PERCEPTION AND ATTITUDE OF RADIOLOGY/RADIATION ONCOLOGY RESIDENTS TO THE MEDICAL PHYSICS COURSE OF THE NATIONAL POST-GRADUATE MEDICAL COLLEGE OF NIGERIA AND WEST AFRICAN COLLEGE OF SURGEONS

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ABSTRACT

Background: **Medical Physics (MP) is a core requirement for clinical radiology and radiation oncology fellowships of both West African College of Surgeons (WACS) and the National Postgraduate Medical College of Nigeria (NPMCN). Despite its relevance, trainees often report challenges engaging with MP. This study assessed determinants of trainees' perception of MP, categorised and measured the proportion of positive versus negative attitudes, evaluated interest levels, and proposed strategies for improving course delivery.**

Methods: **A structured, self administered questionnaire covering five (5) domains- demographics, attitude, interest, perception of course structure, and suggestions - was developed and distributed via eligible residents in all institutions accredited by WACS, NPMCN, or both. Purposive sampling was used. Data collection spanned four (4) months, yielding eighty-six (86) voluntary responses. Descriptive analysis was performed and results summarised in tables.**

Results: **Only 31.4% of trainees rated current teaching methods as good, while 67.4% rated the course structure poorly. Additionally, 65.1% perceived MP topics as difficult. Despite these concerns, interest remained high: 73.3% (n=63) reported strong interest, whereas 26.7% (n=23) expressed low interest. Attitudinal assessment showed 88.4% (n=76) had a positive attitude, compared with 11.6% (n=10) with a negative attitude. Interest level was unrelated to gender but was associated with prior exposure to MP.**

Conclusion: **Trainees' perception of MP is strongly influenced by teaching quality and course structure. Given the high interest and positive attitudes observed, enhanced course delivery—through comprehensive modules, structured materials, and machine side sessions—may significantly improve learning outcomes.**

Keywords: Medical physics, Radiological physics, Perception, Radiology residents

INTRODUCTION

Medical Physics, (MP) remains the bedrock for understanding diagnostic radiology and radiation oncology, hence a core component in the faculty of radiology training curriculum for both West African College of Surgeons (WACS) and National Post-Graduate Medical College of Nigeria (NPMCN). [1] This is not surprising. Clinical radiology and oncology employ the use of equipment with complex physics in making various diagnoses and treatment of cancer respectively.[2] It is therefore pertinent for a practitioner in the field to be conversant with the principles of physics that govern the operation of the machines, contrast agents, and radiopharmaceutical. A pass in radiological physics (RP) is required before a trainee in the faculty can scale to the higher training level.

However, a trainee often find it challenging to scale through due to a gap between actual and required knowledge in the course.[3] A multiorganisational educational summit on physics education of radiologists held in January 2006 in Atlanta established a growing concern about the inadequacy of physics education of radiologists.[4,5] The summit pointed out inadequate medical physicists and poor curriculum as the culprits. Whereas perception of trainees about the course is equally important to evaluate. What are the determinants of the trainees' perception to the course? This is the question this research aimed to answer. Ultimately, useful recommendations can be made to the trainee, faculty

of radiology in both colleges and medical physics teachers to bring about improvement.

METHODOLOGY

This is a cross-sectional study involving the trainees in the faculty of radiology of both WACS and NPMCN. Included participants were radiodiagnosis (clinical radiology) and radiation oncology (radiotherapy) resident doctors in all the institutions accredited by WACS and NPMCN. Participants were residents not less than six (6) months in training.

A self-administered questionnaire was designed (in English language) covering four (4) domains: Demography, Attitude toward Medical Physics, Level of Interest in Medical Physics, Perception of Course Structure and Delivery, as well as suggestion to improve the course. This was imported into a Google Form which was electronically distributed to residents in all the accredited institution in Nigeria, Ghana and the Gambia. The form was shared mainly via Chief Residents and designated WhatsApp platforms radiology residents share in common.

Purposive sampling technique was employed and a total number of eighty-six (86) residents in the inclusion criteria volunteered to respond over a period of six (6) months from July to December, 2025.

