CHAPTER 8

EXPLORING DIGITAL PEDAGOGIES FOR PROCEDURAL SKILLS TEACHING IN THE PLANNING OF COURSEWORK POSTGRADUATE PROGRAMMES IN OPTOMETRY

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Abstract

Introduction and Background: In developing new coursework for postgraduate programmes in optometry aimed at upskilling qualified optometrists, a suitable pedagogy as part of curriculum planning needs to be established. It is currently unknown if traditional face-to-face approaches and digital modalities for clinical skills teaching are synergistic or mutually exclusive.

Methods: A convergent parallel mixed-method design was employed, in which qualitative data from online (Microsoft Teams) focus group discussions (FGDs) and quantitative data from an electronic questionnaire (EvaSys V8.2) were simultaneously collected. There were 17 optometric educators purposively sampled from four higher education institutions (HEI) that participated in the FGDs, and 424 conveniently sampled practising optometrists responded to the questionnaire.

Results: Survey participants agreed (n = 177; 45%) that virtual observations of skills were equivalent to in-person demonstrations. Neutral responses were recorded by 24% (n = 88), and a total of 32.6% (n = 128) disagreed. Optometric educators supported in-person skills development with virtual methods as supplementary only. Survey participants indicated neutrality as the highest recorded selection (n = 154; 39.2%) regarding whether there were adequate optometrists with enhanced specialised skills to support optometric educators in education and training. Interinstitutional collaboration with international and local HEIs yielded 95.4% and 96.4% agreement for the delivery of education and training.

Conclusion: Interinstitutional collaboration was supported to mitigate the challenges of resource limitations in both expertise and educational materials to deliver education and training. Considering that postgraduate students are working and who may also be geographically dispersed, both blended and hybrid approaches were deemed suitable for teaching skills that straddle traditional and digital modalities.

Keywords: digital pedagogy, clinical skills teaching, optometrists, postgraduate, education and training, interinstitutional collaboration, academic partnership.

1 Introduction and Background

Digital pedagogy has emerged as an innovative 21st-century approach to health sciences higher education (Dhakal, 2023). The rapid migration to digital technologies in higher education arose as a contingency measure to the COVID-19 pandemic and has since maintained that momentum, permeating all aspects of teaching, learning, and assessments (Aluko, Krull and Mhlanga, 2022; Prosen & Ličen, 2025). To remain on par with a rapidly evolving society in this fourth industrial revolution (4IR), it was necessary for higher education to adapt and 'upgrade' educational practices from traditional pedagogies to Education 4.0 (Bonfield et al., 2020; Sershan et al., 2025). As we re-evaluate our pedagogical approaches used in undergraduate and postgraduate health sciences education, we must be cognisant of the challenges and multifaceted nuances that come with navigating the digital divide, especially in low and middle-income countries in the Global South (Kanyane, 2023; King & Gotte, 2024; Mwansa, Ngandu and Mkwambi, 2025).

Excluding immersive technologies like virtual reality (VR), augmented reality (AR) and mixed reality (MR) which require high fidelity technological interfaces (Jantanukul, 2024), low-tech technologies using audiovisual (AV) viewing and recording systems and video conferencing programmes can be used innovatively for the delivery of teaching and learning in health sciences education (Chaka, 2020; Yilmaz et al., 2020). While there has been significant pedagogical attention given to online and blended learning for theoretical content knowledge, hands-on clinical skills training in health sciences through an online format has not enjoyed the same exposure and research (Eglseder & Littleton, 2021). In health professions education, the acquisition of clinical skills holds a significant weight in the education and training (Abraham & Singaram, 2019). Habib, Danica and Nadia (2023) cited that the European Commission's Education Action Plan (2021–2027) has reported on the more recent recognition of the value of digital technology in enabling more flexible and student-centred teaching and learning. McGee et al. (2024) noted that digital learning of clinical skills does have the potential to improve educational outcomes. A study with occupational therapy students found that multimedia resources to develop clinical skills virtually were an effective modality and further promoted self-efficacy in clinical skills (Nash et al., 2022). Fourth-year medical students in a neurosurgery clinical course retained that face-to-face teaching was superior to online teaching (Shen et al., 2025). However, a blended approach incorporating face-to-face delivery and digital learning modalities is most effective for the learning experience (McGee et al., 2024). According to Shen et al. (2025), the effectiveness of online teaching in delivering the same quality of education and training as the traditional face-to-face approach in medical education is still debatable. Digitally enhanced practical teaching is deemed acceptable and usable in health sciences education, but addressing barriers is crucial for successful integration. A paper by Forde and O'Brien (2022) concluded that inaccessibility and inequity of online learning, digital illiteracy among staff, technological challenges, lack of engagement with preparatory material, lack of staff-student interaction, and negative attitudes towards online learning were all barriers to practical skills teaching and learning. Technological infrastructure has been identified as an important factor for improvement within health sciences educational institutions (Mabidi, 2024). Connectivity, bandwidth and technological support could be barriers to effectively migrate to online learning methods (Sahu et al., 2022).

The transition to remote clinical skills teaching during COVID-19 was a 'need to' rather than a 'want to' to maintain continuity in students' educational development. A systematic review found that digital education modalities were as effective as traditional ones for knowledge and practice during the COVID-19 pandemic; hence, they could be a valuable strategy for distance learning (Hao et al., 2022). Though Abraham (2021) found it to be a successful transition from face-to-face training to using multimedia resources by modifying and applying the five-step method of teaching clinical skills (George & Doto, 2001), it was still seen as a temporary contingency measure necessary at the time of COVID-19 and not a modality to be used beyond the COVID19 era for skills teaching (Abraham, 2021).

Currently, the optometry higher education system in South Africa (SA) has no regulated coursework or structured postgraduate qualifications at any higher education institution in SA. The current postgraduate qualifications are purely research-based, which limits opportunities to upskill in any specialised field of optometry such as vision therapy, paediatric optometry, contact lenses, low vision and ocular disease where specialised diagnoses, management interventions and/or rehabilitation can be comprehensively provided. Though there are enrichment opportunities through continuous professional development (CPD) activities, such do not award any formal recognition or accreditation for additional training. Both practising optometrists and optometric educators identified a strong need for the development of clinically focused postgraduate programmes in various specialised areas for optometry (Naicker & Munsamy, 2024). Such envisaged focused training can support optometrists to skilfully provide specialised and comprehensive eye care services to patients in need while simultaneously recognising the additional competencies acquired by the optometrists.

To establish specific niche area programmes in optometry, skills teaching of postgraduate students who are both working and geographically dispersed around SA need to be carefully considered, amongst other educational factors. Due to the unique intrinsic and extrinsic factors that differentiate an undergraduate student from a postgraduate one, educational teaching and learning practice need to be authentic for the andragogic learner (Blackard et al., 2024) The approach should be innovative and underpinned by adult learning theories applied to health sciences and medical education (Taylor and Hamdy, 2013). Synchronous and asynchronous clinical skill teaching can be scaffolded with a work-integrated learning strategy where workplace-based experiential learning can take place. Itis not only because we are in an era of digital transformation that educational strategies need to be technology-mediated, but it is because of the characteristics of a postgraduate scholar that technology in education and training is both useful and necessary. With the incorporation of technology, distance learning is possible which may positively facilitate access, promote practitioner enrollment and support throughput success rates.

