# ASSOCIATION OF SCIENCE EDUCATORS ANAMBRA (ASEA)

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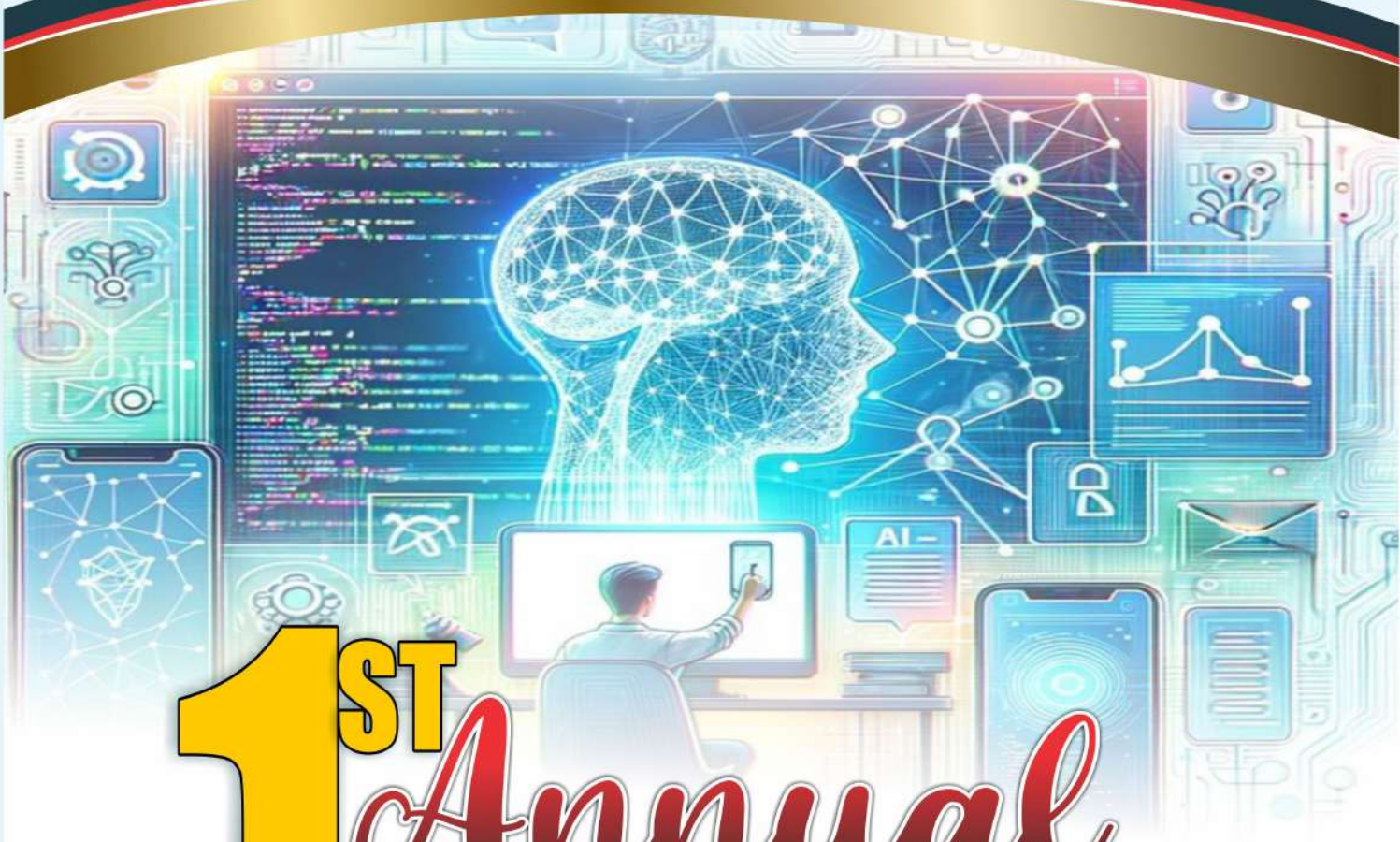
## SCIENCE EDUCATORS AND DIGITAL LITERACY IN THE 21ST CENTURY




