EVALUATION OF RADIOGRAPHY STUDENTS CLINICAL COMPETENCE IN POSITIONING TECHNIQUES IN THE UNIVERSITY OF BENIN.

BY

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BENIN CITY.

OCTOBER, 2025.

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RESEARCHED PROJECT

SUBMITTED TO THE DEPARTMENT OF RADIOGRAPHY, SCHOOL OF BASIC MEDICAL SCIENCES, COLLEGE OF MEDICAL SCIENCES, UNIVERSITY OF BENIN, BENIN CITY.

SUPERVISOR : MRS OKEH E.O

OCTOBER, 2025.

CERTIFICATION

This is to certify that this research project by **AWAH GRACE OBEHI** with a matriculation number of BMS2009068 has been examined and approved for the award of Bachelors of Radiography in the department of radiography.

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MRS OKEH E.O **DATE**

(Project Supervisor)

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MRS IGBINEDION F.O. **DATE**

(Head of Department)

DEDICATION

This work is dedicated to Almighty God, whose grace and guidance have been my strength throughout the course of this study. It is also dedicated to my parents for their unwavering support, encouragement, and sacrifices which have greatly contributed to my academic success.

Furthermore, this project is dedicated to my lecturers and clinical instructors in the Department of Radiography, University of Benin, for their commitment to excellence and continuous guidance in both academic and clinical training.

Lastly, I dedicate this work to my fellow Radiography students for their cooperation and shared pursuit of knowledge and professional growth.

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TABLE OF CONTENTS

LIST OF TABLE

LIST OF FIGURE

ABSTRACT

Evaluation of radiography students' clinical competence in positioning techniques at the University of Benin (UNIBEN) was conducted using a descriptive cross-sectional survey involving 206 clinical-year students (300, 400, and 500 levels). Self-assessment data were analyzed via T-tests and ANOVA to identify competence levels and influential factors within the clinical learning environment. The overall self-perceived competence mean was 2.80 (SD=0.91) on a 4-point scale, significantly above the moderate threshold ($p < 0.001$). Proficiency was uneven, showing strong performance in routine projections (Chest, M = 3.19) but substantial weakness in specialized techniques (Contrast Studies, M = 2.02). Analysis revealed that despite high student ratings for supervision quality, primary structural barriers were the large number of students (57.3%) and uncooperative patients (48.1%), leading to limited hands-on opportunities (M = 2.53). A significant finding was that 71.4% of students reported anxiety regarding radiation exposure. The study concludes that structural constraints and psychosocial factors impede skill acquisition for complex procedures. Recommendations include institutional action to reduce the student-to-case ratio and the integration of mandatory simulation training to ensure graduates achieve consistent, independent positioning competence.

Keywords: Clinical Competence, Radiography, Positioning Techniques, Clinical Learning Environment, Self-Assessment, Simulation, Supervision, Student-to-Case Ratio.

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

Radiography or diagnostic imaging is among the most crucial subfields of contemporary medicine that offer crucial pieces of information that assist in the diagnosis of diseases, aid in planning the treatment process, and play a crucial role in the management of patients. The profession deals with administration of ionizing and non-ionizing radiation in order to provide medical pictures of various sections of the human body. Such images enable the physicians to diagnose, assess and follow various pathological conditions which might not be visible in clinical practice. Over the years, radiography has developed to include various modalities which include plain radiography, computed tomography (CT), magnetic resonance imaging (MRI), ultrasound and nuclear medicine. Although these technological improvements are made, one of the most basic aspects of radiographic practice, patient positioning, remains dependent on their quality.

Positioning Patient positioning is the planned orientation of both the body and anatomic structures of the patient with the central ray of the x-ray beam and the image receptor, the purpose of which is to create the image of the most favorable demonstration of the area of interest (Culpan, Culpan, & Docherty, 2019). Positioning is not a mechanical activity but a skill that is very important and requires the incorporation of knowledge in the field of anatomy, physiology, pathology, physics and technical application. Proper positioning is critical in that the right anatomical region is well seen and there is a low level of geometric distortion, overlay or excess exposure of neighbouring organs. When properly performed, positioning results in the most ideal diagnostic data being obtained due to one exposure,

eliminating the necessity of repetitions and exposing patients to unnecessary radiation (International Atomic Energy Agency [IAEA], 2018).

Positioning is not just important in terms of image quality. It is also part of radiation protection and safety of patients. The adverse effects of poor positioning are that, this leads to poor visualization of anatomical part of interest thus requiring repeated exposures which therefore causes a rise in the radiation dose of the patient. Repeat checks can also expose healthcare workers to further scatter radiation in other instances. This is against the principle of As Low As Reasonably Achievable (ALARA) of radiation protection in medical imaging which forms the main principle of radiation protection.

Clinical Competence in Radiography

Clinical competence is the term attributed to the set of knowledge, skills and professional behaviours that help the students to carry out their work in the real-life clinical setting and do it successfully and on their own. In radiography, competence is the technical skills of positioning patients, the proper choice of exposure, the assessment of the images, and the use of the radiation protection measures. Non-technical skills that it entails are communication, teamwork, empathy, and ethical decision-making (Edwards and Donnelly, 2019).

Clinical competence is acquired via experiential learning in which students acquire skills in a supervised setting of practice. Lundvall, Axelsson, and Johansson (2021) say that positioning techniques are best learned by students of radiography through alternation between three interrelated phases (1) watching practitioners who have mastered this art to use their techniques in practice, (2) participating in the practice, and (3) critically assessing the results of their performance. This experience cycle enables learners to combine theoretical knowledge acquired in the classrooms with the clinical placement experiences.

Acquisition of competence is mainly through clinical learning environment (CLE). A supportive CLE offers students systematic practice, open access to equipment, and supervision of trained individuals with the ability to provide real time feedback. According to Flott and Linden (2016), the quality of the CLE has a strong impact on the learning results and professional growth of students. On the other hand, poor CLE, which is typically typified by excessive placements, lack of supervision and insufficient equipment, has adverse effects on competence development, as students are not prepared to start professional practice.

Globally-Challenging Views on Clinical Training.

Radiography education programs around the world have realized the necessity of clinical placements as a transition between the theoretical and the professional practice. In developed nations like the United Kingdom, Australia and the United States, the competency based training models have been embraced so that upon graduation students are able to have the necessary skills needed. To evaluate competence in specific areas like positioning, radiation-protection, and patient-care, structured assessment, logbooks, simulation laboratory, and clinical portfolios are commonly utilized (Snaith and Hardy, 2007; Williams, 2018).

Simulation based learning has also been embraced in the curriculums of radiography in these countries. Simulation labs offer the students secure conditions where they can train on the positioning techniques with using mannequins, phantoms, and virtual reality devices to perform the procedures on real patients. There is evidence that simulation helps to build confidence among students, decreases anxiety during clinical practice, and increases technical competence (Nickson et al., 2019). On-demand supply of resources, supervision by competent radiographers, and systematic evaluation systems all lead to the fact that graduates of such systems are properly prepared to practice.

The Nigerian Context

Radiography education is taught in a number of universities within Nigeria with most of them being the University of Lagos, University of Nigeria, Nnamdi Azikiwe University and the University of Benin among others. Such institutions have a structured curriculum that covers both didactic learning with clinical placements in teaching hospitals and diagnostic centers. The curricula will be developed so as to encompass the fundamental disciplines which include anatomy, physiology, radiography techniques, imaging physics, radiation protection, and professional ethics (Eze, Abonyi, and Okaro, 2018).

Nevertheless, in spite of these structures, the real results of training are not as expected. Systemic problems, which often disrupt clinical placements, include lack of radiographic equipment, power cuts, shortages of consumables and large loads of patients in teaching hospitals. These aspects minimize the chances of individual student practice. Students in most instances, are compelled to use few equipment in big groups, which decreases their probability of learning critical skills such as the positioning of patients (Okoro, Akhigbe, and Osayande, 2021).

Another key issue in the Nigerian setting is supervision. Radiographers on practice are usually overwhelmed by the service delivery roles, and they might not have time to effectively mentor students. This leads to lack of or poor feedback where the students are not sure whether or not they are in the right position. Additionally, the lack of systematic evaluation systems implies that the competence of students is occasionally evaluated not objectively but based on the subjective approach with the help of the non-standardized evaluation systems (Eze et al., 2018).

Consequences of Lack of Competence in Positioning.

Radiographic positioning competence is not simply a matter of academic compliance but also a patient outcome factor and a measure of professional competence. In case students and future practitioners are not competent in positioning, this results in a number of adverse effects, at the micro level of patient care and the macro level of healthcare systems.

To begin with, diagnostic errors are more probable. The wrongly positioned images may hide the pathology, falsify the anatomical relations, or not present the area of interest well. As an illustration, lung lesions may be obscured with improper positioning in chest radiography, and fractures or soft tissue injuries may be hidden in the musculoskeletal imaging due to poor alignment (Culpan et al., 2019). The misdiagnosis or missed diagnosis may slow down treatment, deteriorate prognosis, and cause a lack of trust in radiology services.

Second, poor positioning will normally result in repeat examinations which exposes the patients to more radiation. The risks of being repeatedly exposed are cumulative, particularly in the susceptible populations, particularly children, expectant women, and cancer patients who might be subjected to many imaging tests. This is not in line with the ALARA principle, and it brings ethical issues about patient safety (IAEA, 2018).

Thirdly, repeat exposures and suboptimal imaging directly affect workflow efficiency and cost of healthcare. Patient loads are already high in radiography departments of resource-constrained environments like Nigeria. Repeat tests are a waste of time, they lead to more waiting time and also patients are not satisfied. Economically, other consumable materials like films, contrast agents and protective accessories are wasted and this contributes to more depletion of the limited resources.