Coursework postgraduate education in various specialised fields of optometry is found to be more prevalent in the Global North, with minimal postgraduate educational opportunities for optometrists in the Global South (Naicker & Munsamy, 2024). Planning for educational expansion requires significant discourse, with the scaffolding of the dual goals of creating access to lifelong learning opportunities for optometrists and for patients to reap the benefits of upskilled optometrists

Health science faculties in South African universities are resource-constrained, a reality that's common amongst low-middle-income countries (LMIC) (Noorbhai & Ojo, 2023). Expanding the educational offerings by incorporating an additional tier to the institutions' programme qualification mix (PQM) through multiple coursework postgraduate programmes, will pose a capacity challenge across all institutions. Capacity challenges are more than just insufficient staff to deliver training; they are much more complex and multifaceted. Higher education Institutions (HEI) working collaboratively in the delivery of postgraduate optometric education would be a novel approach for optometric education and training in SA. Exploring academic partnerships and collaborations to pool resources may be a worthwhile pursuit and requires various stakeholders' input on this novel concept of interinstitutional collaboration.

By exploring theories and establishing a theoretical framework for this investigation, we need to consider the theory of connectivism, which refers to teaching and learning in the digital age. This theory, developed by George Siemens, posits that learning extends beyond individuals to various information resources and connections, where the ability to acquire new knowledge outweighs existing knowledge (Mukhlis et al., 2024). The core argument that Siemens makes is that traditional theories developed before the age of the 4IR inadequately addressed how learning occurs in a rapidly changing knowledge environment, where technology impacts how we live and communicate. The capacity to know more and learn continuously is highly relevant for the 21st century (Mukhlis et al., 2024). It is for this grounding that the strong desire from optometrists to upskill through new postgraduate opportunities resonates with this theory. The postgraduate population of optometrists could be diverse in terms of years of experience, educational backgrounds, age groups, and generational differences, from baby boomers to Generation Z. However, in the current age of innovation, accepting technology for educational purposes is paramount. The Technology Acceptance Model (TAM) explores the factors that influence individuals to make use of technology (Mugo et al., 2017). As time progresses, the importance of technology acceptance cannot be overstated, particularly in relation to education in health professions. For postgraduate education in optometry, medical education, and all other health professions, the utility of technology and digital literacy becomes crucial to succeed with new-age programmes (Jarahi et al., 2024; Jibrin et al., 2025). To effectively integrate pedagogical, technological and content knowledge it would be prudent not to mention the TPACK Model (Koehler, Mishra and Cain, 2013). The essence of this model is merging of the three pillars to support the educational development through appropriate methods and tools to achieve the outcome competencies. Such a model can be applied to tertiary education and specifically in this case of postgraduate education. It is necessary to explore whether technologies such as digital AV systems can be valid and reliable tools for procedural skills teaching to build both proficiency and competency at a postgraduate level. By examining the four levels of Miller's Pyramid for building clinical competence, the digital showcase of clinical skills which this study investigation explores would be pegged at level three i.e., learning and building competence through virtual observation and demonstration of skills digitally in the case of this study, prior to real-life experiential learning (Hampton et al., 2024). With the onset of artificial intelligence (AI), educators could leverage the opportunity to explore generative AI (gen AI) for creating videos of procedures and clinical skills in the near future as a complementary tool for learning. Currently, as such technologies are emerging in medical education, their effectiveness, quality and accuracy remain uncertain (Artsi et al., 2025).

Four HEIs offer optometry undergraduate qualifications and research-based postgraduate master's and doctoral qualifications in SA. The institutions are the University of Johannesburg (UJ), University of Limpopo (UL), University of the Free State (UFS) and the University of KwaZulu-Natal (UKZN). The identified gap of a lack of postgraduate coursework qualifications in optometry in South Africa creates uncertainty regarding the optimal approach for implementing a digital pedagogy. This is especially concerning for clinical skills development if students are not based at the universities regularly as is the case with undergraduate students. Regrettably, we are not immune to the challenges encountered by the Global South, despite our status as a middle-income nation. Consequently, expanding educational resources from undergraduate to postgraduate education and training would require careful planning and consideration of factors such as the availability of human resources, funding, training equipment, and capacity. This may alleviate some challenges related to the sustainability and enrolment of the programmes, as the four South African optometry higher education institutions would collaborate to offer postgraduate education and training through digitally enhanced pedagogies.

Nevertheless, the inability to resolve this issue may compel institutions to plan independently which may lead to diverse curricula planning with no cohesion and commonality between institutions. It is therefore essential to generate evidence to guide institutional curriculum planning and specifically investigating pedagogies that are intersected with multimedia and internet-enabled observational systems to support remote learning of clinical skills in patient examination, treatment and rehabilitation. This paper therefore aimed to examine the pedagogical aspect of virtual modalities for clinical skills teaching in the planning of coursework postgraduate programmes of optometry in SA through resource-sharing from interinstitutional collaboration.

2 Research Design and Methodology

To effectively address the research questions, a convergent parallel mixed method design was implemented, collecting qualitative and quantitative data simultaneously (Razali et al., 2019). To establish robust conclusions, the two study methods were conducted concurrently where the findings were merged and interpreted. Both data sets carried an equal weighting from which the findings and interpretations thereof were derived. A target population of optometrists in South Africa was divided into two distinct study groups: optometric educators from HEIs and optometric practitioners in clinical practice. All optometrists registered with the Health Professions

Council of South Africa (HPCSA) were eligible for participation, subject to specific inclusion criteria for the different populations. Focus points and themes probed in the quantitative and qualitative methods were designed to be synergistic and aligned to the objectives. This was done to facilitate easier integration of numerical with textual data.

2.1 Sampling methods and sample size

Non-probability sampling strategies were employed to recruit the optometric educators and the optometric practitioners. The optometric educators used for the qualitative data collection phase were purposively selected based on the inclusion criteria of having at least five years of optometric undergraduate education and training experience and being currently employed at one of the four HEIs where optometry education is offered in SA. Twenty-eight (28) optometric educators were invited to participate in online Focus Group Discussions (FGD) using Microsoft Teams (Microsoft Corporation; Redmond, WA, USA), and 17 of them were available. This yielded a recruitment rate of 60.7%. For the quantitative approach, optometric practitioners were accessed through convenience sampling and chain referral sampling to broaden participation. All HPCSA-registered optometrists of any age, experience level, working situation, or geographic region were eligible to participate. An advertisement with a survey link was disseminated across multiple social media platforms and through numerous companies and organisations within the optometry sector to extend its reach. A survey method was adopted in which optometric practitioners were provided with a self-administered electronic questionnaire developed using the EvaSys survey system, version 8.2 (EvaSys GmbH; Lüneburg, Germany). A minimum sample size of 354 participants was calculated using the following characteristics: population size (N) = 4204, margin of error (E) = ± 5%, confidence interval = 95%, z-score = 1.96, and percentage value (p) = 0.5. A total of 424 survey participants at the end of the data collection period ensured adequate statistical power and limited the probability of errors.

2.2 Data collection instruments

Four online FGDs that represented the unit of analysis, were conducted by the principal investigator (PI) using a facilitator who was not an optometrist. This was done to mitigate affinity bias as the PI is an optometric educator from one of the four HEIs. The composition of the FGDs consisted of mixed groups of educators from different HEIs. The optometric educators did not represent their institutions' views; instead, they reflected and expressed their own perspectives, which were interpreted as collective opinions. The FGD participants ranged from three to five per group. The FGD agenda was disseminated to all participants prior to their scheduled FGDs. There were three questions presented: the first related to the design features of a postgraduate programme in optometry, the second to a suitable teaching and learning approach for postgraduate coursework programmes, and lastly, the appropriate assessment strategy at the postgraduate level for working health professionals. All FGDs were audiovisually recorded, auto-transcribed and subsequently reviewed by the researcher to ensure authenticity of the discussions. Each FGD lasted approximately 90 minutes. Educators who were HPCSA-registered optometrists with at least five years of undergraduate education and training experience were invited to participate. The purposively sampled educators across the four HEIs that provided written informed consent were recruited as the study sample for the qualitative method.