The responses were analysed using SPSS (Statistical Package for the Social Sciences) 27. Five close-ended Likert-scale items were used to obtain responses to 'attitude toward Medical Physics' and "level of interest". The former was scored using a 5-point scale with options from 1 (strongly disagree), 2 (disagree), 3 (neutral), 4 (agree) to 5 (strongly agree). The scores from each item were added and averaged to obtain an attitude score. The attitude scores were classified into both positive and negative attitude based on their aggregates, with higher scores (4 to 5) representing a positive attitude towards Medical Physics and low scores (1 to 3) representing a negative attitude. Likewise, 'level of interest' responses were scored on a 5-point scale, ranging from 1 (not interested at all), 2 (not interested), 3 (neutral), 4 (interested) to 5 (very interested). As in the case of 'attitude', item scores were aggregated by computing the mean score for each respondent. Based on the aggregate scores, respondents were classified into high interest (4 to 5) and low interest (1 to 3). The higher scores reflect greater interest in Medical Physics. Overall, descriptive statistics – frequency tables were utilised to analyse the categorical variables.

RESULTS

A. Socio-demographic characteristics of respondents

Table 1 shows that the demographic profile describes an early-career population of trainees in clinical radiology (radiodiagnosis) and radiation oncology, a large proportion of whom are without prior Medical Physics exposure. There are more radiodiagnosis participants than radiation oncology, and there is slight male preponderance over the female respondents.

B. Attitude toward medical physics

The majority of respondents, 88.4%, had a positive attitude towards Medical Physics, and 11.6% had a negative attitude towards it, see Table 2.

Table 1: Socio-demographic acharacteristics of respondents (N = 86)

Variable	Category	Frequency	Percentage (%)
Gender	Male	48	55.8
	Female	38	44.2
Department	Radiodiagnosis	69	80.2
	Radiation Oncology	17	19.8
Training Category	Pre-Part I	59	68.6
	Post-Part I	27	31.4
Prior Formal Exposure to Medical Physics	Yes	30	34.9
	No	56	65.1
Age Group (years)	25–30	15	17.4
	31–35	28	32.6
	36–40	29	33.7
	41–45	9	10.5
	≥ 46	5	5.8

C. Level of interest in medical physics

Although trainees are keen to learn Medical Physics for clinical competence, fewer are inclined toward long-

Table 2: Aggregate attitude toward medical physics

Attitude category	Frequency	Percentage (%)
Positive attitude	76	88.4
Negative attitude	10	11.6
Total	86	100.0

term academic or teaching careers in the field. The presence of a notable proportion of respondents with low interest suggests certain factors may dampen sustained engagement for some trainees. See Tables 3 and 4.

D. Respondents' perception of course structure and delivery

Table 3: Responses to interest in medical physics items (N = 86)

Interest Item	Low interest (%)	Neutral (%)	High interest (%)
General interest in Medical Physics	4.7	12.8	82.5
Enjoyment of learning Physics concepts	5.9	18.5	75.6
Willingness to attend optional tutorials	3.5	8.2	88.3
Intellectual stimulation	5.8	12.8	81.4
Future teaching/research consideration	29.1	27.9	43.0

Table 4: Level of interest of radiology residents in medical physics

Interest Level	Frequency	Percentage (%)
High interest	63	73.3
Low interest	23	26.7
Total	86	100.0

32.6% of respondents rated the structure as good or excellent, whereas 67.4% rated it as average, poor, or very poor. Concerning teaching methods, 46.5% perceived the methods as inadequate, while 31.4% considered them adequate. With respect to course pace, only 36.0% perceived the pace as appropriate, whereas 31.4% considered it too slow and 16.3% perceived it as too fast. Despite these concerns, most respondents acknowledged the clinical relevance of Medical Physics, with 84.9% agreeing or strongly agreeing that the subject is relevant to future clinical practice. Furthermore, 65.1% of respondents reported difficulty with at least one Medical Physics topic applicable to their department. Overall, 44.2% of respondents demonstrated a positive perception of course structure and delivery, whereas a combined 55.9% reported moderate or negative perception. See Table 5.