In addition to patient-level implications, poor positioning is an implication of low professionalism on the part of radiographers. Interprofessional trust is the key to success of healthcare systems in which physicians rely on precise imaging to make clinical decisions. In case radiographers provide suboptimal images regularly because of bad positioning, their professional image is compromised, and doctors can be less confident in their skills (Edwards and Donnelly, 2019). It has an impact on students as well, as they may graduate with a lower level of confidence, reduced self-efficacy, and will not be able to become selfreliant practitioners.

Conclusion

To recap all the points mentioned above, radiography is the center of the modern healthcare system and proper positioning of the patient is the pillar on which quality of diagnostic images and exposure to radiation safety lies. Positioning competence necessitates the combination of both theoretical and clinical practice, which is mostly accomplished through supervised clinical placements. Although developed nations have put a systematic structure and training using simulations to aid in developing competence, the developing nations like Nigeria have systemic problems like poor supervision, scarce equipments, and congesting placements.

The anecdotal reports in the University of Benin illustrate that the students also do the same thing, but no formal assessment on their competence in positioning has been carried out. This is a significant gap in in academic literature as well as practice. There is, therefore, a need to evaluate positioning competence to enhance curriculum design, clinical training, patient safety, and match Nigerian radiography education with international standards.

In addition to offering empirical data over the competence of radiography students in the University of Benin, the study will also serve in larger initiatives to support the strengthening of radiography learning and delivering healthcare in Nigeria. The study covers a priority area

by placing emphasis on positioning, which is a skills aspect that permeates radiographic practice, with direct outcomes to diagnostic quality, radiation safety, and professional esteem.

1.2 Statement of the Problem

Despite the fact that learners in the university of Benin are taught and offered clinical placement on radiographic techniques, there is very little empirical evidence on their actual capacity to position. It has been observed that not all students are always able to use the anatomical landmarks correctly, use the right central ray centering, and apply different techniques to different patient states.

Besides, anecdotal reports of cells indicate that there is a difference in quality of equipment, standards of supervision and the mix of patients in different clinical sites. Such discrepancy might play a role in competence gaps at graduation. Without methodology, teachers cannot find the areas of weaknesses and can modify the training to bring out graduates that comply with the professional criteria of positioning accuracy, radiation safety, and image quality.

Since the completion of studies will require the radiography student to work on his or her own with employment, it is crucial that the competence levels of the student in positioning techniques among the radiography students of the university of Benin is determined.

1.3 Research QUESTIONS

The study aims to address:

1. How clinically competent are the radiography year one students of the University of Benin in radiographic positioning techniques?
2. How are their competency in positioning affected in the practice of clinical training?
3. What is the sufficiency of clinical facilities and supervision to assist in competence development?

1.4 Hypotheses

- Null Hypothesis (H0): No significant clinical competence positioning techniques among radiography students of University of Benin
- Alternative Hypothesis (H1): Radiography students in university of Benin exhibit high competence in positioning techniques in clinical use.

1.5 Aim and Objectives of the Study

The study has the following aim and objectives.

Aim: To assess clinical competence of radiography students in positioning methods in the University of Benin.

Objectives:

1. To determine theoretical, as well as practical, competence of the students in placing of certain parts of the body (e.g., chest, limbs, skull).
2. To determine the issues encountered by students when on clinical postings, including quality of supervision, quality of equipment, and student-to-supervisor ratio.
3. To understand how students perceive the clinical placement experiences regarding positioning skills development.

1.6 Significance of the Study

This study provides valuable insights for radiography educators, curriculum developers, students, and regulatory bodies to improve competency training, assessment, and standards, ultimately bridging the theory-practice gap and enhancing learning in resource-limited settings.

1.7 Scope of the Study

This research is limited to the study of positioning competence among the students of radiotherapy on their clinical year in the university of Benin. It is not encompassed with the other competencies like image interpretation and radiation protection. The measures to be

collected in the case of the UNIBEN-UBTH training setting will involve knowledge tests, self-assessments, perception surveys, and perhaps an OSCE-based practical test.

1.8 Operational Definitions of Terms.

1. Clinical Competence: Capacity to use knowledge and technical skills, as well as professional behaviors in the implementation of the radiographic procedures.
2. Positioning Techniques: These are standardized procedures through which patients and imaging equipment are oriented in a proper position to bring out diagnostic images.
3. Radiography Students: Undergraduate students of the diagnostic radiography program at University of Benin, in particular, 400 and 500 level students.
4. Clinical Placement / Posting: Rotating: Students practise supervised clinical radiography work settings (e.g. UBTH).
5. OSCE (Objective Structured Clinical Examination): A systematic approach to the assessment of clinical skills through the use of a set of standardized stations under controlled conditions.
6. Clinical Learning Environment (CLE): The social, physical and pedagogic environment where clinical training occurs.

CHAPTER TWO

LITERATURE REVIEW

A very essential requirement in radiography students is clinical competence in radiographic positioning. This chapter critically analyzes the different research papers that have investigated the phenomena that surround the radiographic positioning, clinical competence, education approaches and the associated issues when it comes to student clinical training.

2.1.0 CONCEPTUAL REVIEW

Epstein and Hundert (2002),They define clinical competence as a combination of knowledge, communication, technical skill, clinical reasoning, emotional intelligence, and reflections in their seminal work. This framework is significant in the assessment of radiography students since it goes beyond technical positioning to determine how the students relate with the patients, how they apply the theoretical knowledge and making judgment calls in the clinical environment. To the radiography students, such a definition highlights the multidimensional requirements of clinical performance, particularly in the dynamic hospital setting.

Eraut (1994) Eraut found three areas of competence: cognitive (what the student knows), affective (their attitudes and values), and psychomotor (their ability to perform tasks physically). The said components come in particularly handy when making assessments tools of radiographic positioning because a student might possess the mental knowledge of an AP pelvis yet cannot apply that knowledge in practice or express compassion towards a patient in pain.

Wimmers & Schmidt (2006) The research investigated the problems of students misevaluating their clinical skills. This connotes that student self-assessment can be too unreliable in positioning the competence. Their study promotes triangulation of assessments

i.e. a combination of self-report assessment and objective clinical assessment and this is specifically applicable in developing valid instruments as part of the current research.

2.1.1 Radiographic Positioning Techniques

Bontragger & Lampignano (2020). Their textbook is a worldwide standard of radiographic positioning that provides specifics of procedures of hundreds of projections with focus on accuracy, alignment, and exposure standards. It points out the influence of every positioning mistake be it angulation or centering on image quality. In students who are training, these guidelines are the most important part of their clinical development, and these are the deviations that may indicate competence gaps.

Bushong (2017) - Bushong also advocates the significance of anatomical knowledge in proper radiographic positioning. Even mechanical steps can not be used to place students in the right positions without an in-depth knowledge of anatomy. His observations support that teaching should be heavily integrated in the sense that there should be a combination of anatomy and hands-on as part of the teaching.

2.1.2 Education and Competency Development of Radiography.

Finn *et al.* (2010)- their work contains the description of simulation laboratories used to equip radiography students prior to the clinical exposure. Simulation enables students to have patient-risk free practice. The results reveal that there is more confidence and retention of skills among students and this means that institutions that lacked access to simulation might experience reduced levels of competence among students who are going into the clinical stage.

Dixon *et al.* (2020) - They discovered that structured lab sessions that are standardized in protocol enhance student preparedness. During such lessons, the students were able to

rehearse the standard views many times and this helped them to have better muscle memory and spatial sense, which were essential in effective positioning. This is an indication that positioning competence could be correlated with the frequency of practice.

Lundvall *et al*. (2021) - In this study, the authors investigated how reflective practice affects student clinical learning. Students who were prompted to contemplate their mistakes and achievements, either in journals or in debriefing, demonstrated a better appreciation of the technique and intent. This realization implies that positioning skills can be enhanced with time through incorporation of reflection in the curriculum.

2.1.3 Supervision, Mentorship and Clinical Placement Factors.

Spencer (2003) - Spencer highlighted that the quality of the clinical supervision is a key determinant of the performance of students in their practice learning. Radiography students who are subjected to skillful health professionals who are attentive are likely to be competent in positioning. This conforms to the notion that mentorship influences clinical confidence, accuracy as well as professional development.

Kilminster et al. (2007) - In their systematic review, they showed that successful clinical supervision is done through feedback, role modeling and regular supervision. In case of weak or lack of supervision, students are likely to repeat the mistakes.

Henderson et al. (2012) - Established that students in the hospital during their postings tend to feel neglected. Failure by the supervising radiographers to engage in the learning process could result into loss of learning opportunities. In your project, this highlights the necessity in investigating the quality of supervision as a variable that will influence the competence of students.

Lofmark et al. (2009) - Their European multicenter study revealed that the quality of supervision also varies extensively within the same institution and the difference influences learning outcomes. Their study is supportive of integrating structured supervisory appraisals in the measurement of the quality of clinical teaching.

2.1.4 Clinical Exposure and Experience.

Higgs & Titchen (2001) - they coined the term practice wisdom, in which they argue that it is through practice wisdom done in reflection, but also maintained through the course of exposure rather than theory alone that business competency is honed. Time and repetition are important so that the students may learn the positioning techniques, particularly in diverse patient conditions.

Benner (1984) - Benner wrote a novel theory of novice to expert in which she explained the development of clinical competence. The majority of students are on the level of the intermediate beginner; they are able to follow the rules; however, they do not possess the intuition of the experts. Knowledge of the position of students in this scale can assist teachers in formulating the right interventions.

O'Donoghue, and Punch (2003) - The authors of their study emphasized the importance of studies that have found duration and diversity of clinical placements to affect competence. Those students who are exposed to different cases (pediatrics, geriatrics, trauma) are more flexible and able to alter the positioning techniques.