The quantitative survey instrument had five sections with 47 items in total. The questions and statements were divided into different sections, systematically arranged to achieve the research objectives of a broader study. The questionnaire obtained nominal, ordinal, ratio, and interval data. The interval data were numeric ranked options. The ordinal data were categorical text-type data, with ordered ranked scales using a five-point Likert scale. Likert scale options used were: strongly disagree, disagree, neutral, agree and strongly agree. There were also ranking questions for the participants to select their most and least preferred choices. Some statements were forced-choice, while others allowed multiple selection. The questionnaire was developed using the Evasys survey system (V8.2), and the link was distributed through advertisements on social media platforms and the principal investigator's professional network. Optometry organisations also agreed to circulate the advertisement and questionnaire through their network and databases. Participants were informed of their rights to anonymity and confidentiality of their responses after clicking the link to the questionnaire prior to the display of statements.

2.3 Quality measures for data collection methods

The FGD agenda underwent an expert quality check by five health sciences researchers from the Faculty of Health Sciences at UFS, who based their evaluation on their prior research experience in designing and conducting FGDs. This exercise helped in finalising the FGD agenda to be used across all focus groups. The agenda contained the time duration per question as a guideline to the facilitator, study objectives, three principal questions with probe points, and clarification of specific terms used in the questions. The same facilitator, who was not an optometrist, was used for all FGDs to avoid any bias in directing the conversations. A pilot FGD was conducted with five optometric educators, and the data obtained were used in the overall data analysis, with the same questions retained and only a single change in vocabulary.

For instrument validation, a group of ten content validity reviewers was purposefully selected based on their postgraduate qualifications in optometry research. The reviewers used a four-point Likert scale to rate the items' relevance in the questionnaire [24]. The scale content validity index (S-CVI) returned a value of 0.921. A survey pilot study was sequentially administered to 15 participants, who completed the online questionnaire over nine weeks from December 2022 to February 2023. The same cohort also performed a qualitative review of the questionnaire as a face validity exercise. The feedback included views on the length of the questionnaire, language usage, and survey completion time. The feedback was then incorporated into the survey's final version. Because changes were made after the pilot stage, the pilot questionnaire findings were not included in the primary empirical data set.

To determine interrater reliability, the intraclass correlation coefficient (ICC) was calculated using IBM SPSS Statistics version 29.0.0.0. ICC estimate of dependability was 0.916 [25]. Internal consistency and exploratory factor analysis (EFA) were calculated using R version 4.3.0. It was determined that the six factors identified were derived from sections A and B and demonstrated Cronbach's alpha (α) reliability scores between 0.66 and 0.87. Four factors were identified in sections C and D, each with a reliability score between 0.53 and 0.81.

2.4 Data analysis

An abductive approach for the qualitative method was employed in this study, where both deductive and inductive data were generated. A qualitative content analysis was carried out utilising Atlas.Ti 23, using primarily deductive logic with a priori coding. Textual data from each of the FGDs was assessed for patterns or common concepts for each question. A code list was predetermined due to the deductive approach adopted with predetermined themes. A priori themes were derived from the study objectives and incorporated into the FGD questions to probe postgraduate pedagogy for clinical skills training to answer the research questions. All participants' names were replaced in the transcript with non-descriptive codes, removing all personal characteristics linked to any participant. Participants were coded according to a standard designation where, for example, FG3p4 represented Focus Group 3 –participant 4 and so forth. Quantitative data analysis was computed using SPSS and R with the support of a biostatistician. Descriptive statistical analysis was conducted with numerical data expressed as frequencies and percentages. Due to the non-normal data distribution found, median and interquartile ranges were computed.

2.5 Ethical considerations

All ethical requirements and due processes were followed to ensure that the research study involving human participants was ethically sound, transparent, avoiding any infringement of human rights and dignity, and abiding by the regulations prescribed by the Protection of Personal

Information Act (POPIA) (Republic of South Africa, 2013) and the University of the Free State Health Sciences Research Ethics Committee's (HSREC) Standard Operating Procedures and Guidelines Version 03.01 (Faculty of Health Sciences, 2021). Informed consent was sought from all participants, where participants' rights to participation were clearly explained. The researcher abided by the principles of biomedical ethics, which are: respect for persons (autonomy and self-determination), beneficence, non-maleficence and justice. Ethical clearance was obtained from HSREC (Ethical approval number UFS-HSD2022/1101/2911).

3 Results

3.1 Online observation of procedural skills through AV systems for building competence versus in-person contact training sessions

3.1.1 Survey results: Optometric practitioners

A survey statement stated that 'online live demonstrations combined with the use of audiovisual teaching aids could develop one's practical skills and clinical competence just as well as being physically present for contact sessions.' Participants' response via the five-point Likert scale showed a marginally higher combined agreement (strongly agree and agree) of 45% with 22.4% indicating neutrality and 32.6% cumulatively disagreed (strongly disagree and disagree) with the statement. The results are illustrated in Figure 8.1.

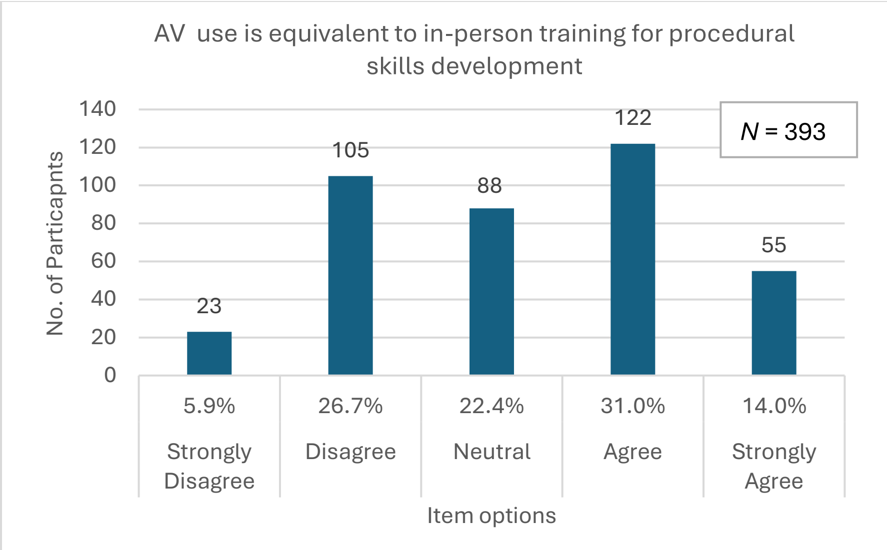

Figure 8.1: Optometric practitioners' responses as to whether audiovisual (AV) systems used as tools for training of skills would be equivalent to receiving in-person training

3.1.2 Focus group discussion results: Optometric educators

A predetermined theme of a feasible educational strategy at postgraduate level derived from a broad FGD question relating to content delivery and skills transfer for working optometrists, gave rise to the following emergent sub-themes, as illustrated in Figure 8.2.

