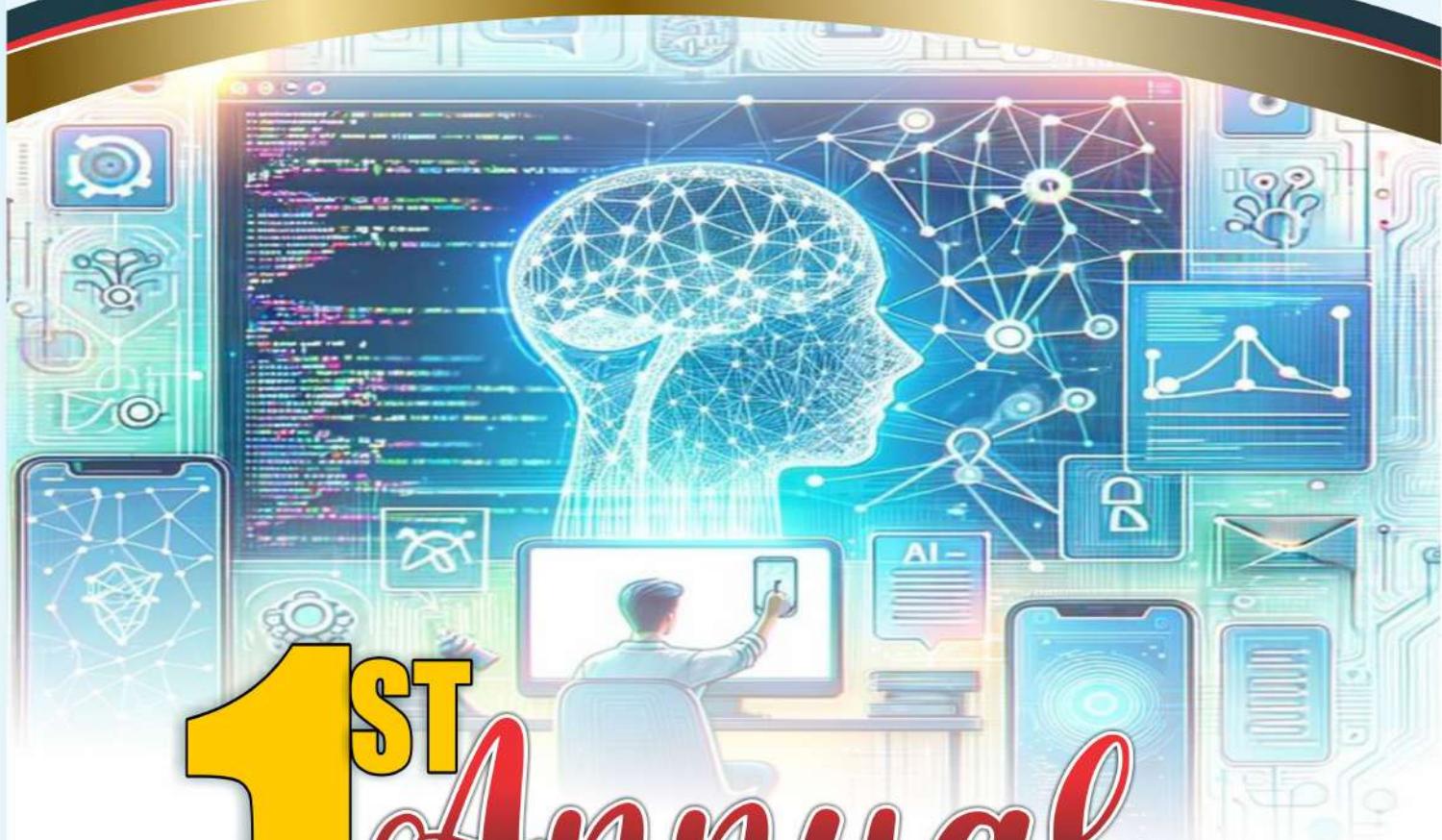




**ASSOCIATION OF SCIENCE EDUCATORS ANAMBRA (ASEA)**

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**SCIENCE EDUCATORS AND DIGITAL LITERACY  
IN THE 21ST CENTURY**



**1<sup>ST</sup>**  
*Annual*  
**CONFERENCE**  
**PROCEEDINGS 2025**

**Editor**  
**Prof. Josephine N. Okoli**

# ASSOCIATION OF SCIENCE EDUCATORS ANAMBRA (ASEA)

**THEME: SCIENCE EDUCATORS AND DIGITAL LITERACY IN THE 21<sup>ST</sup>  
CENTURY**

**1<sup>ST</sup> ANNUAL CONFERENCE PROCEEDINGS, 2025**

**10- 12<sup>th</sup> July, 2025**

*Editor*

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**Usan Peter**

Chemistry Department  
Federal Technical College, Awka,  
Anambra State, Nigeria

## PROGRAMME OF EVENTS

- Opening Praying
- Chairman's Opening Remark
- Breaking of Kola nut
- Welcome Address by the acting President of the Association
- Keynote Presentation by Prof. Cecilia O. Ekwueme
- Lead Paper Presentation by Prof. Telima Adolphus
- About the Electronic Book / Unveiling of Book Chapter – E-Book launch
- Item 7
- Meritorious Award
- Paper Presentations