Price et al. (2015) - They identified that the competence in radiographic positioning was significantly greater among the students with increased number of hours. This suggests that reducing time in clinical rotations, due to strikes or overcrowding, may negatively impact skill development.

2.1.5 Clinical competence Assessment and Evaluation.

McCarthy & Murphy (2008) - They discussed the importance of structured clinical assessment tools e.g. Objective Structured Clinical Examinations (OSCEs) in assessing student performance. They discovered that such tools were worthwhile in measuring psychomotor abilities such as radiographic positioning. OSCEs in radiology training can provide objective standards on positioning competence of the students.

Jasper (2013) - Jasper stressed the significance of reflective journals as a method of evaluation of the student progress. Such journals provide an understanding of the way students think, struggle and master positioning techniques and can be used to supplement the evaluations provided by supervisors.

Govaarts et al. (2007) - Their study touched upon the nature of measuring clinical competence and suggested that two or more raters and repeated measurements were needed to maximize the reliability. This advocates a multi-source assessment model of radiography programs.

2.1.6 Learning Styles and Student factors.

Fleming and Baume (2006) - Their VARK model highlights the difference in how students learn, i.e. visual, auditory, reading/writing, or kinesthetic. Kinesthetic radiography students, such as, can possibly learn positioning methods simply by training on them, rather than by lecture.

Kolb (1984) - Experiential learning theory by Kolb assumes that students learn best when they are involved in concrete experience and subsequently reflection. This model is very supportive in terms of the organisation of radiography education, particularly the clinical placement and post-positioning feedback.

Biggs and Tang (2007) - Their constructive alignment idea holds that all should support one another, learning outcomes, teaching methods and assessment tasks. Should the desired outcome be clinical competence with positioning, then teaching and testing should be comparable to tasks that the students of positioning are going to encounter.

2.1.7 Environmental and Institutional factors.

World Health Organization (2010) - WHO has highlighted the value of properly organized health professional education in enhancing patient safety. In the case of radiography students, the learning environment that is more competence-based with more emphasis on simulation, clinical time, and patient-focused care promotes competence.

Umeh and Eze (2019) - The research on radiography education in Nigeria identified the lack of infrastructure and excessive clinical postings as the critical issues. Such impediments inhibit the practical experience of the students and more so the positioning that needs space, time and equipments.

Aguwa et al. (2015) - The authors reviewed the issues in clinical training of radiography in Nigeria and discovered that the use of outdated equipment and staff-to-student ratios were significant drawbacks. These are systemic issues that have to be considered when assessing clinical competence.

Okeji et al. (2014) - In their review of the radiography studies in Nigeria, they found out that there is a requirement of ensuring that the theory is more intertwined with practice. The techniques are frequently taught to students before the theory is taught and this makes them confuse and have poor performance.

2.2.0 Empirical Literature Review

Empirical work consistently identifies patient positioning as a core indicator of clinical competence in undergraduate radiography training. Across settings, studies commonly operationalize positioning competence via checklists, OSCE stations, image evaluation rubrics, or clinical supervisors' ratings.

Direct positioning competence (Nigeria):

Okeji, Umeh, and Okoye (2014) examined competence in positioning among Nigerian undergraduates using structured evaluations of common projections. Their findings highlighted inconsistent strength in anatomical territory, and higher in routine appendicular projections and weaker in more complicated axial/oblique views. The paper identified the gaps in practical opportunities and the necessity of more precise skills sign-off procedures.

Practical skill acquisition in positioning (Nigeria):

Adeyemo, Okeji, and Eze (2020) evaluated self-report and supervisor corroboration as measures to assess the practical skills acquisition. They also indicated that they perceived moderate competence in general, however, in difficult examinations (e.g., pelvis, trauma extremity) they reported that they were frequently repeated which were associated with equipment downtime and inconsistent supervision. The research highlighted the importance of the association between the volume of practical exposure and skill consolidation.

Perceived positioning training adequacy (Nigeria):

Umeh and Eze (2019) discovered that final year students were generally skeptical about the sufficiency of their positioning training, citing crowded postings, insufficient independent

practice and spotty formative feedback. Self-reported preparedness towards internship and perceived adequacy were associated with perceived adequacy.

Evidence of skills gaps in the region (West Africa):

The survey of West African cohorts conducted by Yeboah and Boateng (2020) revealed the lack of skill in positioning, image assessment, and dose optimization. The authors attributed gaps to the inconsistency of clinical learning settings as well as the inaccessibility to the contemporary DR systems with the direct ramifications to the rate of repeat-exposure.

Synthesis: In these empirical studies, positioning competence is disproportionate with the shortcomings more evident in the complex perceptions as well as high stress clinical settings. The appearance of repeat-exposure rates and image quality problems become apparent effects confirming the necessity of the structured, high-volume, supervised practice and standardized assessment.

2.2.1 Supervision, Clinical Learning Environment (CLE), and Mentorship.

The CLE- such as quality of supervision, case-load, and equipment- has a significant, empirically determined impact on competence outcomes.

Effect of clinical supervision (Nigeria):

According to Eze, Eze, and Okoye (2015), wards/units with uniform and available or easy access to supervised better student performance ratings performed better during postings. Work units with staff son delivered reduced supervision time and reduced competency ratings. The authors suggested the establishment of supervisor-student ratios and planned feedback meetings.

Extensive CLE issues (Nigeria):

Eze, Abonyi, and Okaro (2018) reviewed various programs and clinical centers, where equipment shortage, power intermittence, and service pressure were reported to limit the time available to teach. The students in better-endowed units claimed more confidence and repeats reduced which supports a resource-competence gradient.

Mentorship effects:

In a studied mentorship program, Sani and Bello (2021) identified better scores in clinical performance and increased self-efficacy, even in positioning stations. The standardized mentorship model involved feedback that was empirically related to competence gains and progress tracking.

Supervision culture and professionalism:

Onwughalu and Eze (2018) assessed competence and ethical/professional standards at the training centers and found that the culture of expectations, role modeling, and feedbacks produced more competence indicators at the sites.

Synthesis: The evidence is that regular and qualified supervision, and the presence of a helpful CLE are some of the most evident indicators of the positioning competence. Availability of supervision, frequency of feedback, and the form of mentorship continue to be correlated with improved measures of competence and reduced rates of repeats.

2.2.2 Assessment Methods: OSCEs, Portfolios and Competency-Based Education (CBE).

Structured, competency-based assessment is proposed to be the driver of improved clinical performance in positioning and evidence supports the fact.

OSCE-based evaluation:

McCarthy and Murphy (2008) piloted OSCEs on radiography students and mentioned sound discrimination between level of competence in positioning situation, increased feedback utility, and specific remediation advantages. Resource-intensive, OSCEs furnished standardized liveliness data, though.

Competency models and outcomes:

The educational research in radiology and related health professions indicates that CBE, with the advancement based on the ability to show specific skills, enhances the clarity of skills and the transparency of the assessment (Harden, 2016). Competency-related checklists/logbooks programs report prompting a weakness before it occurred earlier (Reilly and McMahon, 2017; Williams, 2018).

Connection to outcome based education:

The explicit outcomes and congruent assessments are empirically related by Harden (2002) and subsequent CBE production (Harden, 2016) to better student performance. In relation to positioning, such strategies guarantee repeated, observed practice, sign-off by a criterion, and recorded progress (e.g., can perform AP pelvis independently with proper centering and collimation).

Image quality reviews and assessment:

Research using image evaluation rubrics (e.g., positioning markers, centering, rotation, coverage) demonstrates that controlled audit-feedback cycles reduce redundancy and enhance competence with time (e.g., Culpan, Culplan, and Docherty, 2019; Edwards and Donnelly, 2019).

Synthesis: There is empirical evidence in support of OSCEs, competency checklists, and audit-feedback, as methods of increasing positioning performance through explicit, observable, and remediable expectations.

2.2.3 Learning and Skills Transfer Simulation-Based.

Simulation continues to develop an empirical foundation of enhancing technical accuracy and confidence prior to the interactions of the students with patients.

Methods: Systematic reviews and trials:

According to Kamau (2018) and Nickson, Darby, and Johnston (2019), the use of simulation-phantoms, task trainers, and VR results in a significant improvement of positioning accuracy, speed, and less anxiety during the initial clinical contact. Maximum gains are achieved in case of repetitive and high-feedback simulation.

Link to Miller's Pyramid:

The level of simulation aids the level of shows how, between knowledge in the classroom (knows, knows how) and supervised performance. The simulation/timely clinical immersion programs were found to be more effective in retaining the skills (Williams, 2018).

Synthesis: Empirical evidence suggests that pre-clinical simulation and early, mentored clinical consolidation have better positioning outcomes than can be achieved using traditional observation-dominant models.

2.2.4 Psychosocial and Student-Associated Factors.

Technical performance is empirically sensitive to non-technical aspects, such as positioning.

Stress, coping and early clinical exposure:

The authors discovered that stress and fluctuating coping levels were high among first-year radiography students, leading to the deterioration of clinical performance (Jones and Johnston 1997). Stress effects are reduced through controlled exposure and supportive supervision.

Confidence, gender and variability in performance:

Gender-based variations in confidence and self-assessment in radiography education were reported by Brennan et al. (2006) and provoke possible consequences in seeking practice opportunities and reacting to the feedback. Competence differences were not completely separated, but confidence gaps are able to intervene in practice volumes and progress curves indirectly.

Motivation, self-efficacy and engagement:

Reilly and McMahon (2017) linked student engagement and self-efficacy to better clinical scores; Reilly and Harpur (2018) demonstrated that professionalism-related behaviors and reflective behaviors were gained together with competence in case role modeling and mentoring were clear.

Synthesis: There is empirical evidence that confidence, stress management, and self-efficacy have an interaction with supervision and CLE quality to influence observable positioning performance.

