Review

Peer Learning in Medical Scientific Research in Nigeria

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ABSTRACT

The economic downturn globally, and particularly in Nigeria, has hindered access to premium healthcare and medications, such as insulin, highlighting the need for local innovation. Historically, Nigeria has established key research institutions like the Nigerian Institute of Medical Research (NIMR) and the National Institute for Pharmaceutical Research and Development (NIPRD), and leveraged partnerships with entities such as the Bill and Melinda Gates Foundation. Innovators like Dr. Abasi Ene-Obong and Temie Giwa-Tubosun have made strides with 54gene and LifeBank, but their works are not global and revenue generating.

Despite these efforts, Nigeria has yet to fully harness its creative potential, necessitating enhanced peer learning for targeted problem-solving. This article seeks to link peer learning in the medical education field, with research, partnership and scientific innovations. Learning theories, including constructivism, social learning theory, and cognitive load theory, underscore the value of collaborative, active, and reflective learning processes. Peer learning facilitates the development of scientific reasoning, critical thinking, and communication skills among medical researchers. Effective peer learning groups are characterised by accountability, motivation, and positive feedback. However, challenges such as diverse learning paces and potential negative competition need addressing.

To improve research capacity, peer groups for research can be formed to focus on areas including funding, resource generation, capacity building, policy enhancement, and public-private partnerships. Institutions should encourage continuous professional development and engage policymakers to advocate for research-supportive policies. By fostering collaborative peer-learning environments and supporting bold research initiatives, Nigeria can cultivate competent and confident medical researchers, advancing local and global healthcare innovation.

Keywords
Peer learning, learning principles, medical research, Nigeria

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INTRODUCTION

The purpose of this paper is to explore the role of peer learning as a strategic tool for advancing medical scientific research in Nigeria, particularly in the face of economic, infrastructural, and systemic challenges. By examining the current state of research in the country, the paper highlights how peer learning can foster critical thinking, collaboration, and innovation among medical researchers. Drawing on relevant learning theories—such as constructivism, social learning, and cognitive load theory—the paper argues that structured peer learning groups can enhance scientific reasoning, improve research capacity, and ultimately contribute to both local and global healthcare advancements. The paper aims to provide practical recommendations for integrating peer learning into medical education and research, addressing key challenges while promoting a culture of continuous professional development and innovation.

Current State of Scientific Research and Innovation in Medicine and Biomedical Sciences in Nigeria- the need to increase innovative research through peer learning

The economic downturn in the world generally and in Nigeria in particular, makes it difficult for many Nigerians to access premium or optimal healthcare and medications for their health.[1] This would mean that patients in need of insulin and many other medications cannot get these. We are thus left with our fate. Why is it impossible for Nigeria and Nigerians to produce something innovative that the world will use? This is not saying that many Universities do not have patents, but most are not in the world's sphere for use, exportation and revenue generation for the nation.[2 - 5]

Nigeria has made significant strides to improve scientific research for innovations in medicine and biomedical sciences. Key among these is establishment of research institutes like The Nigerian Institute of Medical Research (NIMR) and the National Institute for Pharmaceutical Research and Development (NIPRD) or the International Institute for Tropical Agriculture. Universities are established in communities to drive the educational, research capabilities and economic growths of the communities. The universities have agitated and caused government to establish research and developmental grants like Tertiary Education Trust Fund (TETFund),[6 - 8] National Institute for Health (NIH), collaborative and partnership grants, like Bill and Melinda Gates,[9] the Carnegie Foundation,[10] Aliko Dangote Foundation and World Health Organisation.

Nigeria and her scientists have also developed and collaborated with other research institutions to develop vaccines for Lassa fever, malaria research, leading to better diagnostic tools and treatment protocols and drug trials and development. Dr. Abasi Ene-Obong, founded 54gene, a health technology company that focuses on genomics research and development.[11] It aims to address the underrepresentation of African genomic data in global research, thus improving healthcare outcomes. LifeBank, founded by Temie Giwa-Tubosun, is a digital platform that connects blood donors with hospitals in need. It uses technology to track and deliver blood supplies efficiently, saving countless lives. Farmcrowdy is a digital agriculture platform connects small-scale farmers with investors.using technology to help improve farming practices, increase productivity, and provide better access to markets. Flutterwave is a Nigerian fintech company that provides payment solutions to businesses. It has developed a payment infrastructure that connects Africa to the global economy. Paystack, uLesson, Lumos, and ColdHubs are all innovations in Nigeria that have improved the companies' income and gross domestic product but they are yet to break the African and world markets.[12 - 15] Not only are they not globally recognised, new research is yet to be developed from them and authors believe that working on existing templates, more can be developed from the patents.