# 1ST Annual CONFERENCE

## PROCEEDINGS 2025

Editor
Prof. Josephine N. Okoli

SCIENCE EDUCATORS AND DIGITAL LITERACY IN THE 21ST CENTURY
Editor
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# ASSOCIATION OF SCIENCE EDUCTORS ANAMBRA (ASEA)

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

**1ST ANNUAL CONFERENCE PROCEEDINGS, 2025**

**10- 12th July, 2025**

*Editor*

**Prof. Josephine, N. Okoli**

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# 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), 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 Universitry, Awka,
Anambra State, Nigeriascience

# ADDRESS OF THE ACTING PRESIDENT OF ASSOCIATION OF SCIENCE EDUCATORS ANAMBRA (ASEA), DR. JOHNBOSCO O.C. OKEKEOKOSISI, AT THE OPENING CEREMONY OF THE 1ST ANNUAL CONFERENCE HELD IN AWKA, ANAMBRA STATE, NIGERIA ON 10TH 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. Ikokwu

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 Igwebuike 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 21st 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) 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

# KEYNOTE PRESENTATION

## THEME: SCIENCE EDUCATORS AND DIGITAL LITERACY IN THE 21ST CENTURY

**PROFESSOR CECILIA EKWUEME**

A keynote address delivered at the 1st Conference of the Association of Science Educators, Anambra State (ASEA) on the 10th of July 2025.

**Introduction**

I am delighted to stand here before this great audience to talk on a topic that sits at the heart of educational advancement in our modern world. I must start by commending the organizers of this maiden conference where we explore the intersection of Science Education and Digital Literacy in the 21st Century.

The theme of this conference is '' SCIENCE EDUCATORS AND DIGITAL LITERACY IN THE 21ST CENTURY. There is no doubt that now the world is experiencing unprecedented technological advancement, education is no longer confined to chalkboards and textbooks. Today, digital tools, platforms and resources have transformed how knowledge is acquired, taught, and applied especially in science. The focus of this paper is integration of technology in the classroom in the 21st century. However, before we go into the exhaustive discussion on the theme of this conference, I will briefly examine the keywords which are: Science Educators, Digital Literacy and 21st century.

**Science Educators**: Science educators can be termed to be professionals who teach and promote the understanding of scientific concepts and principles. They instruct, assess, advocate by encouraging students to pursue STEM careers. They inspire curiosity and foster a lifelong love of learning about the natural world. They guide students in inquiry-based learning which encourages critical thinking and problem-solving.

**Digital Literacy**: This is the ability of individuals and communities to understand and effectively use digital technologies, communication tools, and networks to access, evaluate, create and communicate information for meaningful actions within life situations.

It encompasses a range of skills such as:

1. Use of information from digital sources effectively (information literacy)
2. Effective use of digital tools in communication (communication skills) such as telephone, email, social media.
3. Ability to analyze and evaluate online contents and sources (critical thinking) etc.
4. Understanding of how to use various devices such as smartphones, tablets, computers (technical skill)

Generally, digital literacy is essential in today's digital world for personal, academic and professional success. As we teach and promote the understanding of scientific concepts and principles (school educator) we should bear in mind the crucial role of fostering scientific literacy and inspirations of future generations of scientists.

Simply put, digital literacy is the ability to access the computer/mobile/internet for our day-to-day activities. It entails being connected with others through the internet and being able to use digital tools and technologies to work, learn and interact. It is essential in today's world for both personal and professional success, as it enables individuals to participate fully in society and the economy.

**21st Century Skills**: Twenty first (21st) century refers to the current century in the Gregorian calendar spanning from January 1, 2001 to December 31, 2100. It is characterized by significant advancement in technology, globalization and social change. The century is marked with remarkable features such as:

- Digital revolution which is the era of rise in smartphones, internet and digital communication which has transformed how people connect and access information
- Environmental awareness marking growing recognition of climate change, environmental issues and movement for sustainability
- Health innovation which is characterized by the use of sophisticated machines
- Globalization which entails enhanced communication and cultural exchange.