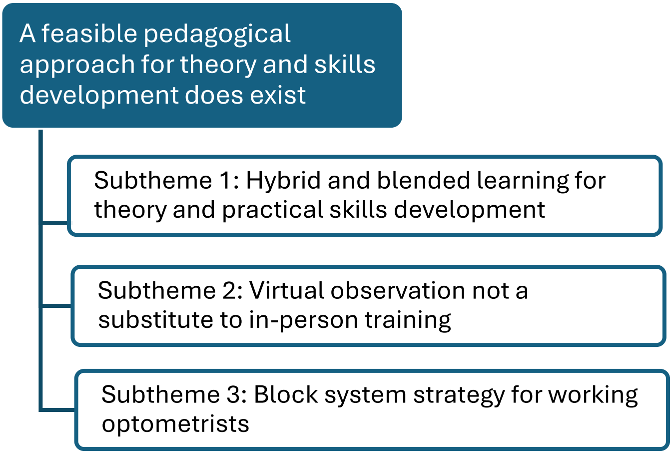

Figure 8.2: A priori theme of a feasible pedagogical approach to clinical skills development, with emergent sub-themes of hybrid and blended learning for practical skills development, and virtual observation is not a substitute for in-person skills training

Finding a suitable pedagogical approach to upskill working optometrists is essential to ensure standards of education are maintained to achieve the intended outcome while being cognisant of extrinsic factors such as family and personal responsibilities, geographic location and travel costs.

Optometric educators across all FGDs readily voiced support for both a blended and a hybrid approach to theory, as optometrists are geographically dispersed and working. FG3p1 stated: *"I think hybrid learning methods work very well to accommodate those that cannot attend face-to-face sessions in conjunction with blended learning because it helps students to be actively involved even if there is no class or practical"*

FG4p2 further stated regarding the pedagogical strategy, that: *"it should not be too onerous, which can result in attrition from the programmes as practitioners are known to have a busy work life"*.

FG4p2, FG3p1 and FG1p3 believed multiple online teaching and learning methods, modes of delivery and activities could be utilised. FG4p2 stated: *"There might be recorded lectures that they can listen to. There might be* *videos that they need to look at. There might be a contact session. So, it needs to be carefully designed because it is not for undergrad students."*

The optometric educators generally expressed that practical skills development should be done in person rather than through virtual observations. FG2p3 stated that *"I do believe that theoretical components as well as practical components can be delivered by audiovisual recording, though not necessarily live-streamed, so I think it is important to allow that flexibility according to practitioner availability. The emphasis and need should be face-to-face contact."*

FG1p2 voiced that *"I think certainly one can have a certain part of the training done online and watching the student performing certain activities, but some of it definitely needs to be in-person."*

The belief was that skills could be video recorded for asynchronous learning but done as a pre-practical exercise in preparation for subsequent in-person contact sessions. Such sessions can be conducted as a block-release strategy, considering both the geographic location of students and their work commitments. FG1p5 described that *"the block system allows people who are waiting (for the contact session) to apply for work leave during that time."* FG1p1 stated that *"They would need to engage with the material before they would need to do the block (referring to in-person practical sessions). They can take these blocks at different times of the year, depending on their practice, when it is not too busy. So engage with the material first, and then a practical face-to-face kind of workshop"*

3.1.3 Summary of FGD findings

Optometric educators supported a blended (in-person and online) and hybrid (recorded and livestream) approache to knowledge and skills acquisition. A blended strategy was endorsed to allow flexibility, using various learning materials, online tools, and modalities in the learning process. Regarding the use of digital modalities via AV systems for skills teaching and training, it was considered to be the exception and not the rule. Primarily, skills teaching and transfer were considered to be best achieved through in-person contact sessions, with audiovisual aids serving as supplementary asynchronous material. A block-release system was proposed as an ideal approach whereby scheduled intermittent contact sessions across the duration of the programme would support student attendance and promote throughput success to navigate work commitments and travel.

3.2 Educational capacity and resources for efficient delivery of teaching and learning in postgraduate programmes for working optometrists

3.2.1 Survey results: Optometric practitioners

Optometric practitioners responded to a statement about whether they believed there were adequate optometrists in SA with expertise in various specialised fields to support HEIs with education and training in the envisaged structured postgraduate programmes. A 5-point Likert scale option was available for this statement. The purpose of this statement was to determine whether those in clinical practice believed that the profession in SA had sufficient capacity to support educators in sustaining teaching and learning by outsourcing aspects of education and training. If this were possible, it could strengthen partnerships in delivering postgraduate education for qualified optometrists. The results found are presented in Figure 8.3, where neutrality was the most prevalent response with a cumulative disagreement percentage of 28.0% and a cumulative agreement percentage of 32.8%.

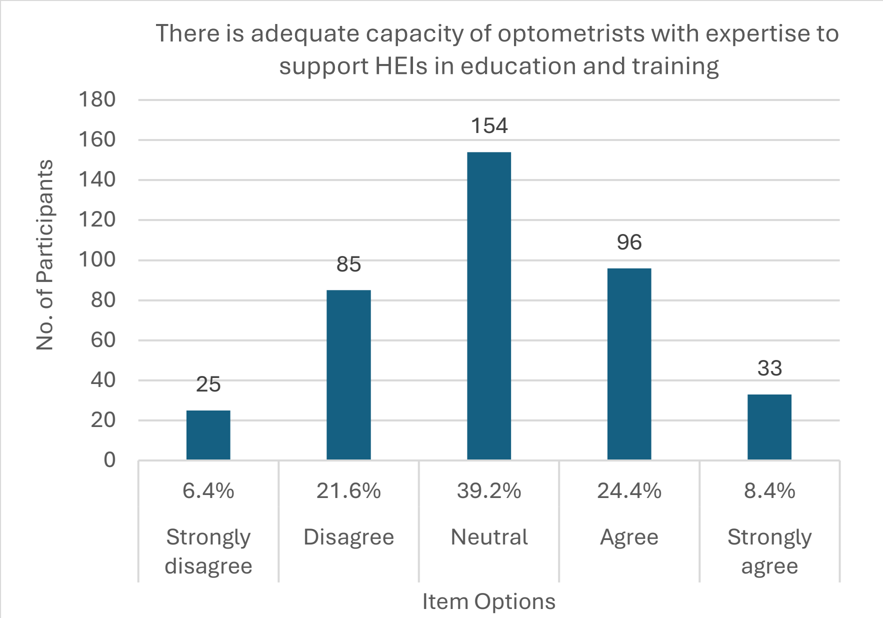

Figure 8.3: Optometric practitioners' views on the capacity of optometrists in SA with expertise in various specialised fields to support the HEIs with the clinical education and training

Optometric practitioners who complete the structured postgraduate programmes in various specialised areas will form a cohort with enhanced skills and competence. To investigate long-term sustainability and capacity building for optometric postgraduate education, it was envisaged that graduates would be able to support the training of future postgraduate students. A survey statement listed various roles that qualified graduates could fulfil to help expand the education and training capacity. Multiple selection options were allowed for this statement in the questionnaire, and the results are presented in Figure 8.4. The results indicated that only 16% of participants shows 'no interest' in supporting the education and training of future enrolled optometrists.

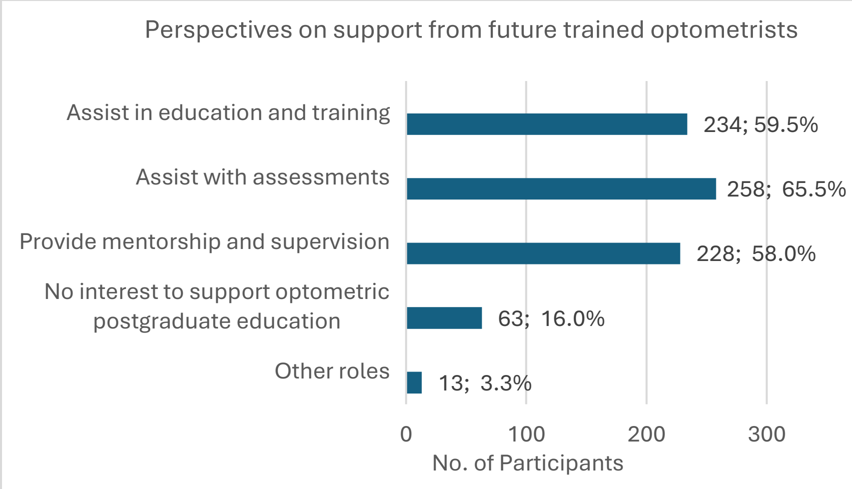

Figure 8.4: Optometric practitioners' roles to take up to support the education and training of future postgraduate students

On two statements regarding both local and international collaboration between optometry HEIs, survey participants fully supported such collaborations for teaching and learning. As illustrated in Figure 8.5, South African HEIs collaborating with international HEIs were strongly supported (n = 375; 95.4%), as well as local optometry HEIs collaborating (n = 379; 96.4%) to deliver teaching and learning at the postgraduate level in various specialised fields of optometry.