One way to break into the global market for these innovations and many more to come, is through scientific research for innovations as done in other resource replete economics. Using peer learning for scientific research, these new inventions can be achieved, and we provide some prescriptions by discussing learning theories and how they connect with research groups and collaborations.

Learning and the brain

For learning to occur, pathways in the brain need to be created and strengthened so that after a while, one becomes a master. For mastery to be achieved, functional pathways must be created. When learning a new skill, or knowledge, there are several uncoordinated synapses, with a cacophony of information which if left unrefined will become nuisance in the memory.[16 - 19] These synapses will need to be revisited constantly or singly based on how fast the genetic makeup of the learner is, so that the din hindering memory and utilisation of the skill are removed. This neuronal plasticity, the ability of the brain to create, and

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strengthen new connections is enhanced by peer learning.[20]

Our memories are our lives, and a fundamental basis of our culture. With our brains and memories, we can travel through time and space, calling to mind places of significance, evoking images and emotions of past experiences.[21, 22] Many regions of the brain are involved in memory, but one of the most critical components is the hippocampus, which plays a crucial role in the formation of long-term memories. Damage to the hippocampus can therefore result in significant memory loss.[23, 24] Memory is not flawless, and to help us remember, many people use mnemonics, and when there are people in study groups who have the gifts of forming mnemonics within seconds, they are valuable to the group. Small group learning helps enhance brain activities and memories which are needed for critical thinking and idea generation in research.

Learning and Learning Theories

Learning is a complex process involving the acquisition of knowledge, skills, attitudes, and behaviours through experience, study, or instruction. Learning theories describe how students process, absorb, and retain knowledge during the teaching/learning experience.[25, 26] The three broad learning theories that have endured throughout history are behavioural, cognitive, and constructivist learning theories. Various learning theories provide frameworks to understand how learning occurs. Each of the theoretical approaches is consistent with Knowles' definition The eight theoretical approaches discussed are: adult learning principles, social cognitive theory, reflective practice, transformative learning, self-directed learning, experiential learning, situated learning, and learning in communities of practice. However, the most relevant theories in the context of peer learning in medical research include constructivism, social learning theory, and cognitive load theory.[23, 27, 28]

Constructivism is an educational theory that posits learners construct their own understanding and knowledge of the world through experiences and reflecting on those experiences. Jean Piaget and Lev Vygotsky, prominent constructivists, argue that learning is an active, contextualised process. Vygotsky's concept of the Zone of Proximal Development (ZPD) highlights the importance of social interactions and scaffolding in learning.[29 - 32] The core tenet of cognitive constructivism is that learning need to be connected to the cognitive growth stage of the learner. By making connections between new information and what they already know, these teaching strategies assist students in acquiring new material and help them adapt their preexisting intelligence to the new knowledge. Cognitive constructivism comes from the work of Jean Piaget and his research on cognitive development in children.

Social constructivism emphasises how learning is a collaborative process. People's interactions with one another, their culture, and society at large shape our knowledge. Pupils build their own knowledge and reality by constructing their own building blocks with the assistance of others, which they obtain from others. Lev Vygotsky is the author of social constructivism, which is closely related to cognitive constructivism but also includes peer and societal influence.[30] In 1974, Ernst von Glasersfeld formulated the radical constructivism which centres on the notion that students and the knowledge they create merely serve to enable them to function in their surroundings. Essentially, the premise is that knowledge is created, not acquired, meaning we can only have interpretations of knowledge because of past experiences, which prevents us from having the truth.