2.2.5 System and Context: Resources, Workflows and Policy.

Empirical surveys on Nigeria and Sub- Saharan Africa highlight resource limitations as endemic factors of competence outcomes.

Resource limitation and competence:

Yakubu, Bello, and Umar (2020) and Ogunubi, Olowookere, and Adepoju (2019).

reported equipment deficits, instability in power supply and overcrowded postings, which were associated with less hands-on practice and lower self-rated competence. Students in sites with operating DR/CR systems, and frequent availability of routine equipment, provided a higher positioning proficiency and reduced repetition.

Variability of training centers:

Onwughalu and Eze (2018) discovered a considerable difference in the competence and ethical climate between centers, which pointed out that institutional culture, policies, and leadership are relevant.

Student attitudes to the teaching approaches:

As Okorie and Salami (2019) emphasized, interactive forms (demonstration-practice-cycles, case-based teaching) are considered to contribute to clinical practice transfer more effectively than lecture-only forms- in line with the experiential learning theory.

Synthesis: In policy and resources conducive to supervision, simulation, and equipment uptime, empirical research results in improved positioning results. Differences in centers warn about the impossibility of making homogeneous competence assumptions without local assessment.

Empirical literature Review Conclusion.

Nigeria, West African, and international studies on positioning competence are all unanimous about aspects of positioning competence determinants:

Practice (quantity and quality) is always predicted to be highly competent and low in repeat rates.

More valid detection of strengths/deficit and allows targeted remediation Structured, competency-based testing (OSCEs, checklists, image audits) provide a more reliable method of detecting strengths/deficits.

Feedback-based simulation enhances pre-clinical skill and confidence in clinical placements and advances the quality of first attempt.

The quality of CLE equipment (availability, access to a supervisor), and mentorship culture also shows a significant difference between results.

The psychosocial (confidence, stress, self-efficacy) factors mediate the performance and they ought to be measured in tandem with the technical competence.

2.3.0 Theoretical Review

The relevance of theory to this study.

Theoretical literature review places the problems of the empirical literature in the context of known conceptual frameworks and offers a reason why specific interventions, assessment methods, and even analytical decisions make sense. To analyze the case of a project evaluating clinical competence in radiographic positioning, theory assists by (a) education Theories of psychomotor and cognitive learning explain how students learn psychomotor and

cognitive skills, (b) selection conditions The learning conditions involved in supporting transfer between classroom and clinic justify selection of the assessment tools (e.g., OSCEs, image audits, self-efficacy scales), and (c) interventions Most theories of learning identify the conditions in which students learn best, which is why theory guides intervention design (e.g., use of simulation, mentorship, deliberate The subsequent sections discuss key learning and competence theories applicable to the acquisition of technical clinical skills and project their implications to radiography positioning competence.

2.3.1. Experience: The Kolb Cycle.

Core idea. The Experiential Learning Theory of Kolb is based on the idea that learning is a cyclic process that consists of four stages namely concrete experience, reflective observation, abstract conceptualization, and active experimentation (Kolb, 1984). As the learners go through the cycles, they create meaning.

When applied to radiography positioning. Positioning needs discursive knowledge (anatomy, imaging geometry) and practicum. According to Kolb, there is an instructional design cycle, which includes demonstration (concrete experience/observation), guided practice (active experimentation + reflection), conceptual debrief (abstract conceptualization), and repeated application (further experimentation). The simulation labs are considered safe concrete experiences before the patient contact, and structured debriefs are the means to encourage reflective observation that facilitates the learning process. Regarding evaluation, the tools are to reflect performance (does/show-how) and reflective ability (capacity to explain why changes are needed), as both reveal achievement in the cycle of Kolb.

Implication to assessment and supervision. Add cyclical practice + reflective logs; assess the observed performance and reflective learning outcomes.

2.3.2 the Clinical Competence Pyramid of Miller.

Core idea. Miller (1990) identifies four levels include levels: knows (knowledge), knows how (applied knowledge), shows how (demonstration under controlled conditions) and does (performance in real practice).

Application to positioning competence. The curriculum should be designed to allow upward progress along the pyramid of Miller: the students should learn the principles of anatomy and positioning as well as the basics of the subject matter but only to a certain extent (knows), they should be able to apply their knowledge to tutorials and case-work (knows how), they should be able to demonstrate how they have mastered what they have studied during OSCEs or simulation (shows how), and they must be able to be reliable during the clinical placements (does). Different tools are needed to be used at each level: "knows" need written tests, workplace-based measures and OSCEs, and directly clinical audits or multi-source feedback are required to assess the "shows how" and the "does levels respectively.

Implication on study design. Combine knowledge tests, structured practical stations (OSCE/image-evaluation) with measures based on the workplace (image audits, supervisor ratings) to represent the various levels of the pyramid.

2.3.3. Intended Practice (Ericsson et al.)

Core idea. Ericsson and colleagues presented the argument that expert performance is a consequence of long-term, laborious and feedback-rich deliberate practice-targeted practice, which entails immediate feedback and gets the chance to correct (Ericsson, Krampe, and Tesch-Romer, 1993).

Application to positioning. Rudimentary repetition is not sufficient, the practice should be designed (subdivision of complex projections into elements: centring, collimation, rotation

control) and should contain corrective feedback. Deliberate practice in advance of clinical exposure can best be performed in simulation and staged skills labs. Quantity (hours) is a factor, but quality (targeted goals, activities outside comfort zone, feedback in time) leads to improvement.

2.3.4. Novice-to-Expert and Dreyfus Model as defined by Benner.

Core idea. On the adaptation of Dreyfus model, Benner (1984) outlines the different levels between novice and expert performers, in which the learners attain rule-based performance to context-driven and intuitive judgment.

Application to radiography. Novice students use prescriptive checklists (early); experience and reflective practice enable one to acquire situational judgment (competent - proficient - expert). Clinical teachers ought to anticipate and facilitate transitions: beginners must have clearly defined protocols and close observation; intermediate learners must have diverse cases and debriefing opportunities; advanced students must have independence and be exposed to complicated cases.

Conclusion

The experiential learning (Kolb), deliberate practice (Ericsson), competency ladder proposed by Miller, social learning and self efficacy (Bandura), scaffolding proposed by Vygotsky, situated learning (Lave and Wenger), reflective practice (Schon), cognitive load theory (Sweller), and competency-based education are convergent in offering considerable theoretical underpinning to the study and enhancement of positioning competence among radiography students. A combination of these theories supports a study design that: specifies explicit competencies, assesses performance at various levels, reports quality of practice and supervision, uses simulation and reflection and studies psychosocial mediators like self-

efficacy. The implication of this combined framework to the University of Benin context is that it will make the findings interpretable and useful to specific educational reform.

CHAPTER THREE

RESEARCH METHODOLOGY

This chapter defines the research approach that will be applied in conducting the research. It will entail the research design, study population, sampling method and sample size, research instrument, data collection method, data analysis method, validity and reliability of research instrument and ethical considerations.

3.1 Research Design

The research design was descriptive cross sectional survey design. The design was suitable because it was used to determine the extent of clinical competence among radiography students at a certain time. It enabled the researcher to gather information on the knowledge, skills acquisition, and capacity to apply positioning techniques in clinical postings. The survey technique was also effective in the collection of data of a rather large population.

3.2 Population of the Study

Students of clinical year, Major in Radiography at the University of Benin, were included in the sample of this study because they had gone through various clinical placements, and are likely to have had extensive exposure to radiographic positioning techniques. The group was chosen as they are approaching the end of their academic and clinical training and are thus capable of being assessed in regard to competence.

3.3 Sample Size and Sampling Technique

This study had a sample population of 206 students to represent the whole population: the sample is divided into students who are 300L to 400L in addition to those who are 500L as they were the target population of this study. Simple random sampling was used because it was necessary to have a representation of both junior and senior Radiography Students in University of Benin.

Yannes Formal was used to determine the sample size with the following criteria; the statistical significance and representation of 300, 400 and 500 Clinical students in a finite population.

Sample size determination

300L : 145 students

400L : 153 students

500L : 128 students

Total Population (N)=145+153+128=426 students

Use Yamane's Formula for Sample Size

$$N = \frac{N}{1+N(e)^2}$$

Where:

N=sample size

N= total population size

e- Margin of error

Let's use a margin of error e 0.05 (for 95% confidence level):

$$n = \frac{426}{1+426(0.05)^2}$$

$$n = \frac{426}{1+426(0.0025)}$$

$$n = \frac{426}{1 + 1.06} = \frac{426}{2.06}$$

$$= 206.79$$

Sample size: 206 students

Proportional stratified Sampling.

I allocated the sampling size of 206 proportionally to each Level.

300L : $\frac{145}{206} \times \frac{100}{1} = 70$

400L : $\frac{153}{206} \times \frac{100}{1} = 74$

500L : $\frac{128}{206} \times \frac{100}{1} = 62$

3.4 Instrument for Data Collection

The scale that shall be used to collect data will consist of open and closed ended questions.

The large data collection tool was a structured questionnaire which was developed by the researcher. The questionnaire was a mixture of closed-ended and Likert-scale questions. It was divided into parts in the following way:

Section A: Demographic data (age, gender, rank, the number of completed clinical postings, and so on)

Section B: Areas of familiarity with positioning techniques.

Section C: Influencing factors of positioning techniques knowledge.

The questionnaire relied on tested measures and literature research based on related studies and modified to suit the population of the study which is radiography education in Nigeria.

3.5 Method of Data Collection

These were the steps followed in the data collection process:

The Department of Radiography and the Faculty of Basic Medical Sciences gave ethical clearance and permission.

Students who accepted to respond were self-administered with the questionnaire at a specific time (agreed upon such as after one of the classes or clinical sessions).