## **MERITORIOUS AWARD**

### **CITATION OF Dr SAMUEL ALFAYO BOH**



It is my pleasure and singular honour to be called upon to read a citation on one of the eminent Doctor that the family of Alfayo has ever produced.

People are not chosen for their comfort, they most often to prepare for a life of self sacrifice and even sufferings on behalf of other. And most often their calling is not for privilege but for service. Whichever prism you use in view him, Dr Samuel Alfayo Boh a class teacher of high repute, a man of integrity and fear of God, sacrifices and service for the betterment and advisement of humanity.

May, 18, 1969 marked the beginning of the steadily progressive son of Boh colored mother and the Shongomite father. This account of this childhood and youth in Gombe State shows the prince he had to pay for such a birth. It did not take long before he was revealed as a man of vision and mission as every step he took in both early life and now was clogged with success, and a wide breath of accomplishment.

Dr.Samuel Alfayo Boh spends is early life in Boh with his parent. He attended Boh primary school from 1976 to1984 exposed his qualities as a gifted child enable him to proceed to Government Science Secondary School Kaltungo 1984 to 1987,Teachers College Gombe 1988 to 1990 the exceptional this qualities made way for him to enlist to College of Education Azare 1993 where he bagged National Certificate in Education (NCE) while in Azare, he was elected parliamentary student union 1994 to 1995 session and thereafter in the year 1987, he proceeded to famous University of Maiduguri Borno State and had a Bachelor of Education and passed with flying colours in 2000. Diploma in World Evangelism Mission Training Institute in Borno State in 1999. In 2001, the indefatigable Samuel was drafted in to the National youth service scheme in Tsafe, Zamfara State his service witnessed a continued story of one success after another like the Nehemiah of the Holy Bible. As a man who fully understand what benefits education could bring his way when tapped. Dr Samuel did not hesitate to define where he was headed for in that direction. In 2004, he gain admission to University of Maiduguri, Borno States as an intelligent

student, he graduated in 2008 with Master of Education in Curriculum and Instruction (M.ED). Diploma and Certificate in computer 2009. In the year between 2013 to 2016 he bagged Masters in Guidance and Counseling in Theological Seminary College Kaltungo in Gombe State. Moreover, the influence this celebrated academia exerted on him equipped him to master the techniques of research, the canons of interpretation and reconstruction of academic research, the craft and skills involved and teacher – students relationship in 2010 he proceeded to one of the best University in Nigeria University of Nigeria Nsukka in Enugu State and come out with Doctor of philosophy (Ph.D) in Curriculum and Instruction.

A man with a formidable profile charismatic personality, Dr Samuel is indeed an achieve per excellence he has not only carved a niche for himself, but has also made name and reputation in Nigeria. He has always impacted positively in the lives of everyone he meets. He has also shown high sense of professionalism and dedication to the service of humanity. On several occasion Samuel has interrupted his travels to attend to civilian, accident victims and he has truly saved a lot of lives.

Dr. Samuel Alfayo Boh started his civil service career as a classroom teacher; he had a little starting with the noble teaching profession. In 1996 he took appointment with Boh primary school, Labeke primary school in 1997, Kulishin primary school 1999, Pivotal Teachers Training Programme Lapan in 1999. In 2000 He moved to Government Day Secondary School Boh. In 2000 Tutor Senator T.U. Wada Educational Emancipation Scheme. Presently, lecturer with Federal University Kashere, in the Department of Educational Foundations

Dr. Samuel is a versatile personality of note and a man of many parts. He is fondly referred to as sport, Author and a born teacher of good repute. In his romance with great academics, he has received more than twenty awards, member of many associations, he has presented more than thirty academic papers in both international and national journals, he has published Ninety journals, sixteen book chapters, he has written eight books, presently chairman board of governors Jim Collis Kufai, fellow members of more than seven associations, former permanent commissioner sports commission Gombe State, chairman and secretary of many association, He is happily married to Mrs. Abigail Samuel and blessed with many children.

Having described himself as an enterprising person who has excellence attached to his name, Dr Samuel Alfayo Boh evinces a friendly disposition towards his students. He is a strong advocate of treating students with understanding and affection, Dr. Samuel incontestably mentors, counsels, reprimands, sympathizes and assists his young and old alike. Some of his students describe him as a luminous teacher whose passion for academic scholarship is infectious and whose pedagogical principle skills and friendly disposition are so admirable and endearing that attendance at his lectures is always high and far outstrips most others.