This approach is linked to peer learning in several ways including:

a. Social Interaction: Constructivism emphasises the importance of social interaction in learning. Peer learning provides opportunities for students to engage with each other, discuss ideas, and collaboratively solve problems, which helps them to construct new understandings.
b. Active Engagement: Constructivist learning requires active engagement with the material. Peer learning activities, such as group discussions, projects, and peer teaching, encourage students to actively participate and engage with the content.
c. Multiple Perspectives: Through peer learning, students are exposed to diverse perspectives and approaches to problems. This aligns with the constructivist view that understanding is deepened when learners are exposed to different viewpoints and must reconcile them with their own.
d. Scaffolding: Constructivism often involves scaffolding, where more knowledgeable peers or instructors support learners in their development. In peer learning, more experienced students can provide this scaffolding, helping their peers to build on their existing knowledge and skills.
e. Reflection: Constructivist approaches value reflection as a key component of learning. Peer

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learning often involves discussing and reflecting on the learning process, which helps students to internalise and understand the material more deeply.

Overall, constructivism and peer learning both emphasise collaborative, active, and reflective learning processes, making them complementary educational approaches.

Albert Bandura's social learning theory emphasises the role of observation, imitation, and modelling in learning. Bandura introduces the concept of self-efficacy, where individuals' beliefs in their capabilities influence their learning outcomes.[26, 33] In clinical learning in some Nigeria medical institutions, lecturers experience situations where students doubt themselves when questions are posed to test their background knowledge of topics and conditions. They have little belief in their capacity and whisper answers to themselves rather than the lecturer thereby losing the opportunities for engagement with their lecturers. Some lecturers circumvent this by having ground rules before start of the clinic or ward round teaching sessions and make individual students speak directly and freely.

John Sweller's cognitive load theory[34] focuses on the limitations of working memory and the need to design instructional methods that optimise cognitive resources. It underscores the importance of reducing extraneous cognitive load to facilitate effective learning. To this, lecturers are challenged to produce learning objectives and learning outcomes for various clinical conditions, procedures or skills that are students can acquire in bits to which they can build on without causing hesitancy in learning.

Learning Styles and Peer Learning

Learning styles refer to individuals' preferred ways of processing information. The VARK model (Visual, Auditory, Reading/Writing, Kinaesthetic) categorises learning preferences, while Howard Gardner's theory of multiple intelligences expands on the diverse ways people learn.[35] Individual students have different methods in which they receive, process, and disseminate information and the interaction process has been known to help facilitate this. The onus is on the lecturers to identify triggers that will assist a student to achieve the objectives faster but with precision. Peer learning also helps the students understand their strengths, weaknesses and build on the strengths while changing the weaknesses in a neutral environment without the pressure of the more experienced lecturer. In the proverbial blind man describing an elephant better than the well sighted man, the blind uses his other senses better than the sighted man who relies more on his sight limiting his perceptive abilities. So many novice students coming together to learn can do more with their lecturer guiding them.

Developing Scientific Reasoning through Peer Learning

Peer learning leverages these diverse learning styles, fostering a collaborative environment where students can teach and learn from each other. It encourages active participation, critical thinking, and the development of communication skills.[36, 37] Peer learning, a collaborative educational approach where students learn from and with each other, has gained traction in medical science research training. Scientific reasoning involves the ability to analyse data, formulate hypotheses, and draw evidence-based conclusions. Peer group learning allows learners to approach problems from multiple perspectives, refine their arguments, and develop a deeper understanding of scientific concepts. The key principles of peer learning are that the group must be properly formed and managed, accountable to themselves and the tasks that are in hand, members are motivated and willing to receive and give positive feedback.[38, 43]

The process of developing scientific research among peers starts from self-studying, with each member of the peer taking up a task and learning about it. Take a group of 5 residents who have low research background and need to improve certain cognitive and psychomotor skills in research, and they are given tasks in this manner; 2 of them should study on research questions development, 2 on developing hypothesis, and the last one takes up formulating research aims and objectives. The group is given a week before the presentation and each group is given 20 minutes for presentation. That cohort of residents will leave the table with the skills of developing research hypothesis, questions, and aims and objectives. Before leaving that task though, they may be mentored to send grants type research aim and objective to TETFUND or a foundation.

Another way to do this is to introduce a case scenario into a large group by the tutor, and then individuals are given instructions to read questions and develop hypotheses. The whole group is broken into small groups where the hypotheses are discussed and critiqued, until group hypotheses are developed. IN the

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large group afterwards, the group hypotheses are then discussed, and differences are addressed.