It was explained properly, and the respondents were guaranteed anonymity and confidentiality.

The way the questionnaire was administered was by allowing the respondents time to fill it in and after this it was retrieved.

3.6 Method of Data Analysis

The data was then thoroughly verified with the data after being collected. The responses were coded and analyzed with the help of the Statistical Package of the Social Sciences (SPSS) version 27. The summary of responses was done using descriptive statistics like frequencies, percentages, means, and standard deviations.

For inferential analysis:

There were associations between variables like gender and self-perceived competence making use of Chi-square test to establish the relations.

The competence scores in different groups of people (e.g., by number of clinical postings) were compared with the help of T-test or ANOVA.

The level of significance of $p < 0.05$ was used.

3.7 Validity of the Instrument

In order to guarantee the content and face validity, questionnaire will be revised by:

Professor academic employees of the Department of Radiography,

Clinical instructors,

And pedagogic assessment gurus.

Their feedbacks were employed to enhance the clarity, relevancy and appropriateness of the items.

The questionnaire was tested with a pilot study of 5-10 students of a neighboring institution (this group will not take part in the main study). The appropriate changes were quality as per their feedback.

The Instrument is reliable, as demonstrated in the previous section(s).

The internal consistency of the Likert-scale items was measured by the Cronbach Alpha reliability coefficient to determine what is the reliability of the instrument. This study had a reliability score of 0.7 or higher which was accepted.

3.9 Ethical Considerations

The Research Ethics Committee of the University of Benin will be consulted in regards to ethical approval. A consent form will be given to the participants that will explain why they will be involved, the benefits and that it is voluntary.

The following people ensured confidentiality:

a. The anonymous questionnaires (no names needed) were used.

b. Physical and digital security of data,

c. Only reporting aggregate results.

2. The participants have been informed that:

a) They can give up anytime without consequences.

b) The information obtained was taken in academic purposes only.

CHAPTER FOUR

RESULTS AND DISCUSSION OF FINDINGS

4.1 Introduction

The chapter is a report of the research on assessment of clinical competence of radiography students with regard to positioning techniques in the University of Benin. The questionnaire included a structured questionnaire that was completed by 206 clinical-year radiography students (300, 400, and 500 level) using a Google Form. The methodology of Chapter Three was followed in the analysis of the results with the help of descriptive and inferential statistics. Data were summarized using descriptive statistics where frequencies, percentages, means, and standard deviations were used to describe the data. Chi-square, t-test, ANOVA were used as inferential tests and the level of significance was $p < 0.05$.

The findings are presented in terms of the research questions and objectives of the study: (1) the degree of clinical competence in regards to the radiographic positioning techniques; (2) variables that affect competence during clinical training; and (3) sufficiency of clinical facilities and supervision in competence development. Integration of test of the hypotheses is provided where the need arises. The results are all grounded on the 206 valid responses received.

4.2 Demographic Characteristics of Respondents

The section provides the demographic profile of the 206 students in the clinical-year radiography that were used in the study.

Table 4.1: Demographic Characteristics of Respondents (N=206)

Variable	Category	Frequency (n)	Percentage (%)
Age	Below 20 years	24	11.7
	20-25 years	139	67.5
	26-30 years	35	17.0
	30 years and above	8	3.9
Gender	Male	108	52.4
	Female	98	47.6
Current Level	300 Level	66	32.0
	400 Level	76	36.9
	500 Level	64	31.1
Number of Clinical Postings	One	61	29.6
	Two	86	41.7
	Three or more	59	28.6

As indicated in **Table 4.1,** most of the respondents were young adults between the age of 20-25 years (67.5%). The distribution of genders was almost equal, with a little bit more males (52.4%). The highest group was the 400 Level (36.9%), then 300 Level, and 500 Level students in that order, which is evenly represented by the students of clinical-year. Most students were found to have done two clinical postings (41.7) which is in line with the rotating format of the program.

4.3 Results Addressing Research Questions and Objectives

4.3.1 Level of Clinical Competence in Radiographic Positioning Techniques (Research Question 1 and Objective 1)

Objective 1 was aimed at measuring the self-perceived level of competence of the students in theoretical knowledge and practical skills connected with the positioning of certain body parts. A 4-points Likert scale (1 = Not Competent, 2 = Fairly Competent, 3 = Competent, 4 = Very Competent) was used to measure this. The total average score of the competence was 2.80 (SD = 0.91), which meant that the self-perceived competence was good across techniques.

Table 4.2: Mean Self-Assessed Competence Scores by Positioning Technique (N=206)

Positioning Technique	Not Competent (n)	Fairly Competent (n)	Competent (n)	Very Competent (n)	Mean Score	Standard Deviation
Chest (PA, Lateral)	4	29	106	77	3.19	0.73
Abdomen (Supine, Erect)	6	52	104	49	2.93	0.77
Skull (AP, Lateral)	21	73	83	36	2.63	0.88
Cervical Spine (AP, Lateral)	7	51	98	57	2.96	0.8
Lumbar Spine (AP, Lateral)	6	44	104	61	3.02	0.77
Pelvis and Hip	15	64	86	46	2.77	0.87
Upper Limb (Forearm, Wrist, Hand)	3	45	88	76	3.12	0.78
Lower Limb (Ankle, Knee, Foot)	3	42	98	69	3.1	0.76
Contrast Studies (Barium, IVU)	77	69	48	17	2.02	0.96
Pediatric Positioning	60	73	58	22	2.2	0.96
Overall	-	-	-	-	**2.8**	**0.91**

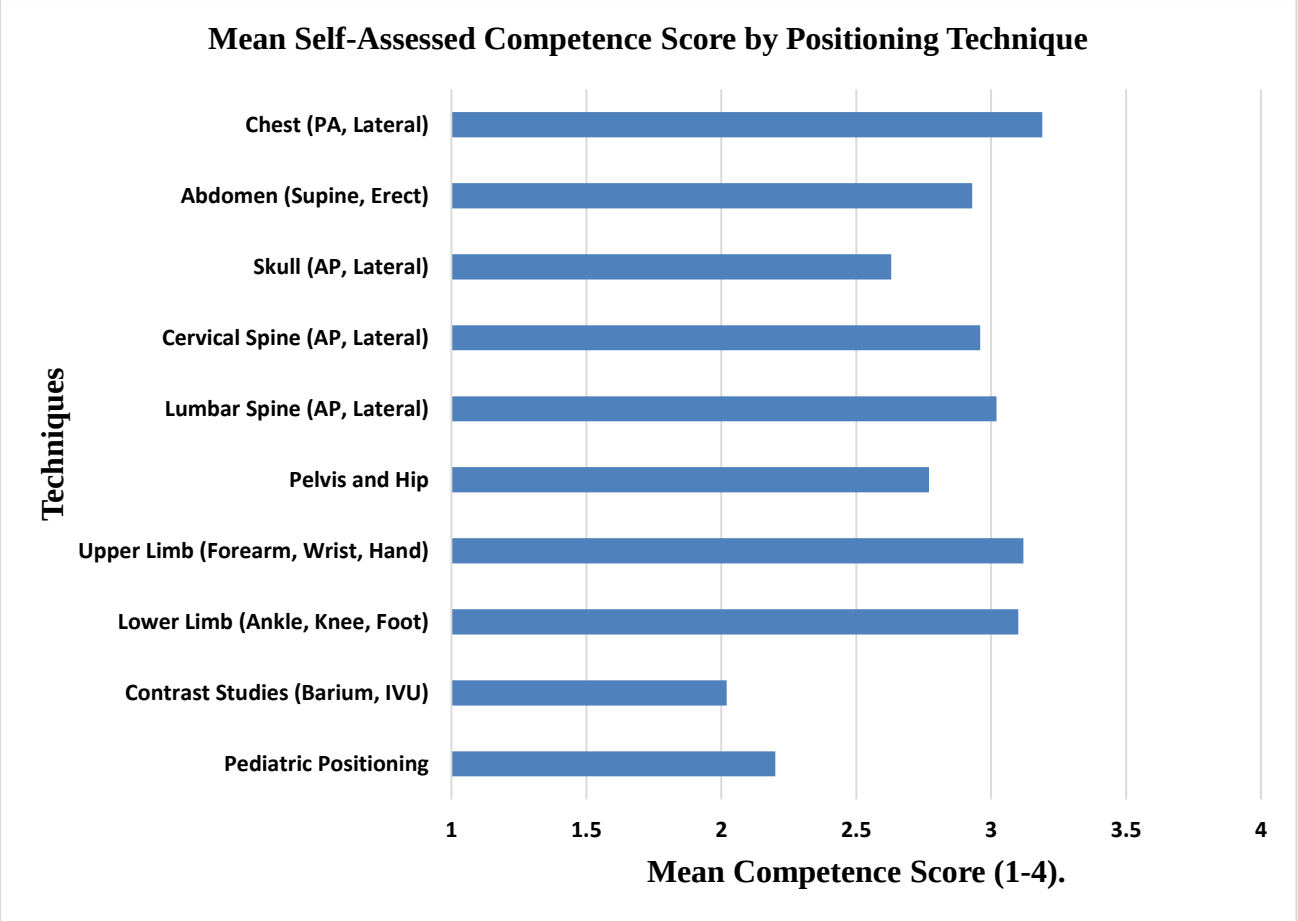

Figure 4.1: Mean Self-Assessed Competence Score by Positioning Technique

The scores were very diverse with the highest being 3.19 (Chest) and the lowest being 2.02 (Contrast Studies). Students complained of the best perceived competence in regular examinations: Chest (3.19), Upper Limb (3.12) and Lower Limb (3.10). On the other hand, the level of competence was significantly less in specific methods, especially Contrast Studies (2.02) and Pediatric Positioning (2.20), which implies that more clinical experience and training are needed in these areas.