Ladies and gentlemen, Dr. Samuel Alfayo Boh is a small figure on the physical appearance. It is my great honour and privilege to call on this academic repute, erudite, scholar, indefatigable and inspirational mentor, community lover, and motivator ardent love of Shongomite culture and humanist to graciously joint the chairman and other for the formal presentation of this fabulous awards to acknowledge to celebrate his hard word, disciplines, kindness, humanness and commendable role he is playing in the academic careers and character-building

## FOREWORD

It is with profound pride and optimism that I write this foreword to the maiden Book of Conference Proceedings of the Association of Science Educators Anambra State a timely and significant academic documentation that captures the robust engagements, research contributions, and transformative ideas presented at the 1st Annual Conference of the Association, scheduled for July 10, 2025, in Awka, Anambra State, Nigeria.

The conference, with the theme “Science Educators and Digital Literacy in the 21st Century,” could not have come at a more opportune moment. In an age where digital transformation is rapidly redefining education, economy, and society, the role of science educators in equipping learners with not only scientific knowledge but also digital competencies has become more critical than ever. The conference offered a strategic platform for scholars, researchers, policy makers, and practitioners to interrogate, share, and shape new pedagogical paradigms that incorporate digital literacy into the fabric of science education.

In his address of welcome, the Acting President of ASEA, Dr. Johnbosco O.C. Okekeokosisi, delivered a compelling call to action. He set the tone by acknowledging the historical importance of the event and the noble mission of ASEA to champion science education across Anambra State and beyond. His words reflected a clear vision of collective progress, innovation, and institutional synergy. Most notably, Dr. Okekeokosisi emphasized that digital literacy in science education is not merely about embracing technological tools but about empowering both educators and learners to critically engage, create, and transform scientific knowledge for societal advancement.

This compilation of conference proceedings is more than a record of presentations—it is a testimony to the enduring commitment of Nigerian science educators to adapt to global educational trends. With insightful keynote and lead paper presentations by eminent scholars such as Prof. Cecilia O. Ekwueme and Prof. Telima Adolphus, participants were exposed to a breadth of ideas, models, and classroom innovations. These contributions are now immortalized in this volume, accessible to researchers, policymakers, and education stakeholders worldwide. The articles by contributors are of quality standard and intimately related to the conference theme.

The proceedings are also a celebration of collective effort. Dr. Okekeokosisi rightly acknowledged the contributions of past leaders of STAN, the Executive Principal of Igwebuike Grammar School, the Local Organizing Committee, and institutional partners who ensured the success of this pioneering event. Their efforts reflect a shared belief in the transformative power of science education when driven by vision, collaboration, and strategic digital integration.

This book also symbolizes the maturity and forward-thinking disposition of ASEA. With its proceedings published online in the Association’s official website ([www.jisepublications.org](http://www.jisepublications.org)), ASEA is setting a benchmark for academic visibility, accessibility, and global relevance. The initiative aligns perfectly with the conference theme—leveraging digital platforms for knowledge dissemination.

As readers engage with the rich content within this publication, it is my hope that they find not only knowledge but also inspiration to further the cause of digital transformation in science education. May this volume serve as a resource, a reference, and a rallying point for continued innovation, research, and excellence in digital literacy, science teaching and learning.

**Prof. Marcellinus C. Anaekwe**  
**manaekwe@noun.edu.ng**  
**National Open University of Nigeria,**  
**Abuja.**

## PREFACE

Digital literacy in the 21st century is crucial for science educators to effectively teach and prepare students for a rapidly evolving scientific and technological world. Science educators must embrace digital tools and resources to enhance their teaching methods and foster students' scientific literacy, critical thinking and problem-solving skills. This includes leveraging online platforms, using educational technologies and digital content to create engaging and meaningful learning experiences.

In this conference proceedings efforts has been made towards promoting the use of digital tools in science education.

**Prof. Josephine N. Okoli**

Science Education Department

Nnamdi Azikiwe University, Awka,

Anambra State, Nigeriascience

**ADDRESS OF THE ACTING PRESIDENT OF ASSOCIATION OF SCIENCE EDUCATORS ANAMBRA (ASEA), DR. JOHN BOSCO O.C. OKEKEOKOSI, AT THE OPENING CEREMONY OF THE 1ST ANNUAL CONFERENCE HELD IN AWKA, ANAMBRA STATE, NIGERIA ON 10<sup>TH</sup> JULY, 2025**

**Theme: “Science Educators and Digital Literacy in the 21st Century”**

Distinguished Guests,

Mother of the Day, and Executive Provost of the Federal College of Education (Technical), Umunze, Prof. Tessy O. Okoli