Peer learning may however have negative impact on some learners as the diversity of the group makes it inevitable to have learners that are fast-ability and others are slow-ability. This may cause early drop out, low self-esteem, and distractions among the peers. There is also the possibility of peers not taking the feedback in positive light and changing their attitudes, and competition may breed negative energy within the group.

Creating a collaborative peer-learning scientific research group - practical prescription

While it is frustrating getting residents to focus on non-core discipline competences like research, i.e. making an OMS resident who has interest in jaw reconstruction to go into research, trainers can form research teams. The team will comprise their lecturer, senior residents, residents and senior resident from community dentistry or community medicine. The dynamics will be such that the lecturer will facilitate the learning process, and the team can focus on key areas of deficit for the residents to acquire the skills on. Focusing on some key areas form better scientific research like funding, and resource generation, capacity building, policy and politics and public-private partnership will help improve capacity for research and development.[24, 26, 44, 45]

Institutions and Government can also motivate peer learners to form research groups that will enhance capacity for writing and competing for research grants regularly within and between institutions. The competence and confidence of the research group will propel them to pursue better infrastructure and laboratory facilities to support advanced research. Training of trainers programme already on-going in both Colleges can invest in training programmes to improve the skills of researchers, not just the update courses that have been tradition since their inception. All College activities should now encourage continuous professional research development through workshops and seminars during their annual meetings.

When preparing for these meetings, politicians and legislators should be invited to participate and advocate for policies that support research and innovation, including intellectual property rights and commercialisation of research findings. They will also help in improving governance and reduce bureaucratic hurdles in the research process. The partnerships between academic institutions and the private sector to drive innovation should be enhanced using community physicians and statisticians. Here is a small prescription for collaboration with a corporate organisation or foundation and the National Post graduate medical College, for research development among young fellows.

In this proposed model, collaboration between the NPMC and the funding foundation or institution holds the promise of significantly enhancing the quality of research and innovation among young medical fellows, fostering an environment where they can thrive, explore groundbreaking ideas, and contribute meaningfully to the advancement of healthcare. By fostering a culture of continuous learning, mentorship, and innovation, this initiative can contribute to advancing medical research in Nigeria and beyond. It does not mean that there are no challenges that can arise even after careful planning and implementation but these can be mitigated especially if the principal actors are proactive.

Peer groups often consist of individuals with varying learning abilities and speeds. Some may grasp research concepts quickly, while others may struggle. This can lead to frustration, early dropout, or disengagement from slower learners. However, considering the diverse nature of the groups, mentors can be assigned to support the slower members of the group, while setting goals and ensuring that they are small chunks that can be achieved without overwhelming the learners. There can be native competitions, resentments and bullying which can be managed by lecturers or leaders setting the tone, making ground rules and tasking the group to be accountable. Other challenges can be resistance to change in educational culture, limited resources and sustainability of the programme.

CONCLUSION

Peer learning is a powerful educational approach that enhances the learning experience in medical science research. By aligning with learning theories, accommodating diverse learning styles, and promoting collaborative learning environments, peer learning improves scientific reasoning, memory retention, and the overall research process. Colleges should continue the peer learning series (training of trainers) and incorporate scientific research that are BOLD, with competitions and support grants applications for learners. Collaborating with corporations can also improve innovation, research capacity building and foster competition among peers. Consequently, peer-

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learning will contribute to the development of competent and confident medical researchers in Nigeria.

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Objective:
To enhance the quality of research and foster innovation among young Fellows of the National Postgraduate Medical College of Nigeria (NPMCN) through a structured collaboration with the Foundation, focusing on peer learning and mentorship.

1. Strategic Goals

i. **Improve Research Capacity:** Enhance the research skills and knowledge base of young fellows through targeted training programs.
ii. **Foster Innovation:** Encourage innovative thinking and problem-solving in medical research.
iii. **Strengthen Peer Learning:** Create a robust peer learning network to facilitate knowledge sharing and collaboration.
iv. **Sustainable Impact:** Establish a sustainable framework for continuous improvement in research quality and innovation.