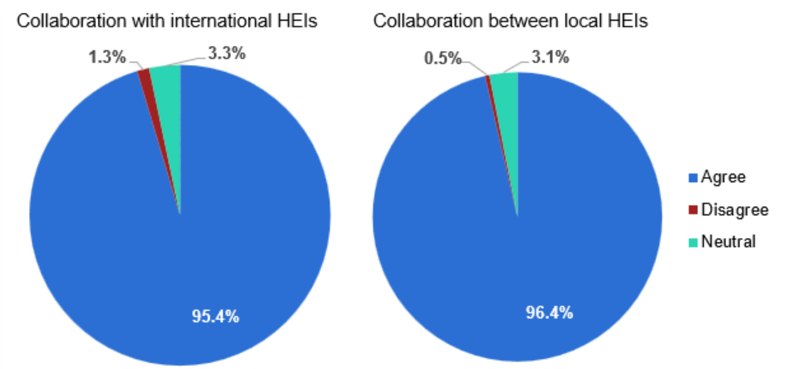

Figure 8.5: South African HEIs to collaborate nationally and internationally for the delivery of postgraduate programmes

Participants rated their level of agreement on the justifiable factors of interinstitutional collaboration for the delivery of education and training in speciality-focused postgraduate optometry programmes in SA and abroad. There was a convincing level of combined agreement (n = 360; 91.6%) that collaboration could benefit the delivery of education and training through sharing resources, such as educational materials and training tools. An equal combined level of agreement (n = 360; 91.6%) supported networking of this nature for human resource support in delivering education and training by identifying specific field experts to assist in the programmes. There were 8.1% (n = 31) and 8.4% (n = 33), respectively, that were neutral on both factors of collaboration, with a single negative response (0.3%) recorded. Table 8.1 presents all five Likert scale responses individually.

Table 8.1: Two factors that could underpin the collaboration between HEIs

Collaboration Factors	Strongly agree n (%)	Agree n (%)	Neutral n (%)	Disagree n (%)	Strongly disagree n (%)
Sharing of teaching and learning educational tools and materials	179 (45.5)	181 (46.1)	32 (8.1)	0	1 (0.3)
Source content expertise for teaching and learning	185 (47.1)	175 (44.5)	33 (8.4)	0	0

3.3 Focus group discussion: Optometric educators

During the FGDs, optometric educators were presented with a probing point about the prospects of institutions collaborating to deliver teaching and learning for new postgraduate programmes, framed under a broad FGD question on workable pedagogical strategies. A deductive logic approach was taken by presenting the hypothesised theme to focus groups, from which inductive sub-themes emerged. The theme and sub-theme are presented in Figure 8.6.

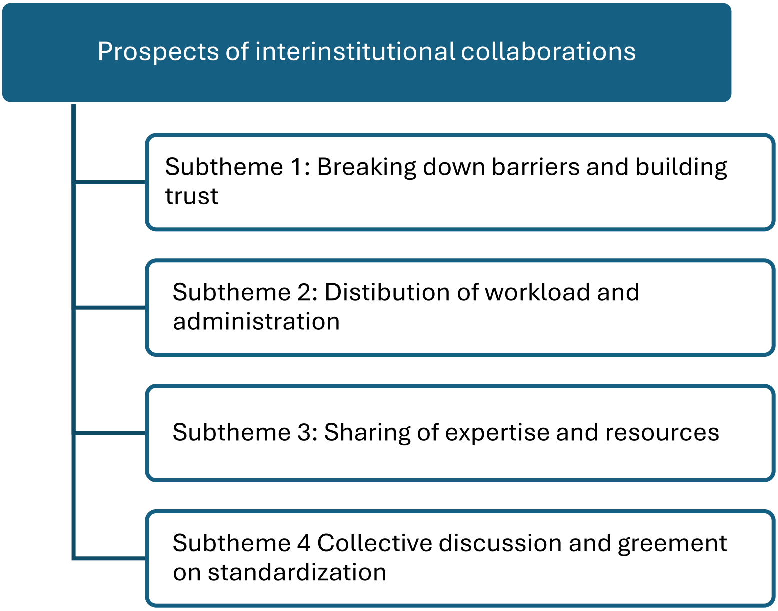

Figure 8.6: A priori theme derived from a FGD question with emergent sub-themes

The rationale for exploring 'capacity' in the delivery of teaching and learning is that all educators are currently involved in the undergraduate training of optometry students. If there is to be an additional programme or programmes with a coursework component, without an increase in the staff establishment at each department, this would pose a workload strain on the existing staff complement. Beyond this issue, there may not be enough skilled educators in the various specialised fields at each HEI to deliver the necessary education and training. It is for this reason that educators' opinions need to be explored on how they envisage sustaining postgraduate education and training, mainly when students are employed as optometrists and distributed across the country.

All four FGDs highly supported interinstitutional collaboration in offering postgraduate coursework programmes in speciality areas. FG1p1 stated: *"I think there definitely is space in South Africa for something like this to work if all stakeholders are properly engaged. I do not think that they (educators in general) would be opposed to it because, in truth, we are all South*

Africans, and in the spirit of ubuntu (humanity towards each other), we would want to work together. We want to uplift all institutions.” It was additionally declared by FG2p1 that: *"We are too few institutions to do this independently"*

A barrier to collaboration was described as fear. FG1p1 stated: *“I think it's a fear. There is much fear out there at the moment, and it's a barrier. So I think those are some of the things that would need to be broken down first before we can even think about proper collaboration."*

It was further expressed that professional collaboration between institutions can build trust, support and respect between peers. FG1p4 stated that *"Once we build that collaboration, it will build more trust between institutions, and they will be at that level of willingness to help out, building human relationships between colleagues in another institution. So basically, we'll be engaging in a level where we all trust each other, with whatever is taught in an institution."*

FG4p1 and FG4p3 described the benefits as numerous, with a reduced administrative burden on individual institutions to carry forward the same programmes. FG4p3 stated: *"We have to think carefully about how we then proceed in the best possible way, so that it doesn't place a burden on both the institutions and candidates in terms of course design."*

Participants FG4p3, FG2p4, and others expressed that knowledge sharing from experts in specific speciality areas is not equally distributed across different HEIs, which also have varying strengths: *"I don't think that one institution can take responsibility for perhaps training in one specialty or all for that matter. What is also generally accepted is that some institutions have strengths in a particular speciality, and perhaps that is where we will start, as to which institutions are strong in certain specialities and how we can collectively model these subspecialty training programmes against a similar framework."*

There was a clear sentiment across all FGDs that a collective discussion among all four HEIs is necessary to ensure standardisation of outcomes, teaching and learning modalities, and content. FG3p5 expressed that *“In* *terms of all institutions, we agree upon the content, we agree upon the materials .....I would like to see that there is some broad generic approach where all institutions work together to deliver the course."*

3.3.1 Summary of FGD findings

With optometric educators collectively supporting interinstitutional collaboration, it was initially concluded that for collaboration to be a successful endeavour, fear of judgment and critique must be dispelled, and trust-building needs to occur. The sharing of educational resources and training tools was highlighted as valuable, with specific educators in the profession acknowledged as experts in specialised fields. This human resource support may not only benefit the institution that the 'expert' is employed at but could collaborate in the delivery of teaching and learning with other institutions for the same specialised programme. Collaboration was considered beneficial for distributing the workload, pooling of resources and administration across institutions.