It is marked by both challenges and opportunities as societies adapt to a rapidly changing world. The skills associated with this century are knowledge and attitudes for 21st century success. It is life-long skill.

**What is then the link between the three?**

Looking at the three keywords, it then means that they are inter connected in that by integrating digital literacy into science education, educators equip students with the tools to tackle real-world problems. Also, emphasizing 21st century skills ensures that students are not only knowledgeable in science but also capable of applying their knowledge in practical, innovative ways.

This link therefore creates a holistic educational approach that prepares students for future academic and career success in a rapidly evolving technological landscape, ensuring that students are well-equipped to face future challenges in both scientific and everyday contexts.

## SCIENCE EDUCATOR AND DIGITAL LITERACY

In Nigeria, the role of a science educator is evolving as digital literacy becomes increasingly crucial for both teaching and learning in the 21st century. The role of Science Educators in the 21st century is multifaceted and increasingly important due to rapid advancements in technology and shifts in educational paradigms.

Technological proficiency is not the only requirement for science educators but how to effectively integrate technology into their teaching to enhance student engagement and learning outcomes. This goes to show that the current knowledge is from "how much" to "how well" to "how useful". In our rapidly evolving world, digital literacy has become a fundamental skill. It is not just about using technology; it is about understanding how to navigate and create information using digital tools. As educators, we have various roles, such as;

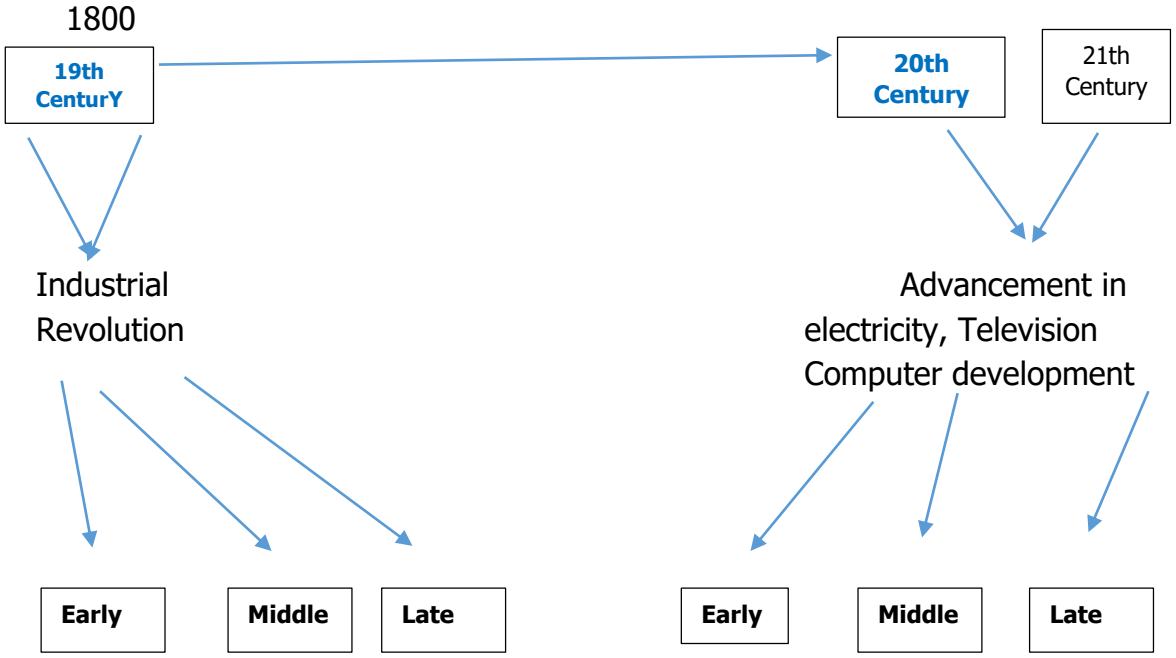
- Facilitating inquiry-based learning
- Promoting collaboration
- Promoting critical thinking and problem solving skills
- Encouraging responsible digital citizenship

This shows that the 21st century science educator must possess information literacy, media literacy and technology literacy to navigate the digital world safely and efficiently.

