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# An exploratory study of the clinical technology undergraduate program in South Africa: Preparedness of students for clinical practice

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#### Abstract:

**BACKGROUND:** This study sought to understand whether the theoretical components of the curriculum prepared students for clinical practice training in the Bachelor of Health Sciences (BHSc) in Clinical Technology program at the Durban University of Technology.

**MATERIALS AND METHODS:** Two samples were recruited, namely, academics and students using non-probability sampling methods. The first sample comprised 13 students, and the second sample included four academics, involved in teaching and supervising the placement of students at healthcare institutions. At least one student from each of the 13 units where clinical practice training was undertaken was invited to participate. Data was gathered using in-depth, semi-structured interviews on an adapted version of Gibbs' cycle of reflection.

**RESULTS:** Three broad themes emerged, namely, curriculum structure, factors that enabled graduate attribute development in the clinical environment, and the transition to online teaching.

**CONCLUSION:** While it appears that the curriculum had in many ways prepared students for clinical practice, the study highlights key issues that may guide curriculum developers when seeking to improve preparedness of students for clinical practice. Furthermore, it underscores the need for continuous review of current curricula so that these are responsive to student and societal needs.

#### Keywords:

Clinical practice learning, clinical technology, curriculum preparedness, South Africa

## Background

The changing higher education (HE) environment calls for the design, review, and renewal of the curriculum to ensure that all students are offered a fair chance of achieving success. Bernstein<sup>[1]</sup> alludes to curriculum design being informed by an understanding of disciplinary knowledge structures. Decisions should be about what knowledge is selected, how it will be sequenced and the amount of time to be spent on each aspect, including the assessment. Fataar<sup>[2]</sup> contends that academics should be cognisant of the student population, and

what "kind of knowers they wish to shape" when curating a curriculum. Evaluation of the quality of health professions education (HPE) not only requires reliable and valid studies of outcomes but that identifies students' perceptions of the effectiveness of the training programs as vital and necessary.<sup>[3]</sup> The evolving nature of the healthcare environment demands graduates who are suitably competent and adaptable, as well as being critical thinkers, problem solvers, creative thinkers all of which should be aligned to graduate attributes in the curriculum. Thus, the need for traditional pedagogies of teaching, learning, and assessment (TLA) need to be

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evaluated and reviewed to appropriately address and include these current demands.<sup>[4]</sup>

South African realities demand that curricula are designed and reviewed in the context of globalization<sup>[5]</sup> to align with international HPE standards. In the context of the Universities of Technology (UsoT), a work-integrated learning (WIL) model is used to allow theory taught at the UsoT to be practiced at the workplace.<sup>[6]</sup> Although the need to develop students who are ready for the workplace, and who have the ability to transfer knowledge and skills from the classrooms to the workplace, has been documented,<sup>[7]</sup> the extent to which WIL contributes to preparedness is still debated since current evidence is informal and anecdotal.<sup>[8]</sup>

From 2012 to 2016, the BHSc in Clinical Technology (CT) program underwent a re-curriculation process, where stakeholders, including academics, students, industry partners, sister Universities of Technology, and the Health Professions Council of South Africa (HPCSA), were consulted on various aspects in the design of the curriculum. Through the guidance of the Durban University of Technology (DUT) Centre for Quality Promotions Assurance (CQPA) unit, the proposed curriculum was approved at institutional level, and then sent to the national regulatory and statutory bodies for approval. The WIL component was replaced by the clinical practice learning constituent, with the same outcome.

Although the BHSc program in CT is in its fourth year of delivery there has not been an exploration of whether the curriculum has prepared students for clinical practice. Moreover, only 65% of students who registered in the first year have progressed to the final year of study, which necessitates a review regarding the experience of the new curriculum. This is the first study related to the curriculum, in South Africa for CT, making it valuable in informing curriculum revision and delivery. The overarching aim was to understand whether the theoretical component of the curriculum prepared students for clinical practice training, from the perspectives of third- and fourth-year CT students and academics. Specific research questions were:

- How did theoretical content prepare students for clinical practice training?
- What further knowledge and skills are required to prepare graduates for their professional practice?
- How appropriate was curriculum design in terms of producing graduates who were ready to adapt to the clinical practice learning environment?