Past and Immediate Past Chairmen of the Anambra State Chapter of the Science Teachers Association of Nigeria (STAN), Prof. C.V. Nnaka, Dr. Christiana U. Ezenduka Past and Immediate Past Secretary of the Anambra State Chapter of the Science Teachers Association of Nigeria (STAN), Dr. Chinwe B. Njelita, Mr. Kingsley N.C. Ezeokeke

The Executive Principal of Igwebuike Grammar School, Awka, Mrs. Amaka Ifebili

Our Esteemed Keynote and Lead Paper Presenters, Profs: Cecilia O. Ekwueme, Telima Adolphus

Meritorious Awardee, Dr. Samuel Alfayo Boh

Representatives of Educational Institutions, Pharm. Adauzoh C. Joe-Obasi

The Conference Planning Committee

The Local Organizing Committee (LOC),

My Fellow Science Educators,

Ladies and Gentlemen.

It is with deep humility and immense pleasure that I stand before you today as the Acting President of the Association of Science Educators Anambra (ASEA), to welcome you all to this historic gathering — the **1st Annual Conference** of our noble Association, taking place here in the vibrant capital city of Awka, Anambra State.

This moment marks a milestone in the life of our Association and in the educational landscape of our dear state. Today, we have gathered not just to deliberate on academic issues, but to collectively reflect on and shape the role of science educators in a rapidly changing digital world. The presence of each one of you here is a testament to your dedication to the advancement of science education in Nigeria, and in particular, in Anambra State.

Let me begin by extending heartfelt gratitude to our **Mother of the Day**, the erudite and distinguished **Executive Provost of the Federal College of Education (Technical), Umunze**, for honoring our invitation. Your presence is a great source of inspiration, and we are immensely grateful for your unwavering support towards science and technical education in the state. The Host and Board of Directors, Prof. Josephine N. Okoli, Prof. Isaac N. Nwankwo, Prof. M.C. Anaekwe

Chairman of the occasion Ass. Prof. Peter I.I. Ikoku

To the **Past Chairman and Immediate Past Chairman of Anambra State STAN**, we salute you. You laid the foundation for excellence and integrity in science education upon which ASEA continues to build. We are proud to carry forward the torch of progress you lit. Your legacies continue to motivate and guide our mission as science educators.

We also sincerely appreciate the **Executive Principal of Igwebuik Grammar School, Awka**, for the enormous and selfless support towards the successful hosting of this conference. Your generosity and logistical assistance have played a crucial role in bringing this vision to reality. We are proud to host this conference within your institution, and we thank you for embracing the ASEA family.

Special thanks also go to our **Keynote and Lead Paper Presenters**, whose scholarship and insight will surely enrich our understanding of the conference theme: *“Science Educators and Digital Literacy in the 21st Century.”* You are the thought leaders that will help us navigate this complex but exciting intersection between pedagogy and technology.

Meritorious Awardee, **Dr. Samuel Alfayo Boh**, whose contributions to teaching and learning in tertiary institutions lead to the foundation of our members.

The **representatives of educational institutions**, both public and private, we acknowledge your partnership and presence. Your contributions, ideas, and institutional support are essential in sustaining quality science education. Together, we can foster a generation of scientifically literate citizens equipped for the demands of the 21st century.

Let me also specially recognize the tireless efforts of the **Local Organizing Committee (LOC)**. You have worked round the clock, attending to logistics, communications, hospitality, and a host of behind-the-scenes responsibilities. This conference would not be possible without your selfless commitment. I say, “Well done!”

This conference has its theme **“Science Educators and Digital Literacy in the 21<sup>st</sup> Century”**. The theme is very apt considering the fact that we are in the digital age. Thus, the committee on conference looked inward to provide this conference theme for science educators to understand, educate, re-educate, write and deliberate on the effective use of digital tools – technologies in our present time for effective instructional delivery. Participants will be taken through hands-on and minds-on activities in various sessions and they will find the conference package very rewarding. I invite you to pay attention during keynote address to be presented by Prof. Cecilia O. Ekwueme, the Dean Faculty of Science Education, University of Calabar, Cross-River State, Nigeria. Your continuous attention is also needed during the lead paper presentation of Prof. Telima Adolphus of Rivers State University, PortHarcourt, Nigeria.

To all **participants** – educators, researchers, students, policy makers – thank you for making out time to be here. Your presence signifies hope for the future of science education. I urge you to make the most of this gathering by networking, exchanging ideas, and exploring new strategies to embed digital literacy in science classrooms and curricula.

As we delve into this conference theme, let us remember that digital literacy is not just about the use of devices or softwares. It is about empowering both teachers and learners to navigate, create, and critically evaluate digital content. It is about transforming science education into an interactive, engaging, and accessible experience that prepares our students for global competitiveness. We must rise to this responsibility with courage, collaboration and innovation.