E. Qualitative findings from open-ended questions

Challenges in learning medical physics

Thematic analysis revealed major challenges including:

- Abstract and theoretical nature of the subject
- Lack of structured teaching and curriculum

Table 5: Perception of course ctructure and delivery among respondents (N = 86)

Variable	Response category	Frequency	Percentage (%)
Rating of Course Structure	Excellent	8	9.3
	Good	20	23.3
	Average	34	39.5
	Poor	21	24.4
	Very Poor	3	3.5
Adequacy of Teaching Methods	Yes	27	31.4
	No	40	46.5
	Not sure	19	22.1
Perception of Course Pace	Too fast	14	16.3
	Appropriate	31	36.0
	Too slow	27	31.4
	Not applicable	14	16.3
Perceived Clinical Relevance	Strongly agree	29	33.7
	Agree	44	51.2
	Neutral	8	9.3
	Disagree	3	3.5
	Strongly disagree	2	2.3
Perceived Difficulty of Topics	Yes	56	65.1
	No	30	34.9
Aggregate Perception of Course Structure and Delivery	Positive perception	38	44.2
	Moderate perception	36	41.9
	Negative perception	12	14.0

• Shortage of qualified medical physicists and mentors
• Time constraints due to heavy clinical workload
• Difficulty with calculations and poor retention

Difficult topics in medical physics

MRI physics emerged as the most frequently reported difficult topic, followed by CT physics, X-ray production, radiation biology/protection, dosimetry, ultrasonography and nuclear medicine physics. Several respondents reported difficulty across almost all topics.

Suggestions for course improvement

Key recommendations included:
• Structured and standardised teaching curriculum.
• Mandatory involvement of trained medical physicists.
• Increased practical and clinically oriented teaching.
• More tutorials, teaching time, and learning resources.
• Removal of outdated topics and inclusion of modern technologies.
• Early and continuous exposure to Medical Physics during residency.

DISCUSSION

Medical Physics is one of the foundational subjects required of radiodiagnosis and radiotherapy residents in both colleges as its knowledge is tested in both the primary and part 1/membership exams.[6] The perception of this topic among radiology residents is crucial, yet it has been minimally explored, underscoring the importance of this research.

With respect to the gender characteristics, there is no significant gender imbalance among radiology residents in the subregion; although the males slightly outnumbered females (M:F = 1.3:1). This finding, although similar to reported demographics, shows a significant improvement in the previously reported demographic patterns, where males predominated radiology training. A report showed a male-to-female ratio of 2.7:1, reflecting the earlier predominance of male in radiology residency program.[7] However, this gender specifics did not have a significant impact on the study findings, as the objective was to capture the perspectives of all residents irrespective of gender. As in the analytics, a greater proportion of respondents were radiodiagnosis residents, and most responses were obtained from pre–Part 1 residents.

Notably, the majority of participants reported no prior formal exposure to Medical Physics. This suggests that Medical Physics represents a relatively new domain for many residents, emphasising the importance of structured teaching, adequate guidance, and sustained instructional support to facilitate a better understanding of its underlying principles and clinical relevance. This is similar to the findings of Shankar *et al.*[8], in his study where he reported limited prior formal physics exposure among radiology trainees, motivating dedicated teaching efforts to build foundational understanding amongst the residents.

The findings of this study demonstrate that radiology residents recognise Medical Physics as a core component of clinical training, with a direct impact on clinical practice and diagnostic accuracy. There is high motivation among trainees to learn the subject and apply it principles in radiodiagnosis and radiation oncology. This aligns with existing literature, which emphasises Medical Physics as fundamental to safe imaging practices, image optimisation, and radiation protection in radiology training programmes.[8–10] The expressed interest by residents in accessing additional learning resources further reflects the acknowledged role of Medical Physics in enhancing both clinical competence and performance in professional examinations, thus showing positive attitude of residents towards Medical Physics.

The National Postgraduate Medical College and the West African College of Surgeons play a central role in resident training by organising periodic update courses aimed at strengthening clinical competence. Within this framework, the Faculties of Radiology of both colleges jointly conduct an annual Medical Physics update in January, designed to keep residents informed about emerging technologies and advances in the field, while reinforcing fundamental principles relevant to clinical practice. Although this initiative is commendable, findings from this study suggest that residents perceive Medical Physics as intellectually stimulating and engaging, and that more structured and sustained training sessions may further enhance interest, academic engagement, and potential career opportunities in Medical Physics.