## Materials and Methods

### Study design and setting

This study adopted a qualitative, exploratory approach.<sup>[9]</sup> This approach was most suitable to explore, describe,

and document aspects of a situation in its natural environment, while simultaneously analysing the meaning and providing a detailed perspective of human experiences.<sup>[10]</sup>

The study population was third- and fourth-year students registered for CT in the Department of Biomedical and Clinical Technology, in the Faculty of Health Sciences, DUT. The CT program is one of two programs in the Department of Biomedical and Clinical Technology. Academic staff members are specialists in the CT field, evenly spread across both genders, comprising Black and Indian ethnic groups.

### Study participants and sampling

Data was collected from two samples: a population of 82 students, and five academics. Two samples comprising 13 students and four academics who were involved in teaching and supervising the placement of students at hospitals were recruited using a non-probability,<sup>[11]</sup> purposeful sampling strategy. This strategy enabled the researchers to target participants who could contribute to an understanding of the phenomenon under study.<sup>[12]</sup> At least one student from each of the 13 clinical departments at the different hospitals, where clinical practice training is undertaken was invited to participate. Clinical training units are typically located within tertiary hospitals in both public and private sectors. Where departments had larger numbers of students, more than one student was invited. Furthermore, each of these participants had to have sufficient exposure to the clinical practice environment. The interviews stopped when data saturation was reached.

### Data collection tool and technique

Data was gathered using in-depth, semi-structured interviews. To assist the researchers in this process, the interviews were structured on an adapted version of Gibbs' cycle of reflection.<sup>[13]</sup> According to this cycle, six questions were presented to each participant. These questions were underpinned by the findings from the literature review and modified specifically to the context of this study.

The interviews were conducted in English. The semi-structured interview schedule included questions such as: "What personal attributes have you acquired through your placement?" and "What can you recommend for improving curriculum preparedness of students for clinical practice?" For in-depth, rich data, interviews ranged from 30 to 60 min and included open-ended questions. The interviews were conducted virtually on Microsoft Teams considering the coronavirus disease 2019 (COVID-19) restrictions. The purpose and the process of the study were explained to participants and all those willing participants signed an informed consent.

The audio-recorded data was transcribed verbatim, allowing researchers to become familiar with the data and to identify any similarities or patterns.<sup>[14]</sup> Thematic analysis (TA) was used to analyze the data. Castleberry and Nolen<sup>[15]</sup> state that TA is a method of “identifying, analyzing, and reporting patterns (themes) within data”. During analysis, the data was first grouped into smaller parts called “meaning units”. These meaning units were then condensed, and codes were generated.<sup>[14]</sup> Similar codes were then grouped into categories and themes, which allowed for a more manageable data set to record in the final narrative report.

### Ethical consideration

The study was approved by an institutional ethics committee, with ethics clearance number IREC 046/21. The three primary ethical principles of beneficence, respect for human dignity, and justice, were observed to safeguard study participants.

To maintain beneficence, the participants were informed of the average interview duration being an hour.<sup>[16]</sup> Participants were requested to sign an informed consent form to voluntarily participate in the study. They were also made aware of their right to withdraw from the study at without any consequences.