As we officially declare this conference open, let us do so with a shared sense of purpose and vision. Let us reflect deeply, discuss intelligently and leave this gathering better equipped to build a technologically savvy and scientifically vibrant society.

Ladies and Gentlemen, it may interest us to note that this young growing association has an online Journal, Electronic Book (e-book) and Conference Proceedings. The E-Book and Conference Proceedings were hosted online at the association's website ([jisepublications.org](http://jisepublications.org)) for its visibility. It is obvious that this association has come to stay. To God be the glory.

Once again, I welcome you all to the 1st Annual Conference of the Association of Science Educators Anambra (ASEA). May our deliberations be fruitful, and may the bonds we forge here today grow stronger for the benefit of science education in our state and beyond.

Thank you, and God bless you all.

**Dr. Johnbosco O.C. Okekeokosisi**

Federal College of Education (Tech) Asaba,  
Delta State, Nigeria  
Acting President, ASEA  
10th July, 2025

# PAPER 17

## COLLABORATION BETWEEN SCIENCE AND PHYSICAL AND HEALTH EDUCATORS IN PROMOTING DIGITAL HEALTH LITERACY

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### Abstract

*The integration of digital technology into Physical and health education has the potential to revolutionise teaching and learning by enhancing teacher-students participation on engagement and performance. Health literacy is defined as the capacity to obtain, process, and understand basic health information needed to make appropriate health decision. As health-related misinformation proliferates online, the need for effective digital literacy education has become more pressing. This paper explores the significance of collaboration between science and physical and health education educators in promoting digital health literacy in the 21<sup>st</sup> century. This can be achieved through curriculum integration by gaining knowledge from human biology, epidemiology, and biochemistry among others which address scientific understanding and practical application of health information. The paper, therefore, examine the power of digital technological tools such as mobile health apps, fitness apps and online health information resources to promote health and digital literacy. The paper also emphasized the roles of digital literacy as in promoting public health particularly in preventing chronic, managing mental health and addressing health inequities. Challenges of implementing digital technology in teaching such as insufficient training of staff, inadequate funding, lack of infrastructure and materials were also discussed. Finally, the paper recommended that government should provide fund, gadgets and train more staff in the area of digital technology to promote digital health literacy.*

**Keywords:** Science Physical and Health Education, Health Educators, Digital Health Literacy

### Introduction

Promoting digital literacy among Physical and Health Educators faces several challenges, including limited access to resources and training, outdated teaching methods, and concerns about student privacy and data security. Overcoming these obstacles requires addressing the digital divide, providing adequate professional development, and fostering a supportive environment for integrating digital tools in physical and health education.

Promoting digital literacy among Physical and Health Educators is crucial for enhancing their teaching effectiveness, student engagement, and overall health outcomes. It enables educators to utilize digital tools for delivering engaging content, accessing reliable health information, and fostering a healthier lifestyle among students. This ultimately contributes to improved learning experiences, increased physical activity levels, and a more informed approach to health and well-being (Casey & Armour, 2017).

In an increasingly interconnected world, digital technologies have transformed how individuals' access, interpret, and utilize health information. With the widespread adoption of digital tools, the roles of educators in fostering digital literacy especially health literacy has become paramount.

Health literacy is traditionally defined as the capacity to obtain process and understand basic health information needed to make appropriate health decisions (Nutbeam, 2000). The emergence of digital health literacy (DHL) is defined as the ability to seek, understand, evaluate, and apply health information from electronic sources to solve a health problem (Norman & Skinner, 2006). This has become critical for empowering individuals to make informed health decisions. As health systems become progressively digitized, competencies in navigating online platforms, evaluating digital content, and using electronic health tools are indispensable not only for healthcare consumers but also for students, who represent future health citizens (Sentell, Vamos, & Okan, 2020; Sykes, Wills, Rowland & Popple, 2023).

The integration of digital health literacy into formal education is no longer optional, it is imperative. Schools serve as foundational institutions for lifelong learning, and equipping students with DHL skills at an early age contributes to health promotion, disease prevention, and the responsible use of digital health innovations (Higgins, Green, & Harmer, 2022). This is especially vital in low- and middle-income countries like Nigeria, where misinformation, health illiteracy, and inequitable digital access exacerbate public health challenges (Onyeaka, Anumudu, & Ojo, 2021). Embedding digital health competencies in the education system is consistent with global priorities such as the WHO Global Strategy on Digital Health 2020–2025, which calls for inclusive digital health ecosystems and health literacy-enhancing interventions within schools (World Health Organization, 2021). This new dimension of health literacy demand collaborative approach, especially between science Physical and health educators to equip students with the necessary skills to evaluate health information critically and make informed decisions about their health.