4 Discussion

While optometric practitioners generally agree that online demonstrations of skills for clinical teaching are equivalent to in-person sessions, one cannot ignore the significant number of practitioners who disagreed or were neutral about this issue, indicating a level of uncertainty. In contrast, optometric educators viewed virtual modalities for skills development as supplementary to the traditional approach, perceiving them as an exception rather than the rule. Traditionally, skills development has been only done through in-person contact sessions as standard practice in optometry at the undergraduate level. Even though the idea is not to replace this traditional practice but to make education more accessible, other modalities that can achieve this need should be given the consideration they deserve. We need to make a paradigm shift, accept technology integration into pedagogy, and explore new approaches if we determine their ease of use, practicality, and ability to achieve the outcomes of the learning exercise. A study by Belew et al. (2024) with postgraduate medical and health sciences students found that the acceptance of e-learning was largely promising. This acceptance stemmed from its usefulness and ease of use, which in turn increased their positive attitude towards learning through technology (Belew et al., 2024). It must be noted, however, that this study was based only on first-generation universities in Ethiopia and lacks generalisability. Mastour, Yousefi, and Niroumand (2025) concurred that ease of use and usefulness play an important role in technology acceptance, based on a study conducted at one of the top universities in Iran (Mastour, Yousefi, and Niroumand, 2025). However, in this age of innovation and due to the COVID-19 pandemic, there has been an increased use of audiovisual tools with newer technologies for observation in health professions education, such as wearable viewing systems that can facilitate mobility during clinical sessions (Sheng et al., 2024).

Especially in scenarios where a patient is in bed and the clinician needs to manoeuvre to get a specific view, a wearable camera recording device would be most appropriate (Brown & Reid, 2022). In optometric clinical skills teaching, wearable technologies could be highly effective. In many instances, you would need to be positioned closer to the patients' eyes and perform procedures such as insertion and evaluation of contact lenses and performance vision training exercises as examples. In this instance, wearing a head-mounted camera to project to students in various sites and regions in the country could be a valuable strategy for livestream observations. Hence, the concept of Internet of Things (IoT) is especially valuable for synchronous teaching. The IoT is a critical need in medical education, and HEIs must ensure that connectivity capabilities and the application of internet-enabled learning technologies are suitable for expanding into various online and digital pedagogies (Mastour et al., 2025). In a literature review paper that proposed a conceptual model linking effective pedagogy with the TPACK model where pedagogical knowledge, technological knowledge and content knowledge are integrated, it further recommended that HEIs invest in technological infrastructure and equip educators and students with advanced technologies to enhance student learning and raise the bar in innovative teaching and learning strategies and institutional competitiveness (Khoza, 2022).

The key stakeholders in this study found an overwhelming need to pursue interinstitutional collaboration in the delivery of teaching and learning. With only four HEIs of optometry in SA and under a resource-limited status quo, it would be well judged to commence with new programme development collaboratively and establish educational partnerships for teaching and learning innovation. A study by Daniels et al. (2015) identified the need for inter-institutional collaboration in higher education, particularly in health professions in South Africa. The study also highlighted the collaborative initiative of establishing a Common Teaching Platform for undergraduate nursing education for all HEIs in the Western Cape. With the advent of globalization, interinstitutional collaborations are strategic drivers for joint research initiatives, staff professional development and educational innovation (Van Vugt and Gallagher, 2026). Interinstitutional collaboration can provide opportunities in postgraduate optometric education for skills transfer, resource sharing, learning from colleagues across different institutions, building professional networks and for student mobility.

Optometric practitioners and educators have overwhelmingly indicated a need for international collaborations. Such initiatives do exist and are in progress such as the European Universities Initiative where a transnational alliance of at least 10% of HEIs across Europe collaborate towards pedagogical transformation and educational excellence (Palmowski and Angouri, 2025). Cross-border institutional collaboration in the African continent focused on optometric education would be an exciting prospect considering that as of 2020, only 16 African nations offer optometric education across 33 HEIs, of which four are in SA (Abu, 2020).

An existing North-South global partnership between Nottingham Trent University in the United Kingdom and Makerere University School of Public Health in Uganda provided opportunities for co-learning for both students and staff across both institutions such as guest lectures, seminars and conference presentations. The broader key areas of this longstanding partnership include community health workers training, tackling antimicrobial resistance, student/staff mobility and joint publications, among others. Though it was hailed a success, this collaboration was not without challenges such as funding for study mobility and academic scheduling between institutions across hemispheres. Exploring interinstitutional collaboration for optometry education in SA would require multiple stakeholders and multiple stakeholder engagements, as this would be a novel pursuit requiring discourse at the different institutional levels. Institutional competitiveness is more familiar territory as each HEI aims for academic excellence driven by global rankings.

Optometric practitioners indicated a significant level of uncertainty about the 'adequate capacity of optometrists with expertise to support the postgraduate education and training at HEIs'. The existence of this uncertainty implies that optometrists with specialised and advanced skills in SA lack visibility or are very scarce. It is for this reason that optometric practitioners previously declared that receiving professional recognition from the Health Professions Council of South Africa (HPCSA) would motivate them to pursue further education and training, as it would improve their visibility in the profession (Naicker & Munsamy, 2024). Practising optometrists who have completed their postgraduate qualification may consider participating in the education and training of new cohorts of postgraduate students. This consideration supports capacity-building and relieves pressure on full-time educators at HEIs by managing all aspects of education and training, including mentorship and supervision. It is worth noting though, that to effectively mentor and supervise trainees to foster skills proficiency and competency, development in this area is necessary to take on such roles and be effective (Garth et al., 2024). Qualified health professionals are needed to support the education and training of new students, addressing global health workforce challenges. This is the position of the World Health Organisation (WHO) to address the global shortage of healthcare workers with acknowledgement of the constraints experienced in health professions education (WHO, 2013)

Evidence-based practice (EBP) is key in the education and training of health professionals (Lehane et al., 2019). In support of this widely accepted principle, empirical evidence in the use of AV systems for procedural skills training as an adjunct or supplementary tool to in-person skills acquisition was generated as a plausible pedagogical strategy for postgraduate education. Furthermore, evidence supporting the collaborative delivery in the education and training between the HEIs in SA is a welcome endorsement considering the resource-constrained educational climate in SA. Such empirical evidence holds value for optometric HEIs for curriculum planning for envisaged postgraduate coursework programmes in optometry.

5 Conclusion

Digitalising procedural skills teaching at a postgraduate level for optometrists was recommended as a beneficial educational tool that can support hands-on skills training for the postgraduate scholar. The synchronous and asynchronous use of audiovisual tools to develop procedural skills is a valuable resource that can be adapted for various competencies across multiple clinical specialities in optometry and collaboratively shared between institutions to standardise and maintain quality training across different programmes.