During data collection and analysis, privacy was maintained by keeping all data confidential and using pseudonyms. Permission to record interviews on the virtual platform was sought from participants. The data will be stored for a period of five years for possible future verification purposes.<sup>[12]</sup>

### Trustworthiness

In order to establish trustworthiness,<sup>[17]</sup> four criteria were considered, namely, credibility, transferability, dependability, and confirmability. Credibility refers to confidence that the findings are authentic and believable.<sup>[18]</sup> Credibility was ensured by selecting participants who had personally experienced the phenomena under study. Furthermore, the authors attempted to describe the experiences as they were perceived by the participants, thus reflecting the credibility of the findings.<sup>[16]</sup> Transferability refers to the extent to which the findings are applicable to other contexts. This was initiated by using detailed descriptive narratives about the context being studied so that judgments about the degree of similarity could be made by other researchers attempting to apply the findings to other scenarios.<sup>[19]</sup> Dependability refers to the stability of the findings over time.<sup>[20]</sup> This was enhanced by using triangulation, where both students and academics were included as participants. Confirmability indicates a degree of neutrality on the part of the researchers and is supplemented by peer debriefing during the coding

process, and the development of an audit trail.<sup>[18]</sup> The audit trail included careful documentation of the research process and of each step of the data analysis process, from the initial transcript to the finally coded transcripts.

## Results

Following a holistic analysis of the data from both samples, three main themes emerged, namely:

1. Curriculum structure
2. Factors enabling graduate attribute development in the clinical environment
3. The transition to online teaching.

### Theme 1: Curriculum structure

Curriculum structure refers to perceptions regarding the comprehensiveness of the theoretical and clinical content to prepare students for clinical practice learning. The broad consensus from both samples, was that the current curriculum prepared students for clinical practice and was responsive to their needs within the clinical practice learning environment. The modules in first year are the basic science modules like Anatomy, Physiology, Pathophysiology I, Chemistry, and Physics, with two program-specific modules. The second-year modules continue with basic science but include more program-specific modules which advance in volume and complexity.

*“With the theory in first and second year, it was a lot of information which is helpful now in fourth year because it’s basically like the foundation of clinical technology, the lectures were great and there’s a lot of communication, so it was a good first two years.” [P8]*

There was however, a concern regarding the complexity and specificity of the content:

*“I think year one was too basic; it was touch and go.”  
“And I felt like we focused a lot on theoretical things that we didn’t really use in application and maybe I could have benefited more from the more applied theory.” [P3]*

A few students reflected on how the theoretical content gave them an added advantage over those from other HEIs (Higher education institutions) completing a similar qualification.

*“So I really felt like all our theory parts for first year and second year was really well prepared. And when we were at George Mukhari (GM), where we had other students from other varsities, I felt like we were more prepared than they were because we, we knew all the basic elements...” [P1]*

The inclusion of the General Education program was found to be contentious, as students felt that these

modules had little to no benefit for them. Students also believed that there should be a greater emphasis on the basic science modules like Anatomy, as opposed to General Education.

*“In terms of the general education modules, as you know, some of these modules, I feel like they do not contribute in clinical technology as a programme itself...” [P6]*

This idea was also shared by academics:

*“...when this Gen Ed has moved, students will get even more scientific, basic science background on human physiology.” [L3]*

Regarding the relevance of the curriculum for clinical practice learning, sentiments were predominantly positive, as students felt they were able to apply whatever they had learned in the preceding years in the clinical environment.

*“So it (year 1 & 2 modules) did help when I got into the clinical environment. There was a lot that I knew...” [P9]*

## **Theme 2: Factors enabling graduate attribute development in the clinical environment**

### *Sub-theme 1: Student graduate attributes*

Academics suggested that students still struggled to adapt to HE in third and fourth years, as follows:

*“I will say they still rely too much on lecturers to spoon feed them, which is not what the curriculum is designed for.” [L3]*

There was however, a perception among academics, that the challenges of the clinical environment stimulated a paradigm shift, within students, in terms of responsibility and accountability for their learning, and maturity:

*“You know, they just don’t take it (academic modules) seriously and reality then hits them in the third and fourth year... and that’s when you see an attitude shift.” [L2]*

Students shared similar views:

*“So I think for me, those are the attributes is adaptation, be able to adapt to a new environment, and accountability, as well as being a team player...” [P6]*

These attributes also helped students cope with the challenges of the COVID-19 lockdown, and the consequent reduction of the academic year:

*“I just learned to be responsible and do the work.” [P8]*

*“I spent a lot of time studying even at work. I never wasted any bit of time.” [P11];*

*“It’s like there’s no difference now. I have adapted.” [P12]*

### *Sub-theme 2: Attributes of role players involved in students’ learning*

In the context of this study, there are various role players involved in students’ learning, including the academics, who are responsible for formal classroom teaching, clinical instructors who are responsible for the formal practical component as well as the clinical staff who play a more informal role in students’ learning. The attributes in this sub-theme relate to the qualities of each of these role players as perceived by students. Although students expressed general satisfaction with academic and clinical staff, there were a few concerns regarding academics.