Science Education and Physical and Health Education (PHE) are uniquely positioned to champion the integration of digital health literacy in schools. Science Education, with its focus on inquiry, empirical reasoning, and content knowledge in biology, chemistry, and environmental science, offers students a theoretical foundation for understanding disease transmission, nutrition, and body systems (National Research Council, 2012). PHE, on the other hand, emphasizes practical applications such as hygiene, physical activity, mental wellness, and preventive health behaviour. In the digital age, both disciplines can collaborate to engage learners in evaluating online health information, utilizing health apps, and promoting personal and community well-being through technology-enabled instruction (Adeoye & Ola, 2020). Digital health literacy encompasses more than just the ability to use digital tools; it involves understanding how to critically engage with online health resources. In an age where social media, online health blogs, and various apps offer a wealth of health related contents, students must learn to distinguish credible sources from unreliable ones. Digital health literacy according to WHO (2020), is essential in promoting public health, particularly in preventing and management of chronic diseases and mental health, and addressing health inequities. Furthermore, with the out-break of deadly diseases highlighting the critical role of digital information in public health, the importance of digital health literacy has never been clearer (Udo & Chukwu, 2021).

## **Purpose of the Study**

The study seeks is to;

1. determine the need for collaboration between science and Physical and Health educators in promoting digital Health education among learners.
2. promote science and PHE educators teaching and learning process via digital foundation

3. ascertain the application of knowledge and Health behaviour via digital literacy among students.
4. determine the significance of collaborating science and PHE in promoting digital literacy among learners.
5. find out the problems facing collaboration between science and PHE in promoting digital literacy.
6. identify road map for effective collaboration of science and PHE educators for integrating digital education in teaching and learning process.

### **Statement of the Problem**

Promoting digital literacy among science and Physical and Health educators faces several challenges, including inadequate infrastructure, lack of training , inconsistent application of technology and concerns about data privacy and students engagement. Addressing these issues requires improved infrastructure, targeted training programmes, and a focus on integrating digital tools effectively into the curriculum

### **The Need for Collaboration between Science and Physical and Health Educators**

The integration of digital health literacy into educational curricula requires a cross-disciplinary approach, and this is where collaboration between science and PHE educators becomes pivotal. Science educators are adept at teaching the underlying principles of health science, such as human biology, epidemiology, and biochemistry. PHE educators, on the other hand, are experts in promoting health behaviours through physical activities, nutrition, and mental health initiatives. By working together, these tow disciplines can create a well- rounded, dynamic curriculum that address both the scientific understanding and practical application of health information (Norman, et al, 2006).

### **Science Educators Teaching the Foundation of Health Literacy**

Science educators can lay the groundwork for digital health literacy by teaching students the fundamental scientific concepts behind health and wellness. For instance, lessons on the human body, nutrition, exercise physiology, and disease prevention provide students' knowledge necessary to understand health information in digital spaces. In this context, science educators can guide students in evaluating the accuracy and validity of health information found online. Moreover, digital platforms such as interactive database, virtual labs, and science journals offer students the opportunity to engage with cutting-edge health research.

### **PHE Educators: Application of Knowledge and Health Behaviour**

While science educators provide the knowledge, PHE educators can focus on the application of the knowledge in everyday life. PHE educators often engage students in activities that promote physical fitness, mental health, and wellness. Through these activities, students can learn to apply their digital health literacy by assessing health apps, fitness trackers, and online wellness resources (Nutbeam, 2000). For instance, PHE educators can facilitate discussions on their liability of fitness apps and their effectiveness in improving health outcomes. Furthermore, PHE educators can create digital content by themselves such as online workshops health blogs, or video tutorials helping students not only consume but also create health-related digital contents.

## Benefits of Collaborating Science and PHE in Promoting Digital Health Literacy

- 1. Holistic Health Education:** An interdisciplinary approach fosters a holistic understanding of health, bridging abstract scientific knowledge with concrete behavioral practices. This integration ensures that students not only comprehend *why* certain health practices are beneficial but also *how* to implement them effectively using digital tools such as mobile health applications, fitness trackers, or interactive learning platforms (Kay, Leung, & Tangrey, 2019).
- 2. Contextualized Learning through Technology:** When Science and PHE collaborate, digital tools can be embedded meaningfully within real-world learning scenarios. For example, Science educators can guide students in understanding the algorithmic logic behind health apps, while PHE instructors focus on the behavioral outcomes of using those apps (Casey, Goodyear, & Armour, 2017). Such contextualized learning promotes situated cognition enhancing the applicability and transferability of digital health competencies.
- 3. Improved Student Engagement and Digital Competence:** Interdisciplinary instruction can increase student engagement by providing varied, relevant, and active learning experiences (Drake & Reid, 2020). Moreover, it nurtures digital competence, a key component of 21st-century literacy, by encouraging students to navigate, evaluate, and apply online health information in authentic settings thus addressing both cognitive and affective dimensions of learning (Sørensen, Levin-Zamir, Duong, Okan, & Dadaczynski, 2021).

