereby confirms that Lalini Reddy has contributed to the work as stated below:

Intellectual input:

☐ less than 25% X 25 - 50 % ☐ 50 - 75% ☐ 75 - 100%

Comments:

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1. Experimental results (indicate contribution to individual figures, tables and supplementary data):

☐ less than 25% X 25 - 50 % ☐ 50 - 75% ☐ 75 - 100%

Comments:

Writing process:

☐ less than 25% X 25 - 50 % ☐ 50 - 75% ☐ 75 - 100%

Comments: _____

Lalini Reddy — Written Name

10 October 2025 — Date

Signature