*“some of them weren’t prepared to teach their courses, but I think it was that it was their first time ever teaching that subject.” [P3]*

The perception of students around clinical instructors was varied, with most citing a supportive and accommodating clinical instructor, as a positive factor for learning experiences:

*“You have a lot of very educated and confident people around you, it kind of rubs off on you. And you strive to be as good as everyone around you and to be a functional part of the team.” [P3]*

Conversely, others felt that the expectations of clinical instructors were unrealistic and lacked experience in research.

*“...Like if I was doing my thesis and stuff, I never really had apart from you and maybe doctor when he had a gap. I couldn’t give it to my clinical supervisor to look over because she’s never done any research.” [P3]*

## **Theme 3: The transition to online teaching**

The CT program transitioned to a virtual platform for all theoretical modules following the national lockdown in South Africa, which resulted in loss of two months of the academic year. Students and academics were offered training on the MS Teams and Learning Management systems, after which the theoretical modules were timetabled, and teaching resumed. The fourth theme focused on the transition to online learning, with three sub-themes.

### *Sub-theme 1: Challenges of online learning*

The challenges identified related to access to technology hardware, software, skills, and access. Concerns around data and connectivity issues, as well as limited abilities to use the LMS platforms for learning and assessment were identified:

*“Because the virtual one, sometimes you might have problems with the devices and then you can’t attend.” [P1]*

*“I think we should get the data issue sorted out. That would, I think, be the best way to get around this challenge.” [L1]*

Academics also experienced their own challenges:

*“I was literally thrown into the deep end and having to swim because you couldn’t tell the students sorry, you know I don’t know...” and “as a new staff member, because there was a really big sense of disconnect in isolation”. [P2]*

Academics had to quickly become adept in the pedagogy of the virtual learning space, which was challenging for those new academics who also required greater peer support. They also had to contend with finding creative ways of ascertaining whether students were present, particularly as it affected their accountability for learning.

*“The challenge with that was not knowing if the students are present or not present being in the class you can see a student is not paying attention to you. Their mind is wandering.” [L2]*

There was an acknowledgment that the pandemic also catapulted teaching and assessment practices out of sheer necessity:

*“So it really impacted on the actual training, even the actual relationship with the industry...and “I will say that here is what we need it is for us to be able to contribute to the call for fourth industrial revolution (4IR). When COVID-19 came it drastically speed up the process where we are now using the technology quite a lot in delivering our either theory, or even the practical’s.” [L3]*

### *Sub-theme 2: Integrity of assessments*

This sub-theme related to the lack of a proctoring system for online assessment. Academics said:

*“The fact that we at some point, were not sure whether we could do the assessments and then you do the assessments online from students to get 90% when they were actually 45% students.” [L1]*

### *Sub-theme 3: Workload of academics*

The workload of academics influenced the way they were able to support students, as learning moved to the online platform. Academics reported that they are currently burdened with administrative, research, supervision, teaching, learning, assessment, and community engagement, which invariably limited the time available to assist students in the online space.

*“But on the surface, I think if we were to have extra hands-on deck to try and assist and alleviate some of the*

*workload that we have, whether it is alleviating the problem with regards to administrative duties,... so that so that we could be able to focus on and give attention especially to those students that might need extra attention.” [L1]*

## **Discussion**

HPE has seen a marked global pedagogical shift in the last 50 years, with few countries in Africa making this transition.<sup>[21]</sup> Furthermore, there is a growing awareness within the field of HPE that integration of theory with practice is what constitutes effective learning.<sup>[22]</sup> The World Federation for Medical Education<sup>[23]</sup> recommended that medical education programs ensure that curriculum design and instructional methodology is linked to the achievement of the requisite clinical practice competencies. Our study reports that students felt they were able to apply whatever they had learned in the preceding years in the clinical environment.