## Strategies for Collaboration of Science and PHE

Interdisciplinary collaboration between Science and Physical and Health Education (PHE) is essential for cultivating digital health literacy (DHL), a critical competence for navigating health information and making informed decisions in the digital age. To operationalize this collaboration, strategic approaches are required at both the instructional and institutional levels. The following strategies offer a roadmap for integrating digital health education across these disciplines in a cohesive and impactful manner.

- 1. Curriculum Design Integration:** A foundational strategy for collaboration is the deliberate integration of curricula to reflect shared goals and complementary content. This involves designing cross-cutting themes such as "Understanding Communicable Diseases in the Digital Age" or "Nutrition and Digital Tracking Tools" that connect biological concepts from Science Education with practical health behaviors from PHE. The integration of such themes can be guided by national or institutional curriculum frameworks, ensuring alignment with learning objectives and assessment standards (Drake & Reid, 2020). Furthermore, curriculum integration fosters cognitive coherence and allows learners to perceive the interconnectedness of scientific theory and health behavior within digital contexts.
- 2. Project-Based Learning (PBL):** Project-Based Learning offers a dynamic and student-centered approach for fostering collaboration between the two disciplines. In PBL, students work in teams to investigate real-world digital health issues, develop solutions, and present findings using digital tools. For example, students might research the spread of infectious diseases and design an awareness campaign using info graphics, mobile applications, or social media. This approach supports experiential learning and develops critical thinking, communication, and collaboration key 21st-century competencies (Bell, 2010). It also reinforces both the scientific content and the health promotion objectives of DHL.

**4. Use of ICT Tools:** The integration of Information and Communication Technology (ICT) tools is central to building DHL. Science and PHE teachers can co-design lessons that employ:

- **Wearable technology** (e.g., pedometers, heart rate monitors) to link biological principles with physical activity monitoring.
- **Mobile health applications** for tracking diet, hydration, sleep, or exercise, allowing students to analyze personal health data scientifically.
- **Virtual labs and simulations** to explore health-related biological processes, such as the effects of pathogens or the human body's physiological responses to exercise.
- **Digital storytelling and AR/VR platforms** to visualize disease transmission, health choices, or historical health interventions.

Such tools not only enhance engagement but also develop students' functional, communicative, and critical health literacy, as conceptualized by Nutbeam (2000).

**5. Teacher Professional Development:** For interdisciplinary collaboration to be effective, educators must be equipped with the requisite technological, pedagogical, and content knowledge (TPACK) (Mishra & Koehler, 2006). Joint professional development (PD) initiatives such as collaborative workshops, lesson study groups, and peer mentoring can enhance teachers' ability to design and deliver integrated digital health lessons. These PD programs should focus on:

- Understanding DHL frameworks.
- Exploring interdisciplinary pedagogical strategies.
- Developing ICT competencies for classroom application.
- Assessing student learning in integrated contexts.

Research underscores the effectiveness of collaborative PD models in fostering instructional innovation and curricular coherence across subject areas (Avalos, 2011; Darling-Hammond, Hyler, & Gardner, 2017).

**6. Community-Based Projects:** Bridging the classroom with the wider community enhances the authenticity and impact of DHL initiatives. Science and PHE educators can facilitate community-based digital health projects, where students participate in campaigns addressing issues like sanitation, vaccination, mental health awareness, or adolescent nutrition. These initiatives may involve partnerships with local health agencies, NGOs, or tech startups to disseminate digital health content through:

- Social media platforms.
- School-based webinars or podcasts.
- Student-led health exhibitions.
- Citizen science projects involving community data collection and analysis.

Such projects not only promote civic engagement and social responsibility, but also deepen students' understanding of how digital health tools can address local health challenges (OECD, 2018).

### **Challenges and Barriers of Collaborating between Science and PHE Digital Literacy**

While interdisciplinary collaboration between Science and Physical and Health Education (PHE) hold significant promise for fostering digital health literacy (DHL), its implementation is often constrained by a range of structural, pedagogical, and systemic barriers. These challenges hinder

the seamless integration of digital tools and collaborative pedagogies in health education across educational levels.