Though a discrepancy between practitioners and educators existed in the usefulness of AV systems for online teaching and learning of procedural skills, it was concluded that a blended and hybrid approach combining online and face-to-face training is a viable pedagogical approach, with an emphasis on in-person contact training. Pivoting between the traditional in-person and pre-recorded and livestream virtual observations should be a strategy adopted by HEIs for clinical teaching in postgraduate qualifications in optometry. There was a firm conviction that collaboration between HEIs on both local and international scales could enhance teaching and learning. Resource sharing of educational materials and expertise could be advantageous for a middle-income nation. The empirical evidence generated from this research can support consistency in the curricula planning phase between all four HEIs. Leveraging technology to deliver education and training collaboratively presents an innovative pedagogical approach for postgraduate-level clinical education. By expanding higher education opportunities for optometrists to upskill, they will be equipped to deliver high-quality care to patients who access the health system. We can support the global vision of both lifelong learning and internationalisation through collaboration by utilising technology to enhance educational provision and reach, particularly in the Global South.

6 Limitations and Recommendations

Statements about online theoretical engagement were omitted from the online questionnaire because, since the emergence of COVID-19, it has become standard practice to deliver content knowledge through online modalities. However, the population of practitioners may not all have experience in any form of online teaching and learning; hence, their perspective on this modality for theory may be valuable. Although the nature of a survey format does not allow for in-depth exploration of a concept, additional questions about the use of technology and connectivity in the current South African socio-economic climate could have been examined.

As optometric educators had predominantly undergraduate teaching and learning experience, they encountered difficulties during the FGDs in distinguishing the attributes of a postgraduate scholar from those of an undergraduate scholar and heavily reflected on their predominantly undergraduate educational and training backgrounds.

Scheduling participants into the various FGDs was challenging as schedules and availability between educators varied greatly. Though the aim was to mitigate power dynamics by grouping more senior and experienced educators separately from junior educators, it was not always possible in every FGD.

An evidence gap was observed, as most scholarly work focused on undergraduate-level education, training programmes, and undergraduate students, while there is a lack of research on postgraduate education and training. Though concepts could be applied to the postgraduate level, they were not always relevant or applicable.

It is recommended that the HPCSA take a leadership and oversight role in steering the curriculum planning with the HEIs in SA, as there are only four optometry institutions. The HPCSA can facilitate stakeholder engagement with optometric educators and curriculum developers. It would be a feasible endeavour to ensure all HEIs work synergistically towards establishing their postgraduate programmes. In addition, exploring and planning the collaborative efforts between HEIs under the stewardship of the HPCSA would help expedite this process and strengthen interinstitutional collaboration, which is both novel and unexplored in the higher education sector, particularly in optometric education.

7 References

Abraham, R. (2021). The need of the hour: Adapting the delivery of clinical skills teaching remotely. *Perspectives in Education, 39*(2), 82–94. https://doi.org/10.18820/2519593X/pie.v39.i2.7

Abraham, R. M., & Singaram, V. S. (2019). Using deliberate practice framework to assess the quality of feedback in undergraduate clinical skills training. *BMC Medical Education, 19*(1), 1–11. https://doi.org/10.1186/s12909-019-1547-5

Abu, S. L. (2020). The history and current status of optometric education in Africa. *Hindsight: Journal of Optometry History, 51*(4), 84–92. https://doi.org/10.14434/HINDSIGHT.V51I4.31557

Aluko, R., Krull, G., & Mhlanga, E. (2022). Shaping open, distance and e-learning in post school education and training: A call for a revised agenda. *Perspectives in Education, 40*(1), 1–17. https://doi.org/10.18820/2519593X/PIE.V40.I1.1

Artsi, Y., Sorin, V., Glicksberg, B., Korfiatis, P., Thomas, D.C., Nadkarni, G.N., Klang, E. (2025). Generated videos in medical education: Systematic review. *BMJ Open Quality, 14*, e003704. https://doi.org/10.1136/bmjoq-2025-003704

Belew, A., Ketemaw, A., Sitotaw, G., Alganeh, H., Wogayehu, B., Ayenew, T., & Damtew, A. (2024). Acceptance of e-learning and associated factors among postgraduate medical and health science students at first generation universities in Amhara region, 2023: Using modified technology acceptance model. *BMC Medical Education, 24*, 838. https://doi.org/10.1186/s12909-024-05942-w

Bonfield, C. A., Salter, M., Longmuir, A., Benson, M., & Adachi, C. (2020). Transformation or evolution? Education 4.0, teaching and learning in the digital age. *Higher Education Pedagogies, 5*(1), 223–246. https://doi.org/10.1080/23752696.2020.1816847

Brown, W. J., & Reid, C. (2022). Implementing a cost effective and configurable hybrid simulation platform in healthcare education, using wearable and web-based technologies. *Smart Learning Environments, 9*(1), 1–16. https://doi.org/10.1186/s40561-022-00201-1

Chaka, C. (2020). Higher education institutions and the use of online instruction and online tools and resources during the COVID-19 outbreak — an online review of selected U.S. and SA's universities [Preprint]. Research Square. https://doi.org/10.21203/rs.3.rs-61482/v1

Dhakal, B. P. (2023). Digital pedagogy: An effective model for 21st century education. *Academic Journal of Mathematics Education, 5*(1), 1–9. https://doi.org/10.3126/ajme.v5i1.54534

Eglseder, K., & Littleton, A. (2021). Teaching clinical skills online: Techniques, student feedback, and lessons learned. *Journal of Occupational Therapy Education, 5*(2). https://doi.org/10.26681/jote.2021.050211

Faculty of Health Sciences, University of the Free State. (2021). Health Sciences Research Ethics Committee (HSREC) standard operating procedures and guidelines (Version 03.01, 24 November 2021). University of the Free State. https://www.ufs.ac.za/docs/librariesprovider25/default-document-library/hsrec-standard-operating-procedures-and-guidelines_v03-01_24nov2021.pd

Garth, B., Kirby, C., Nestel, D., & Brown, J. (2024). Becoming a general practice supervisor: A longitudinal multi-case study exploring key supportive factors. The Clinical Teacher, 21(4), e13738. https://doi.org/10.1111/tct.13738

George, J. H., & Doto, F. X. (2001). A simple five-step method for teaching clinical skills. *Family Medicine, 33*(8), 577–578.

Hampton, D., Melander, S., Tovar, E., Falls, C., Makowski, A., Grubbs, A. B., Chitwood, H., & Scott, L. (2024). Value of Miller's pyramid for clinical skills assessment in the evaluation of competency for nurse practitioner students. Journal for Nurse Practitioners, 20(4), 104952. https://doi.org/10.1016/j.nurpra.2024.104952

Kumar, R., Gupta, P., Sharma, M., Chandra, S., Verma, A., & Singh, N. (2021). Application of digital education in undergraduate nursing and medical interns during the COVID-19 pandemic: A systematic review. Nurse Education Today, 108, 105183. https://doi.org/10.1016/j.nedt.2021.105183

Jantanukul, W. (2024). Immersive reality in education: Transforming teaching and learning through AR, VR, and mixed reality technologies. *Journal of Education and Learning Reviews, 1*(2), 51–62. https://doi.org/10.60027/jelr.2024.750

Jain, P., Kumar, A., Sharma, R., Gupta, N., Verma, S., & Singh, H. (2025). Implementing an Internet of Things-based learning platform into medical education: Addressing educational challenges with innovative solutions. Medical Teacher, 47(8). https://doi.org/10.1080/0142159X.2024.2445036

Jarahi, L., Akbari, A., Kaheni, A. H., Amiri, M., & Mohammadian Ghosooni, M. (2024). Digital literacy among medical sciences students: A systematic review and meta-analysis. Future of Medical Education Journal, 14(3), 29–38. https://doi.org/10.22038/fmej.2024.80358.1595

Adedoyin, S. O., Abdulrazaq, A. I., & Sani, M. A. (2024). Digital literacy competencies of postgraduate students for access and use of digital information resources and services in university libraries in Kaduna State. Information Impact: Journal of Information and Knowledge Management, 15(2), 27–43. https://doi.org/10.4314/iijikm.v15i2.3