A few students reflected on how the theoretical content gave them an added advantage over those from other HEIs completing a similar qualification. While this was encouraging, it was also concerning, as students from both universities are being trained for the healthcare needs of the country. This highlights the need for constructive discussions between the different providers of the CT qualification, so that there is national harmonization of curricula. This will allow for a common understanding of the benchmarked outcomes and delivery at the appropriate standard.

An issue highlighted among students and academics was the relevance of some of the modules, specifically, General Education. According to the DUT General Education Guidelines,<sup>[24]</sup> the goals of General Education are ‘to help students think critically, develop values, understand traditions, respect diverse cultures and opinions’, and to use these in their daily lives. The curriculum structure comprises a 30% component of general education, most of which are elective modules which develop these outcomes. Given the complexity of the program in that provisions need to be made for seven sub-specialities, and a maximum number of credits capped to a 480-credit BHSc degree, this criticism was expected. These findings prompt the need for the program to find creative solutions to address these curriculum gaps.

The second theme related to factors enabling graduate attribute development in the clinical environment. Graduate attributes have been defined as “the generic skills, knowledge, dispositions and attitudes undergraduates develop during their university studies<sup>[25]</sup> and are associated with graduates’ employability within a specific time frame.”<sup>[26]</sup> This is one of the main indicators

of the efficiency of the educational system.<sup>[27]</sup> Within the African context, universities have been urged to provide the necessary competencies and skills for students to become employable, by becoming responsive to the demands of the labor market and a rapidly changing world. The widening access to South African HE has led to an increased number of students entering HE spaces from disadvantaged backgrounds without the necessary “cultural capital” for success.<sup>[28]</sup>

While there has been a move in developed countries to replace the traditional pedagogies of rote learning, students, in this study still seemed to struggle with self-directed and independent learning; however, they appeared to have achieved these in the latter years of the qualification. A possible explanation for this development from third to fourth year, is that lecturers have the expectation that graduates with specific employability attributes like critical thinking, and effective communication skills may be developed in the clinical practice environment.<sup>[29]</sup>

Oliver and de St Jorre<sup>[30]</sup> pointed out that, the evolving nature of HE compels universities to determine the necessary graduate attributes that successful learners will need, and then evidence its achievement and assessment in various ways at the requisite stage of the qualification offered. The DUT ENVISION 2030 strategic plan emphasizes the development of distinctive attributes like creativity, innovation, entrepreneurship, and adaptivity, to name a few. Although the university strategic plan deeply espouses these graduate attributes, it is clear that the effectiveness thereof may be limited by virtue of the absence of explicit criteria for assessment of these graduate attributes in the current curriculum assessment plan. A valuable exercise would be to determine the needs of stakeholders to ascertain which graduate attributes may enhance employability, and which could be improved through the curriculum.<sup>[31]</sup>

The current debate on graduate attributes in South Africa appears to be dominated by academics<sup>[32]</sup> and stakeholders like clinical training staff, while students’ perceptions are noticeably silent. To nurture the desired attributes among students, academics, and clinical instructors should model these behaviors. Cruess *et al.*<sup>[33]</sup> argue that role modeling is a powerful tool and their personal characteristics of having a positive attitude, being respectful, and knowledgeable were found to be important to students. In fact, Glicken and Merenstein<sup>[34]</sup> reported that the behavior observations of their role models, specifically clinicians, by medical students influenced their learning more than formal teaching.