2. Partnership Framework

A. Roles and Responsibilities

- **NPMCN:**
  i. Identify and select young fellows with a strong interest in research and innovation.
  ii. Provide logistical support for training programs, workshops, and peer learning activities.
  iii. Facilitate access to existing research infrastructure and resources.
- **The Foundation:**
  i. Provide funding and expertise for the development and implementation of training programs.
  ii. Offer access to global networks of researchers and innovators.
  iii. Support capacity building through fellowships, grants, and mentorship programs.

B. Governance Structure

i. **Steering Committee:** A joint committee comprising representatives from NPMCN and The Foundation will oversee the collaboration. The committee will set strategic priorities, allocate resources, and monitor progress.
ii. **Working Groups:** Specialised working groups will focus on specific areas, such as training development, peer learning, mentorship, and monitoring and evaluation.

3. Implementation Strategy

A. Needs Assessment

Conduct a Comprehensive Needs Assessment: Identify gaps in research skills, innovation, and existing peer learning structures among young fellows. This assessment will inform the design of the program.

B. Programme Design

1. **Research Training and Capacity Building:**
   i. **Workshops and Seminars:** Develop a series of workshops and seminars on advanced research methodologies, data analysis, and innovative thinking.
   ii. **Research Fellowships:** Offer The Foundation-sponsored fellowships for outstanding young fellows to pursue research projects that demonstrate innovation potential.
   iii. **Online Learning Modules:** Create online learning modules on research best practices and innovative approaches, accessible to all fellows.
2. **Peer Learning and Mentorship:**
   i. **Peer Learning Circles:** Establish peer learning circles where fellows can collaborate on research projects, share knowledge, and provide mutual support. Each circle will be guided by a senior mentor.
   ii. **Mentorship Programme:** Pair young fellows with experienced researchers and innovators from the Foundation network. Mentors will provide guidance, feedback, and support throughout the research process.
   iii. **Annual Peer Learning Conference:** Organise annual conferences where fellows can present their research, exchange ideas, and network with peers and mentors.
3. **Innovation Incubation:**
   i. **Innovation Challenge:** Launch an annual innovation challenge to encourage young fellows to develop novel solutions to pressing healthcare challenges. Winners will receive funding and support to bring their ideas to fruition.
   ii. **Research Grants:** Provide small research grants to support innovative pilot projects, with the potential for scale-up based on results.

4. Monitoring and Evaluation

A. Continuous Monitoring:

i. **Progress Reports:** Regular progress reports from fellows, mentors, and peer learning circles.
ii. **Feedback Mechanisms:** Implement feedback mechanisms to gather input from participants and stakeholders to refine the program continuously.

B. Impact Assessment:

i. **Annual Reviews:** Conduct annual reviews to assess the impact of the collaboration on research quality, innovation, and peer learning.
ii. **Key Performance Indicators (KPIs):** Track KPIs such as the number of research publications, innovations developed, and successful peer learning engagements.

C. Sustainability Plan:

Scaling Success: Develop strategies to scale successful initiatives to other medical institutions in Nigeria.
Long-term Funding: Explore additional funding opportunities to ensure the sustainability of the collaboration beyond the initial phase.

5. Communication and Outreach

A. Awareness Campaign:

Launch a communication campaign to raise awareness about the collaboration and its benefits among young fellows and the broader medical community.

B. Knowledge Dissemination:

Publications and Reports: Disseminate research findings, case studies, and best practices through publications, reports, and presentations at conferences.
Online Platform: Create an online platform to share resources, research outcomes, and success stories from the collaboration.

6. Timeline

Phase 1: Planning and Needs Assessment (Months 1-3)
Phase 2: Program Design and Development (Months 4-6)
Phase 3: Implementation and Rollout (Months 7-18)
Phase 4: Monitoring, Evaluation, and Sustainability Planning (Months 19-24)

7. Budget and Resources

Funding Requirements: Detailed budget outlining costs for training programs, fellowships, mentorship activities, peer learning circles, innovation challenges, and administrative support.
Resource Allocation: Allocation of resources between NPMCN and The Foundation, with a focus on maximising impact.

Box 1: Plan for Collaboration Between NPMCN and the Foundation to Improve Research Quality and Innovation

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