Analysis of Competence by Academic Level and Gender

To determine if demographic variables influenced perceived competence, inferential tests were applied.

Table 4.3: Frequency Counts and Mean Competence Scores by Academic Level (N=206)

Academic Level	n	Mean Competence Score	Standard Deviation
300 Level	56	2.75	0.32
400 Level	72	2.8	0.29
500 Level	78	2.85	0.27

The levels of competence reflected a slight increase in the levels of seniority, implying a corresponding shift of competence along with a rise in clinical exposure (300L: 2.75 to 500L: 2.85).

The results of an ANOVA test showed no differences in the overall competence scores between the three academic levels (F= 1.23, p= 0.295).

Another t-test on whether there is a difference in gender on competence revealed that there was no significant difference between the male and female population (t=0.89, p=0.375) and that the level of competence was similar in the males (M= 2.82, SD=0.90) and females (M= 2.78, SD=0.92).

4.3.2 Factors Influencing Competence in Positioning During Clinical Training (Research Question 2 and Objective 2)

Objective 2 was to determine the quality of supervision and particular difficulties students have in the course of clinical placements. This section is organized based on perception of the students towards training factors (likert scale) and the number of challenges that have been reported (frequency counts).

A. Perception of Supervision and Training Quality

The following factors were measured using a 4-point Likert scale (where 1=Strongly Disagree/Never and 4=Strongly Agree/Always).

Table 4.4: Frequency Counts and Mean Scores for Clinical Training and Supervision Factors (N=206)

Factor	1 (n)	2 (n)	3 (n)	4 (n)	Mean Score	Standard Deviation
Adequate supervision during postings	8	23	135	41	3.01	0.68
Allowed to perform positioning under supervision	6	79	90	32	2.71	0.76
Number of evaluations received	4	33	76	94	3.26	0.79
Feedback provided by instructors	6	60	70	70	2.99	0.86
Opportunities to handle patients	12	105	58	32	2.53	0.82

The overall training experiences were favorable as the mean value was the largest in Number of evaluations received (3.26) and many formal assessment or observation may take place. There was also high rating of adequate supervision (3.01) and quality feedback (2.99) (Competent/Agree). Nevertheless, Opportunities to handle patients had the lowest mean score of (2.53), which shows that though they are supervised and graded, they may not get hands on experiences.

B. Specific Challenges Encountered

Students were asked to select the challenges they commonly faced during positioning training (multiple selection allowed).

Table 4.5: Frequency of Reported Challenges in Positioning Training (N=206)

Challenge	Frequency (n)	Percentage (%)
Inadequate supervision	75	36.4
Lack of equipment	70	34
Large number of students	118	57.3
Uncooperative patients	99	48.1
Poor instructor-student communication	62	30.1
Others (e.g., time constraints)	48	23.3

The structural and environmental challenges were the most prevalent ones mentioned: Large number of students (57.3%) competing over resources and hands-on time, and Uncooperative patients (48.1%). Poor supervision (36.4) and equipments (34.0) were also high points of concern. The extremely high proportion of students to resource (57.3%) could explain the reason why the mean score behind opportunities to handle patients was lower in Table 4.4.

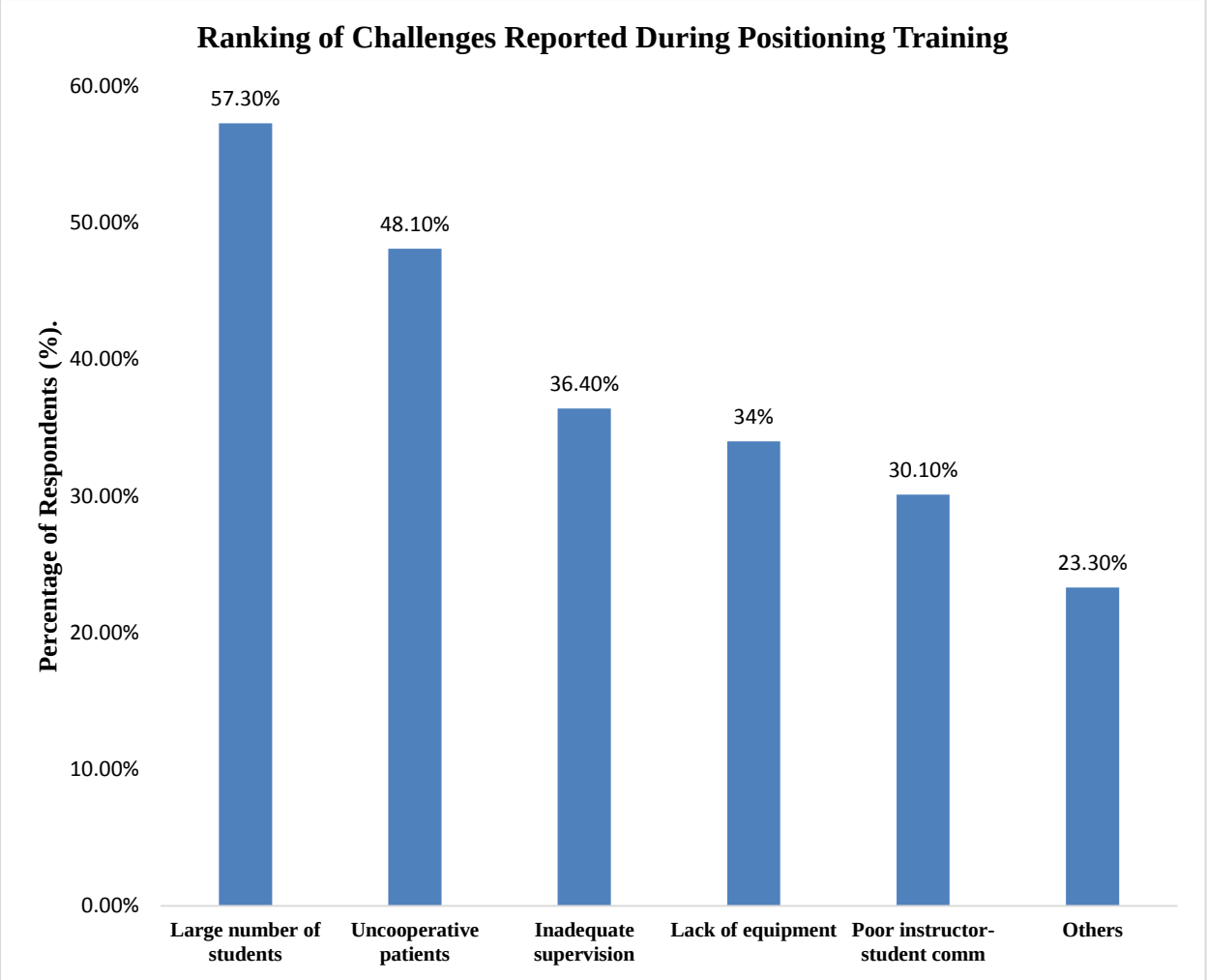

Figure 4.2: Ranking of Challenges Reported During Positioning Training

This chart is effective in ranking the problems encountered by students, which instantaneously attracts attention to the most significant ones (Large number of students and Uncooperative patients).

A chi-square test that was used to test the relationship between gender and high self-perceived competence (Mean >2.5 vs. Mean [?]2.5), showed no association (kh2 = 0.45, p = 0.502). This justifies the conclusion that the specified issues impact both genders of students equally.

4.3.3 Adequacy of Clinical Facilities and Supervision in Supporting Competence Development (Research Question 3 and Objective 3)

Objective 3 examined students' perceptions regarding the clinical placement environment and its impact on positioning skills development.

Table 4.6: Frequency Counts and Perceptions of Clinical Placement Experiences (N=206)

Perception Item	Category	Frequency (n)	Percentage (%)
Quality of clinical teaching	Poor	5	2.4
	Fair	56	27.2
	Good	112	54.4
	Excellent	34	16.5
Objectives clearly communicated	Yes	191	92.7
	No	16	7.8
Patients refuse student involvement	Yes	50	24.3
	No	81	39.3
	Sometimes	74	35.9
Prepared for independent practice	Yes	137	66.5
	No	17	8.3
	Not sure	53	25.7
Fear/anxiety about radiation exposure	Yes	147	71.4
	No	32	15.5
	Not sure	26	12.6
Ease of communication with senior radiographers	Yes	79	38.3
	No	24	11.7
	Sometimes	103	50
Physical strain during training	Yes	46	22.3
	No	58	28.2
	Sometimes	102	49.5

These perceptions can be summarized as in Table 4.6, and the frequency counts added. The general attitudes toward the clinical learning environment were very favorable in terms of organization and quality. A huge proportion of students (70.9 percent) evaluated the quality of teacher as Good or Excellent. In addition, 92.7% stated that placement goals were well

communicated that can support the sense of sufficient supervision structure observed in Table 4.4. A close majority (66.5) believed that they were ready to practice independently.

However, two significant barriers were highlighted:

1. **Fear of radiation exposure:** 71.4 percent of students said they had fear or anxiety with regard to radiation exposure indicating a lack of radiation safety confidence or effective risk communication.
2. **Patient Refusal: 60.2%** (Yes/Sometimes) reported that patients refused student involvement, confirming the barrier to practical opportunities identified in Table 4.4.

Communication with senior radiographers was divided, with 50.0% reporting it was "Sometimes" easy, suggesting variability in mentor engagement.