Kanyane, M. (2023). DigitalWork — transforming the higher education landscape in South Africa. In *New digital work: Digital sovereignty at the workplace* (pp. 149–160). Springer International Publishing. https://doi.org/10.1007/978-3-031-26490-0_9

Khoza, N. G. (2022). A review of literature on the effective pedagogy strategies for online teaching and learning in higher education institutions: Lessons from the COVID-19 pandemic. *European Journal of Education, 5*(1), 43–55. https://doi.org/10.26417/738tqq65

King, J., & Gotte, E. (2024). Bridging the digital divide in developing and developed countries: A meta-analysis. In W. James, C. Cobanoglu, & M. Cavusoglu (Eds.), *Advances in global education and research: Volume 5* (pp. 1–12). USF M3 Publishing. https://doi.org/10.5038/9781955833127

Knapke, J. M., Hildreth, L., Molano, J. R., Schuckman, S. M., Blackard, J. T., Johnstone, M., Kopras, E. J., Lamkin, M. K., Lee, R. C., Kues, J. R., & Mendell, A. (2024). Andragogy in practice: Applying a theoretical framework to team science training in biomedical research. British Journal of Biomedical Science, 81, 1–8. https://doi.org/10.3389/bjbs.2024.12651

Koehler, M. J., Mishra, P., & Cain, W. (2013). What is technological pedagogical content knowledge (TPACK)? *Journal of Education, 193*(3), 13–19. https://doi.org/10.1177/002205741319300303

Lehane, E., Leahy-Warren, P., O'Riordan, C., Savage, E., Drennan, J., O'Tuathaigh, C., O'Connor, M., Corrigan, M., Burke, F., Hayes, M., Lynch, H., Sahm, L., Heffernan, E., Blake, C., Horgan, F., & Hegarty, J. (2019). Evidence-based practice education for healthcare professions: An expert view. *BMJ Evidence-Based Medicine, 24*(3), 103–108. https://doi.org/10.1136/BMJEBM-2018-111019

Mabidi, N. (2024). A systematic review of the transformative impact of the digital revolution on higher education in South Africa. *South African Journal of Higher Education, 38*(3), 97–113. https://doi.org/10.20853/38-3-6366

Mastour, H., Yousefi, R., & Niroumand, S. (2025). Exploring the acceptance of e-learning in health professions education in Iran based on the technology acceptance model (TAM). *Scientific Reports, 15*(1), 1–14. https://doi.org/10.1038/s41598-025-90742-5

Mugo, D., Njagi, K., Chemwei, B., & Motanya, J. O. (2017). The technolgy acceptance model (TAM) and its application to the utilization of mobile learning technologies. *British Journal of Mathematics & Computer Science, 20*(4), 1–8. https://doi.org/10.9734/bjmcs/2017/29015

Mukhlis, H., Sari, S. Y., Sholeh, M., Fitriyani, H., Mulyani, N., Rizki, I. A., Sukron, M., & Hamid, A. (2024). Connectivism and digital age education: Insights, challenges, and future directions. *Kasetsart Journal of Social Sciences, 45*(3), 803–814. https://doi.org/10.34044/j.kjss.2024.45.3.11

Mwansa, G., Ngandu, M. R., & Mkwambi, Z. (2025). Bridging the digital divide: Exploring the challenges and solutions for digital exclusion in rural South Africa. *Discover Global Society, 3*(1). https://doi.org/10.1007/s44282-025-00189-2

Naicker, N., & Munsamy, A. J. (2024). Optometrists' perspectives on speciality programme development in South Africa. *African Vision and Eye Health, 83*(1). https://doi.org/10.4102/AVEH.V83I1.910

Noorbhai, H., & Ojo, T. A. (2023). mHealth and e-learning in health sciences curricula: A South African study of health sciences staff perspectives on utilisation, constraints and future possibilities. *BMC Medical Education, 23*(1), 1–18. https://doi.org/10.1186/s12909-023-04132-4

Palmowski, J., & Angouri, J. (2025). A paradigm shift in European transnational collaboration? European university alliances as communities of practice. *Globalisation, Societies and Education*, 1–19. https://doi.org/10.1080/14767724.2025.2524479

Prosen, M., & Ličen, S. (2025). Evaluating the digital transformation in health sciences education: A thematic analysis of higher education teachers' perspectives. *BMC Medical Education, 25*(1). https://doi.org/10.1186/s12909-025-07420-3

Razali, F. M., Aziz, N. A. A., Rasli, R. M., Zulkefly, N. F., & Salim, S. A. (2019). Using convergent parallel design mixed method to assess the usage of multi-touch hand gestures towards fine motor skills among pre-school children. International Journal of Academic Research in Business and Social Sciences, 9(14), 153–166. https://doi.org/10.6007/ijarbss/v9-i14/7023

Republic of South Africa. (2013). *Protection of Personal Information Act 4 of 2013*. Government Gazette.

Sahu, P. K., Nayak, S., Sharan, S., Narasimhan, K., Chandran, D. S., & Bhattacharjee, A. (2022). Best practices for effective implementation of online teaching and learning in medical and health professions education: During COVID-19 and beyond. *AIMS Public Health, 9*(2), 278–292. https://doi.org/10.3934/publichealth.2022019

Sattar, K., Hashmi, A. M., Qureshi, M. A., Khan, S. A., Ali, F., Ahmed, Z., & Rehman, S. U. (2024). Digital learning of clinical skills and its impact on medical students' academic performance: A systematic review. BMC Medical Education, 24(1), 1477. https://doi.org/10.1186/s12909-024-06471-2

Santosa, I. W. E. (2025). Adapting to the new frontier: The transformative role of academics in shaping higher education. Acitya: Journal of Teaching and Education, 7(1), 164–178. https://doi.org/10.30650/ajte.v7i1.3985

Sheng, A., Chubbs-Payne, A., Horner, E., Issa, M., Leung, F.-H., & Malek, M. (2024). Using POV wearable technology as a tool in virtual teaching sessions to supplement clinical skills training: A medical student perspective. University of Ottawa Journal of Medicine, 14(1). https://doi.org/10.18192/uojm.v14i1.6483

Taylor, D. C. M., & Hamdy, H. (2013). Adult learning theories: Implications for learning and teaching in medical education: AMEE Guide No. 83. *Medical Teacher, 35*(11). https://doi.org/10.3109/0142159X.2013.828153

Thomas, A., McDonald, P., & Lape, J. (2022). Student self-efficacy levels for performing clinical skills learned virtually during a pandemic. Journal of Occupational Therapy Education, 6(3), 9. https://doi.org/10.26681/jote.2022.060309

Van Vugt, S. J. H., & Gallagher, S. E. (2026). Staff development in higher education interinstitutional collaborations: An exploratory literature review. *Innovations in Education and Teaching International, 63*(1), 270–287. https://doi.org/10.1080/14703297.2025.2461159

World Health Organization. (2013). *Transforming and scaling up health professionals' education and training*. https://apps.who.int/iris/handle/10665/93635 [verify URL]

Yilmaz, Y., Bhatt, M., Sherbino, J., Chan, T. M., & Mondoux, S. (2020). Technology-enhanced faculty development: Future trends and possibilities for health sciences education. *Medical Science Educator, 30*(4), 1787–1796. https://doi.org/10.1007/s40670-020-01100-1

Zhang, Y., Li, X., Wang, J., Chen, H., Liu, Q., Zhao, Y., & Sun, M. (2025). Comparison of face-to-face teaching and online teaching in neurosurgery education for medical students. BMC Medical Education, 25(1), 1–9. https://doi.org/10.1186/S12909-025-06817-4