**The question is: Are the science educators ready and equipped for this?**
While we ponder over this, we know that there is progress but numerous challenges still remain as will be discussed here.
To empower science educators through digital literacy, we must:

1. **Institutionalize Digital Pedagogy** in Teacher Education:
   Colleges of Education and Faculties of Science Education must embed digital tools in teacher training programmes, which is integrating various digital applications into a website such as maps, calculators, chartbots, ……...
2. **Design National Science EdTech Frameworks**:
   Create policies that mandate and guide the use of EdTech in science classrooms, especially for WAEC and NECO-aligned curricula.
3. **Strengthen Capacity Building for Teachers**:
   Launch continuous digital upskilling programs tailored to science teachers, including training in data analysis, coding, and virtual experiments.
4. **Encourage Local Content Development**:
   Let Nigerian science educators create culturally relevant, digitally accessible content such as online museums and virtual tours, YouTube channels(Ted-Ed) videos on history, interactive storytelling Apps.
5. **Ensure Inclusion**:
   Deliberately design digital literacy policies that reach teachers and students in underserved communities such as those in rural areas, low-income urban neighborhoods, older adults, people with disabilities, Refugees and immigrants, …….

**Let us look at the times and seasons in technological development with a view to situating the 21st Century in the course of time. That brings us to the sketch, as represented in Figure 1 below:**