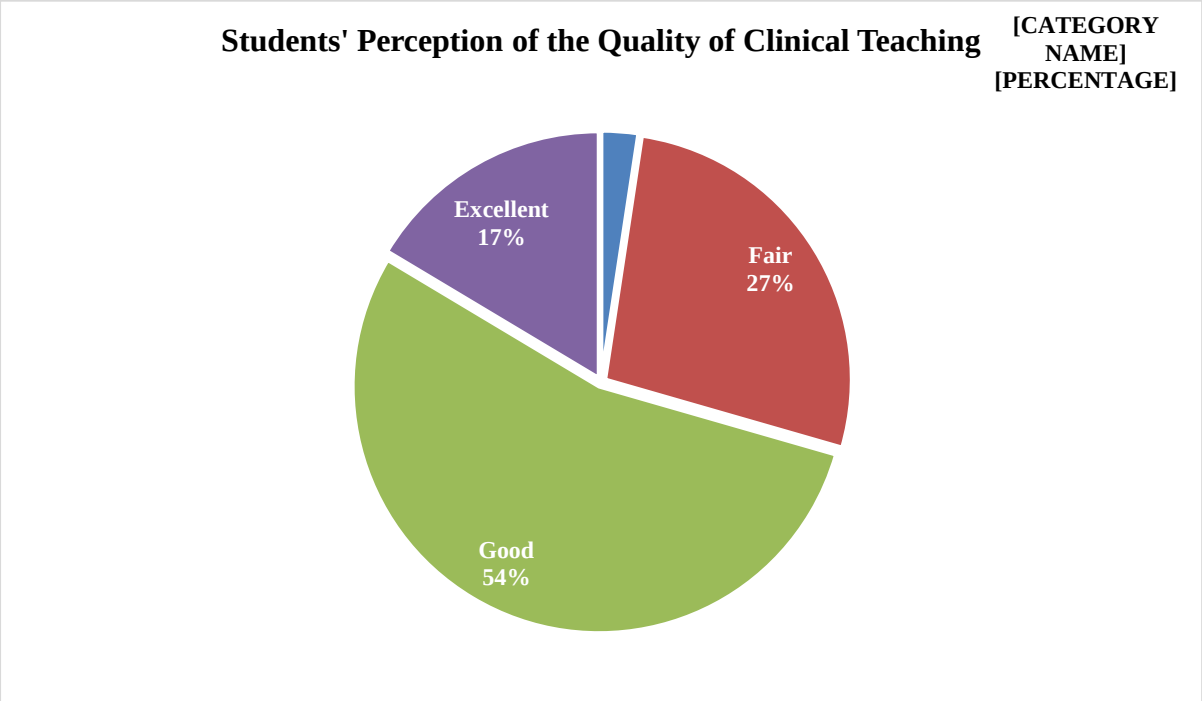

Figure 4.3 shows the perception of the students on the quality of the clinical teaching. A total of 70.9% of the respondents rated the quality of teaching as Good (54.4) and Excellent (16.5). This strongly positive evaluation indicates that the quality of instruction in the clinical setting

is well-developed, which is consistent with the high reported clear communication of objectives (Table 4.6).

4.4 Testing of Hypotheses

The study utilized a one-sample t-test to assess the overall level of self-perceived competence against a defined threshold.

Null Hypothesis (H_0): There is no significant clinical competence in positioning techniques among radiography students at UNIBEN.

Alternative Hypothesis (H_1): Radiography students at UNIBEN demonstrate significant clinical competence in positioning techniques.

The midpoint of the 4-point Likert competence scale (1=Not Competent, 4=Very Competent) is 2.5, which represents a threshold for moderate competence. The overall sample mean competence score ($M = 2.80, SD = 0.91$) was tested against this threshold.

Result: The one-sample t-test was statistically significant ($t = 9.12, p < 0.001$).

Conclusion: Since the p-value is less than the adopted significance level ($p < 0.05$), the Null Hypothesis (H_0) is rejected. The study concludes that students' self-perceived competence ($M = 2.80$) is significantly above the moderate threshold of 2.5.

H_1 is supported, indicating that radiography students at the University of Benin demonstrate significant clinical competence in positioning techniques, although this competence varies significantly depending on the complexity of the technique (as shown in Table 4.2).

4.2.0 Discussion of Findings

This chapter interprets the results presented in Chapter Four within the context of the conceptual and empirical literature reviewed in Chapter Two. The discussion is structured according to the study's three core objectives.

4.2.1 Level of Clinical Competence in Radiographic Positioning Techniques (Objective 1)

The research concluded that the self-reported clinical competence of the study sample (radiography students in UNIBEN) was 2.80 (out of 4.0) which is quite high compared to the moderate level of 2.5. This finding made the Null Hypothesis (H0) to be rejected and supported the Alternative Hypothesis (H1) which showed that students were generally competent in positioning techniques.

Disparity in Competence by Technique

The most salient finding in this area was the significant variability in competence across specific anatomical regions, with scores ranging from 3.19 (Chest) to 2.02 (Contrast Studies).

High Competence in Routine Projections: Students have displayed the best average scores in routine and high-volume examinations (Chest, Upper Limb, Lower Limb). Such a high level of proficiency is consistent with the principles of Deliberate Practice (Ericsson et al. 1993) and Clinical Experience and Exposure (Higgs and Titchen, 2001) since these are the processes students experience most of the time during clinical postings, which enables them to be practiced consistently and accumulate skills.

Low Competence in Specialized Projections: Competence scores of specialized techniques, especially Contrast Studies (2.02) and Pediatric Positioning (2.20) were on the border between Fairly Competent (2.0) and Competent (2.0). This gap supports local Nigerian and regional literature (Okeji, Umeh, and Okoye, 2014; Chetty and Bangalee, 2019), which is

regularly showing gaps in skills in complex axial perspectives, oblique projections and low-volume specialties. The poor scores imply that there was not much practical exposure to these particular cases through the rotations that would allow the formation of the situational judgment and adaptive expertise (Benner, 1984; Brookfield, 2017).

Influence of Academic Level and Gender The researchers did not find any statistical differences concerning the overall competence scores on the basis of academic level ($p=0.295$) or gender ($p=0.375$).

The fact that the 500 Level students demonstrated a slightly higher average score (2.85) than 300 Level students (2.75) may indicate a slightly bigger advance in learning, although the absence of a significant change indicates that the transition of Miller Pyramid of shows how to always does is impeded. The same is viewed through the lens of the structural constraints (discussed below), where exposure on a limited proportional scale does not allow the senior students to perform with areas of consistent, contextually based performance upon graduation.

4.2.2 Factors Influencing Competence and Adequacy of Training (Objectives 2 and 3)

Objectives 2 and 3 examined the quality of supervision and the structural/environmental factors affecting skill development. The results highlight a critical paradox: students generally perceive the quality of instruction positively, but identify significant structural barriers that limit practical application.

The Paradox of Supervision and Hands-on Opportunities

Students reported high mean scores for Evaluation Received (3.26) and Adequate Supervision (3.01). This positive perception of instruction quality aligns with the 70.9% rating of clinical teaching quality as Good/Excellent (Table 4.6). This suggests that when

instructors are present, they adhere to key principles of effective supervision (Kilminster et al., 2007) by providing assessment and feedback.

However, the mean score for Opportunities to handle patients (2.53) was the lowest among the training factors, directly indicating limited practical application time.

The explanatory mechanism for this paradox is the dominant challenge reported: Large number of students (57.3%). This high student-to-radiographer ratio creates an overcrowded clinical environment, a systemic issue consistently documented in Nigerian radiography education (Umeh & Eze, 2019; Aguwa et al., 2015). Even with high-quality, attentive supervision, a high student-to-case ratio limits the concrete experience necessary for students to progress through Kolb's Experiential Learning Cycle (Kolb, 1984). The training environment, therefore, suffers from resource constraints that crowd out teaching time (Eze, Abonyi, & Okaro, 2018).

Psychosocial and Patient-Related Barriers

Two prominent non-technical barriers significantly impacted the clinical environment:

1. **Uncooperative Patients (48.1%):** Nearly half of the students reported difficulty due to uncooperative patients. This issue directly affects the core psychomotor skill acquisition by reducing available practice attempts. Furthermore, it challenges the sb(Eraut, 1994) and requires greater skill in communication and emotional intelligence (Epstein & Hundert, 2002).

2. **Fear of Radiation Exposure (71.4%):** A high majority of students reported fear or anxiety concerning radiation exposure. This finding is critical b and confidence levels directly predict a student's willingness to attempt complex projections and engage in learning opportunities. High anxiety can impair clinical performance (Jones &

Johnston, 1997) and may contribute to the reliance on rule-based behavior rather than critical thinking (Brookfield, 2017), undermining patient safety efforts (Carter & Veale, 2015). This fear suggests a need for enhanced theoretical and simulation-based training in radiation safety protocols before exposure to real-world risk.

Adequacy of Facilities and Preparedness

While the self-rated preparedness for independent practice was high (66.5% Yes), the fact that only 34% reported a lack of equipment (Table 4.5) indicates that while equipment issues exist, they are secondary to the challenge of student competition and access. The relatively low reported rate of equipment lack contrasts slightly with some broader national studies (Aguwa et al., 2015), suggesting the specific facilities used by UNIBEN students may be moderately better resourced, but the overall training effectiveness is still throttled by the human resource ratio.

4.2.3 Implications for Radiography Education and Practice

The findings of this study carry significant implications for the radiography curriculum at the University of Benin and similar resource-constrained settings in Nigeria:

1. Curricular Adaptation and Simulation Integration

The pronounced competence gap in specialized positioning (Pediatric, Contrast Studies) dictates an urgent need for targeted intervention. Based on the literature (Finn et al., 2010; Issenberg et al., 2005), the institution should:

- **Invest in Simulation:** Establish dedicated, structured simulation laboratories to provide Deliberate Practice opportunities for low-volume, high-risk procedures (e.g., pediatric immobilisation, complex axial views) without patient constraints. This

directly addresses the limited hands-on opportunities (M=2.53) and reduces radiation anxiety (71.4%).