- 1. Lack of Digital Infrastructure and Professional Training:** One of the most pervasive barriers to implementing digital health literacy initiatives is the limited access to ICT infrastructure, especially in under-resourced educational settings common across many parts of Nigeria and sub-Saharan Africa (Adeleke & Olayemi, 2021; Oyediran et al., 2022). Many schools lack essential digital tools such as internet connectivity, projectors, tablets, or educational software, thereby limiting the potential for digital integration. Moreover, teacher capacity in using digital tools for health education remains low due to inadequate professional development. As observed by Okebukola (2020), most science and PHE teachers were trained using traditional models, leaving them ill-prepared for teaching in digitally mediated environments. This leads to underutilization of available technology, even when infrastructure exists.
- 2. Curriculum Rigidity and Misalignment:** Another critical challenge lies in the rigid structure of national curricula, which often discourages interdisciplinary approaches. In Nigeria, for instance, curriculum design is compartmentalized, with Science Education and PHE taught as distinct subjects with separate learning outcomes, assessments, and instructional hours (NERDC, 2013). This disconnection makes it difficult to embed cross-cutting digital health themes without significant curriculum overhaul. The lack of curricular flexibility limits the capacity of teachers to co-plan and co-teach topics such as nutrition, hygiene, or infectious diseases using digital simulations or health apps. This rigidity also affects assessment modalities, which are predominantly summative and subject-specific, rather than holistic or competence-based.
- 3. Institutional Silos in Schools and Teacher Education Programs:** Institutional soloing of departments within schools and colleges of education poses a major barrier to collaboration. Departments of Science and Health & Physical Education often operate independently with minimal cross-communication or shared pedagogical practices. As reported in a multi-institutional survey by Udo and Chukwu (2021), only 12% of teacher education colleges in Nigeria had interdepartmental joint training or curriculum design activities.

This soloed approach results in:

- Redundant or fragmented health-related content.
- Lack of shared ownership of digital tools and resources.
- Missed opportunities for synergy between cognitive science learning and affective health behavior change.

#### **4. Resistance to Change among Educators**

- Pedagogical inertia remains a significant challenge, as many educators are resistant to changing long-standing instructional routines. This resistance is often fueled by:
- Fear of technology or low self-efficacy in using ICT tools.
- Perceived increase in workload associated with co-teaching or planning integrated lessons.
- Institutional cultures that reward adherence to subject boundaries rather than innovation (Fullan, 2007).

Even when policies promote digital or interdisciplinary learning, the implementation gap persists due to the reluctance of educators to adopt new methods without adequate incentives or support mechanisms.

**5. Assessment Difficulties in Interdisciplinary Learning:** Assessing digital health literacy within an integrated instructional framework presents unique challenges. Traditional assessments in Science and PHE focus on discipline-specific knowledge and skills, with limited mechanisms to evaluate:

- Critical thinking in appraising digital health content.
- Competence in using mobile health tools.
- Attitudinal and behavioral outcomes of health education.

Moreover, there is a lack of validated assessment instruments tailored for interdisciplinary digital health literacy, particularly in the African educational context (Eke, 2022). Without reliable tools, educators struggle to justify the effectiveness of collaborative teaching models, limiting their uptake and scalability.

## Conclusion

Collaboration between Science and Physical and Health Education educators is crucial for promoting digital health literacy in the 21<sup>st</sup> century. As digital technologies become increasingly integrated into daily life, students must be equipped with the skills to navigate and critically assess health information online. By combining the strengths of both disciplines, educators can create a comprehensive, interdisciplinary approach that empowers students to make informed, healthy decisions. This collaborative model, also ensure that the digital health literacy framework is both scientifically grounded and practically applicable in students' everyday life. As the need for digital health literacy continue to grow, the partnership between science and PHE educators will remain an essential strategy in preparing future generations for the challenges of the digital health landscape.

## Recommendations

The study recommends that;

- Educational leaders and school administrators should foster enabling environments that encourage joint planning, interdisciplinary learning, and the ethical use of digital health technologies.
- Educators are urged to break disciplinary silos and initiate collaborative teaching models that are informed by digital innovation and public health needs.
- Curriculum developers especially in contexts like Nigeria where digital health remains emergent must proactively revise national curricula to reflect cross-cutting competencies in DHL.
- Policymakers should embed digital health literacy into educational and health strategies, and teacher training institutions must equip educators with the tools to integrate technology meaningfully into instruction.
- Government should review NCE and B.Ed curricula in Science and PHE to include courses on digital health technologies, health informatics, and interdisciplinary lesson planning.
- Government and stakeholders should organize joint professional development workshops for Science and PHE educators on co-teaching strategies, digital content creation, and data-driven health education.

- Curriculum planners should incorporate digital health practicum experiences in teacher education, allowing student-teachers to implement DHL lessons in real classroom settings.
- Government should provide micro-credentialing or certification programs in Digital Health Literacy Education to recognize and incentivize teacher engagement.
- Ministry of Education and relevant agencies should provide budgetary allocation for digital learning infrastructure, including procurement of mobile health devices, digital labs, and internet connectivity.

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