A few negative comments from students regarding attitudes of clinical instructors were concerning because

the quality of teaching, and delivery thereof contributes significantly to the students’ cognitive, professional, and personal development.<sup>[35]</sup> This difference may stem from those clinical instructors who placed emphasis solely on discipline content or were unaware of specific outcomes of a requisite level or were unable or unwilling to engage the softer skills into their delivery. Bendermacher and Egbrink<sup>[36]</sup> describe this as a rigid, control-orientated, and disciplinary culture which invariably contributes to an unfavourable environment, and an inhibitor of curriculum quality. It is thus necessary to acknowledge the need for development of faculty involved in teaching students so that the quality of learning design is optimised.

The COVID-19 pandemic transformed the HE space into the virtual realm, and recent studies highlight the differences in accessibility of digital equipment as well as acumen in computer skills between students from developing and developed countries.<sup>[37,38]</sup> Our findings were expected, as South Africa has a complexity of challenges facing HEIs locally, intensified by the inequalities experienced by students from socially and educationally disadvantaged backgrounds.<sup>[39]</sup>

In HE, formative and summative assessments are used to support learning in conjunction with appropriate feedback and linked to module or qualification outcomes. The pandemic required a reanalysis of how the dominant mode of teaching, learning, and assessment was done, moving from face-to-face, to virtual. Most institutions faced additional challenges due to lack of preparation, particularly under resourced institutions, in ensuring integrity of assessments in the absence of a proctoring system.<sup>[40]</sup> The counter argument is that it forced academics into exploring creative forms of assessment which shifted the focus from testing knowledge through rote and recall, toward manifestation of the higher order knowledge and skills required for that module.<sup>[41]</sup> In as much as there have been challenges to online learning, there is hope that the blueprint for fine tuning a more refined and sophisticated program delivery is now available.

Findings from this study highlight the idea that academics in South Africa work under immense work pressure.<sup>[32]</sup> El Shikieri and Musa<sup>[42]</sup> postulated that a high workload negatively impacts lecturers’ ability to prepare quality lecturing material, developing themselves intellectually and professionally, as well as advancing their research and community service. There is a perpetual challenge in balancing these roles while finding time to update themselves on the evolving virtual platform for teaching and assessment, while continuing to nurture and act as role models for students. In addition to halting creativity and innovation,<sup>[43]</sup> a high lecture workload is associated

with a high level of stress.<sup>[44]</sup> Managers of HE institutions need to acknowledge these complexities, while finding ways to support academics to balance these roles.

### Limitations and recommendation

The limitation of this paper could be that it presents the perspectives of the first cohort of BHSc CT students only. A sample including subsequent graduates, as well as those who have been practicing may be valuable in ascertaining whether the theoretical component of the curriculum prepared students for clinical practice training.

The evolution of a student into a reflective clinician poses both intellectual and emotional challenges. As such, it is incumbent upon the HE institution to provide a curriculum that supports not just theoretical knowledge, but the attainment of the requisite graduate attributes for the qualification. While results from this study have raised important findings on this previously unstudied area in CT, and may be extrapolated to similar qualifications, a larger national study is called for. The strength of this study lies in this being the first such study which provided original data through a robust methodology regarding the preparedness of BHSc in CT degree students for clinical practice learning.

### Conclusion

This study explored the BHSc curriculum in CT to understand if it prepared students for clinical practice learning. Although there was general consensus that the curriculum was both adequate and relevant in preparing students for clinical practice learning, the issues around General Education, as well as enhancing the depth and exposure to basic science modules needed attention. In addition, the harmonization of the CT curriculum whereby all institutions offering this qualification reach consensus on the curriculum content and assessment, is essential if the profession is to contribute to meeting the Millennium Development Goals related to health and ensure that high-quality graduates are produced by all providers of this qualification.

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### Ethical considerations

The study was approved by the DUT institutional ethics committee, with ethics clearance number IREC 046/21. The three primary ethical principles of beneficence,

respect for human dignity, and justice, were observed to safeguard study participants.

### Declaration of patient consent

The authors certify that they have obtained all appropriate participant consent forms. In the form, the participant(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The participants understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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### Conflicts of interest

There are no conflicts of interest.

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