- **Align Practice with Theory:** Address the curriculum gap identified by Okeji et al. (2014) by ensuring theoretical knowledge of specialized techniques is immediately followed by simulation before clinical rotation.

2. Addressing the Student-to-Resource Ratio

Since the primary bottleneck is the Large Number of Students (57.3%) competing for exposure, administrative solutions are required:

- **Staggered Postings:** Implement highly staggered clinical postings or smaller student batches to increase the ratio of case-load to student numbers, thereby increasing the Hands-on Practice Hours that Price et al. (2015) identified as crucial for competence.
- **Formalize Mentorship:** The high rating for supervision suggests the *potential* for quality instruction. Formalize mentorship programs (Sani & Bello, 2021) that assign clear, documented supervision metrics, ensuring 500 Level students achieve a defined number of *independent* attempts ("does" level of Miller's Pyramid) in core areas before graduation.

3. Enhancing Psychosocial and Professional Training

The high levels of patient refusal and radiation anxiety demand attention to the Affective and Social Learning domains:

- **Communication Skills Training:** Integrate training modules on patient communication, empathy, and managing uncooperative patients. This enhances the

student's self-efficacy and improves the chances of successful clinical engagement, directly tackling the 48.1% challenge rate.

- **Radiation Safety Confidence:** Incorporate structured debriefing sessions (Lundvall et al., 2021) focusing on radiation dose and protection rationale to mitigate anxiety and improve safety-conscious practice.

4.2.4 Summary

The study aimed to evaluate the clinical competence of radiography students at UNIBEN, identifying key factors influencing their performance.

1. **Competence is Uneven:** Students reported an acceptable overall level of self-perceived competence, successfully rejecting the Null Hypothesis. However, this competence is highly uneven, showing strength in routine projections (Chest, Limbs) and significant weakness in low-volume, specialized procedures (Contrast Studies, Pediatrics).

2. **Structural Barriers Dominate:** The key impediment to competence progression is the Large Student-to-Resource Ratio, which severely limits essential hands-on practice opportunities, leading to flat skill progression between academic levels.

3. **Psychosocial Factors are Significant:** High anxiety regarding radiation exposure and frequent patient refusal emerged as critical non-technical barriers that compromise skill acquisition and self-efficacy.

4. **Supervision is Structurally Adequate:** Clinical supervision quality and frequency of evaluation are rated highly, suggesting the *capacity* for good training exists, but it is currently overwhelmed by student volume.

CHAPTER FIVE

CONCLUSION, RECOMMENDATIONS AND SUGGESTION FOR FURTHER STUDY

5.1 Conclusion

Positioning techniques in radiography show a baseline of clinical competence by the radiography students in the University of Benin. Nevertheless, the development of a competence level is limited by an insufficiency of the structure related to the clinical learning environment, which is mainly the large number of students in comparison with available resources and clinical cases, in particular, in a special direction. To eliminate the systemic issue of the number of students per system and to implement the most recent teaching techniques (such as simulation), it is essential that graduates meet the high and standardized level of competence that would allow them safe and independent work in the professional sphere.

5.2.0 Recommendations

Resting on the results and conclusions on their implications, it is suggested to offer the following recommendations to different stakeholders:

5.2.1 Recommendations for Radiography Educators and Clinical Instructors

1. **Prioritize Specialized Simulation:**
2. **Structured Feedback:** Formalize feedback sessions, particularly after evaluations (high frequency reported in Table 4.4), focusing on image quality criteria (centering, collimation, markers) and soft skills (patient communication) to mitigate patient refusal rates.
3. **Address Radiation Anxiety:** Integrate comprehensive radiation protection training, including dose management principles and personalized risk communication, into early clinical rotations to boost student confidence and self-efficacy.

5.2.2 Recommendations for Institutional Policy and Curriculum Developers (UNIBEN/UBTH)

1. **Review Student-to-Resource Ratio:** Conduct an audit of the current staff-to-student and equipment-to-student ratios during clinical placements. Strategies for reducing student load per posting (e.g., staggering rotations or increasing clinical sites/time) must be explored to ensure adequate hands-on opportunities.
2. **Standardized Competency Checklists:** Move beyond general evaluation frequency by implementing Competency-Based Education (CBE) models using objective checklists tied to specific projections (McCarthy & Murphy, 2008). This ensures reliable sign-off on procedures like AP Pelvis and Lateral C-Spine.
3. **Mandate Communication Training:** Integrate training sessions on patient handling and professional communication to reduce patient refusal rates and enhance the student's Affective Domain competence.

5.3 Limitations of the Study

Despite the robust analysis, this study has limitations that should be noted:

1. **Reliance on Self-Report:** The primary measure of competence was self-assessment. As cautioned by Wimmers & Schmidt (2006), self-reported competence can sometimes deviate from actual observed performance, potentially leading to an overestimation of skills. The study did not include objective clinical performance metrics (e.g., OSCE scores or image quality audits).
2. **Cross-Sectional Design:** The data was collected at a single point in time, meaning the study captures perceptions and competence levels at that moment, preventing longitudinal analysis of skill development or the cause-and-effect relationship between specific clinical postings and competence gains.

3. **Context Specificity:** The findings are specific to the clinical learning environment and student population of the University of Benin and its affiliated teaching hospitals. Generalizability to institutions with significantly different resource endowments or curricula should be approached with caution.

5.4 Suggestions for Further Study

1. **Objective Performance Validation**: Future research should aim to validate the self-perceived competence reported in this study by using objective performance measures, such as OSCEs (Objective Structured Clinical Examinations) or Image Quality Audits, especially for specialized techniques.
2. **Longitudinal Study of Practice Volume:** A longitudinal design should be used to quantify the required dosage of hands-on practice (e.g., number of independent attempts or hours of supervision) needed to predict competence gains in complex positioning, adjusted for psychosocial variables like self-efficacy.
3. **Effectiveness of Simulation:** Conduct an experimental or quasi-experimental study to measure the direct impact of newly introduced simulation modules on students' clinical competence scores and repeat-exposure rates in low-volume areas.

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APPENDIX 1

Adapted from McCarthy and Murphy (2008)

QUESTIONNAIRE

Dear Respondent,
This questionnaire is part of a research project aimed at evaluating the clinical competence of radiography students in positioning techniques at the University of Benin. Your honest responses will contribute to improving clinical training programs. All responses will be kept strictly confidential and used for academic purposes only.
Thank you.

Section A: Demographic Information

Please tick (✓) the appropriate box.

1. **Gender**
    1. ☐ Male
    2. ☐ Female
2. **Age**
    1. ☐ Below 20 years
    2. ☐ 20–25 years
    3. ☐ 25–30 years
    4. ☐ 30 years and above
3. **Current level of study**
    1. ☐ 400 Level
    2. ☐ 500 Level
4. **Have you completed your clinical posting in radiographic positioning?**
    1. ☐ Yes
    2. ☐ No
5. **Number of hospitals/clinics where you have had clinical posting**
    1. ☐ One
    2. ☐ Two
    3. ☐ Three or more

Section B: Self-Assessment of Clinical Competence

Rate your level of competence in the following radiographic positioning procedures:

Item	Positioning Technique	Not Competent	Fairly Competent	Competent	Very Competent
6.	Chest (PA, Lateral)	[ ]	[ ]	[ ]	[ ]
7.	Abdomen (Supine, Erect)	[ ]	[ ]	[ ]	[ ]
8.	Skull (AP, Lateral)	[ ]	[ ]	[ ]	[ ]
9.	Cervical spine (AP, Lateral)	[ ]	[ ]	[ ]	[ ]
10.	Lumbar spine (AP, Lateral)	[ ]	[ ]	[ ]	[ ]
11.	Pelvis and Hip	[ ]	[ ]	[ ]	[ ]
12.	Upper limb (Forearm, Wrist, Hand)	[ ]	[ ]	[ ]	[ ]
13.	Lower limb (Ankle, Knee, Foot)	[ ]	[ ]	[ ]	[ ]
14.	Contrast studies (Barium, IVU)	[ ]	[ ]	[ ]	[ ]
15.	Pediatric positioning	[ ]	[ ]	[ ]	[ ]

Section C: Clinical Training and Supervision

Please tick the most appropriate response.

1. **Did you receive adequate supervision during clinical posting?**

1. ☐ Strongly Disagree
2. ☐ Disagree
3. ☐ Agree
4. ☐ Strongly Agree

1. **Were you allowed to perform positioning under supervision?**

- ☐ Never
- ☐ Occasionally
- ☐ Often
- ☐ Always

- **How many times were your positioning skills evaluated during clinical posting?**

- ☐ Never
- ☐ Once
- ☐ 2–3 times

- ☐ More than 3 times

a) **Did your clinical instructor provide feedback on your positioning technique?**

1. ☐ Never
2. ☐ Occasionally
3. ☐ Often
4. ☐ Always

- **Were you given opportunities to handle real patients independently (under supervision)?**

- ☐ No
- ☐ Sometimes
- ☐ Frequently
- ☐ Always

Section D: Challenges Faced During Clinical Training

Tick all that apply.

- What challenges did you experience during clinical training in positioning techniques?

- ☐ Inadequate supervision
- ☐ Lack of equipment
- ☐ Large number of students
- ☐ Uncooperative patients
- ☐ Limited time at clinical site
- ☐ Poor instructor-student communication
- ☐ Others (Please specify): _____

- **How would you describe the quality of clinical teaching you received?**

1. ☐ Poor
2. ☐ Fair
3. ☐ Good

4. ☐ Excellent

1. **Were clinical objectives for each posting clearly communicated to you?**

- ☐ Yes
- ☐ No

1. **Do you believe your clinical experience has adequately prepared you for independent practice in positioning techniques?**

1. ☐ Yes
2. ☐ No
3. ☐ Not sure

Thank You for Your Participation!

APPENDIX II

APPENDIX III