In this study, a higher proportion of residents rated the Medical Physics course structure as average or poor, highlighting the need for review and improvement by the relevant professional and regulatory bodies. Course delivery was largely perceived as moderate, a finding attributed to the limited availability of qualified medical physicists and mentors, as well as the absence of a uniformly structured teaching curriculum across training centres. These findings are supported by national data, which indicate that Nigeria has about (forty) 40 medical physicists, with fewer than half properly qualified and practising in healthcare institutions, underscoring workforce and training gaps that may contribute to residents' perceptions of suboptimal course delivery.[11] There is a need for Medical Physics training bodies, including the National Association of Medical Physicists, to expand accredited

training centres and strengthen the education of qualified medical physicists to bridge existing workforce and training gaps.[12] National or regional academic and clinical training programmes have also been identified as essential to increase the number of clinically qualified medical physicists and improve the quality and consistency of Medical Physics services.[13]

Another important finding of this study is residents' perception of medical physics as a challenging component of their training. The subject was commonly described as abstract and highly theoretical, with difficulties arising particularly from complex calculations. Residents reported challenges across most topic areas, with MRI physics perceived as the most difficult. This perception is not unexpected, given the inherent conceptual and mathematical complexity of MRI when compared with other imaging modalities. Additionally, these difficulties may be compounded by infrastructural limitations, as many training centres lack access to fully functional MRI facilities, thereby restricting hands-on exposure and practical reinforcement of theoretical concepts.[7,13]

Finally, teachings in Medical Physics appears suboptimal, representing a persistent challenge in radiodiagnosis and radiotherapy training programme since its inception. This long-standing deficiency may contribute to residents' difficulties in mastering key concepts and performing effectively in both clinical practice and professional examinations. A study by Idowu however reported an improvement in performance of residents recently but a sustained and systematic efforts are needed to consolidate these gains and ensure consistent, high-quality training.[6]

Limitation

A notable limitation of this study is the unavailable population data of residents in the faculty of radiology of both colleges. This, if readily available would have eased the calculation of an actual sample size for the study and completely eliminate distribution bias. However, the eventual total number of respondents was a good representation of the trainees in the faculty, considering the current various population of trainees known per institution across Nigeria and West Africa.

Recommendations

The following recommendations evidenced in the results analysis would be helpful:

1. A look into the Physics profile of a candidate seeking admission into the faculty might be necessary to measure their level of interest in Physics. This way, it is assuring that the candidate should have no problem dealing with the physical science forming the principles to be mastered in radiological and radiation oncology training.

2. Both colleges and trainers should consider making more learning resources available to trainees in the faculty. This could be a review or representation of the existing structure or a complete redesign of modules trainees can effortlessly assimilate and acquire an excellent grasp of the subject.

3. Considering the current demands and the need to equip trainees in both colleges accordingly, it is necessary at this point to incorporate artificial intelligence into the training syllabus, strengthen MRI education and undertone screen-film radiography.

4. There is urgent need to transform the subject from theory to reality. MP has to be represented in relatable format to trainees.[14,15] Medical Physics teachers should have recurrent machine-side sessions where trainees are shown how the principles they have learnt in the classroom really work. This should also be complemented by the clinicians showing trainees the output and application of the subject principles in the image being reported or a procedure being carried out. By this, trainees are able to appreciate the subject as long-term and an everyday application in their career beyond mere passing exams. This could also easily inspire some to consider a future career in it.

5. In the same vein, it is pertinent that examiners in the faculty of radiology in both WACS and NPMCN consider restructuring physics examinations in all formats to reflect practical and essential applicative principles across all imaging modalities evenly. This is needful to strike an agreement between candidates' experience in the classroom and examination hall. Examinations will be contributory and a true test of knowledge if the practical principle taught is the knowledge being required to sit examination successfully.

6. In addition to a more structured and standardised teaching curriculum, there should be mandatory involvement of medical physicists to deliver the training. The heads of radiodiagnosis and radiation oncology should increase their advocacy for the recruitment of more medical physicists. Aside medical physicists domicile in our teaching hospitals. Support could also be sort from those in industries to facilitate teaching sessions. An interinstitutional time-table could also be drawn to facilitate collaborative teaching of the subject. There should also be a continuous institution-based audit of formal teaching sessions of Medical Physics with standardised formal hours. This would help to

keep track of the effort being made to make progress in various institutions of the faculty.

7. Both colleges should endeavour to a keep a live update of the total number of trainees in the faculty and make it readily available on their website. This would help sampling in future research regarding this population.

CONCLUSION

The perception of trainees to Medical Physics course is mainly informed by teaching methods and course structure. In other words, the more investment is put in teaching, the better the perception of trainees about the subject. Good enough, a large proportion of the trainees exhibit positive attitude to, and show high level of interest in the course. Hence, resources poured into revamping the teaching methods will be a step taken in the right direction.

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