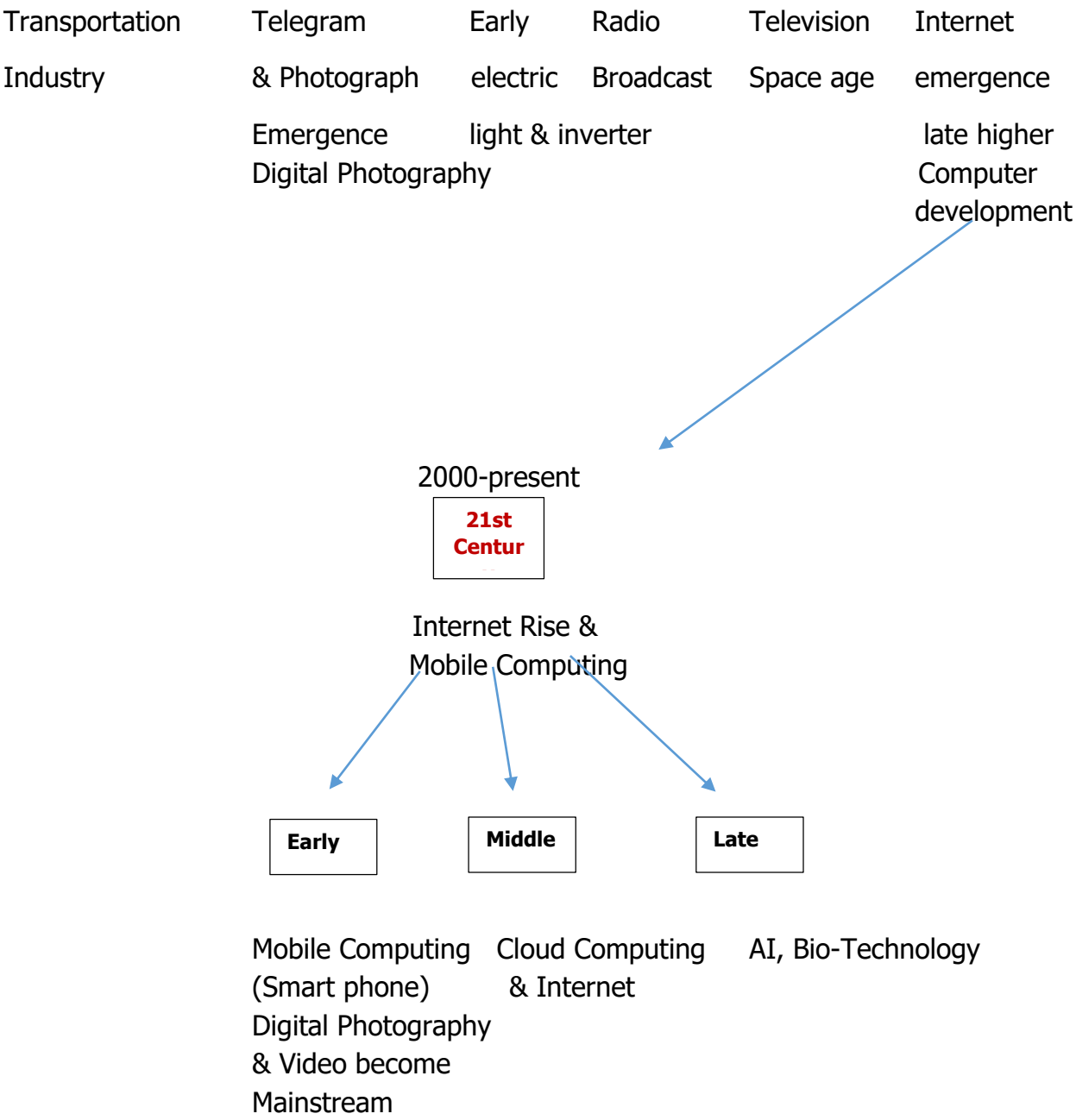



Figure 1 clearly illustrates the different times and seasons right from the 19th Century through to the end of the 1st Quarter of The 21st Century. We have moved from the Industrial Revolution at the close of the 19th Century(1800) through the Computer Revolution of the 20th Century(1900), Dominated by the Internet Revolution, giving way to the 21st Century(2000 – Present) that has increasingly been the theatre of information boom, supporting the knowledge economy, growing into the connected economy of the 4th Industrial Revolution that is gradually increasing into the Artificial Intelligence Revolution, clearly dominating the space as we approach the 2030s.

## INTEGRATION AND EFFECTIVE USE OF TECHNOLOGY FOR THE 21ST CENTURY CLASSROOM

In the profession of teaching, technology has the potential to transform teaching and learning for students; however, many schools do not take full advantage of or are unaware of the many opportunities to improve teaching and learning through effective technology integration. The majority of elementary teachers are uninformed of effective ways to integrate technology and how

to incorporate 21st century skills into lessons with technology, resulting in many elementary teachers utilizing technology haphazardly without any direction on how to successfully incorporate technology into daily lessons (Ally, 2008).

Technology can provide an effective way to teach and reinforce 21st century skills. Incorporating technology and 21st century skills while teaching not only provides a time efficient method of integrating both areas, but also provides students with lessons more representative of actual jobs.

Technology has transformed educational practices, making learning more engaging, interactive and effective. We have strategies for successful technology integration in education and challenges.
An effective method of integrating technology into the classroom is by utilizing technology as a tool to incorporate 21st century skills. Twenty-first century skills such as collaboration, problem solving and critical thinking, creativity, and technological literacy are all vital for students to practice, so that they will be well-prepared as they enter society. Problem-based learning, multi-user virtual experiences, mixed reality experiences, blogs and Twitter are all ways to integrate these skills and technology into the classroom.

To fully prepare students for later school, higher education, and the workforce, it is imperative that schools begin to introduce and encourage 21st century skills. There are many different methods of teaching with technology while integrating 21st century skills. Some methods of teaching with technology and 21st century skills build on previous methods of teaching, updating methods to include the use of technology, such as problem-based learning (PBL) and small group work updated to include the use of the interactive whiteboard (IWB). Other methods are new practices, having been solely utilized in conjunction with technology. Some methods utilized solely with technology are multi-user virtual environments (MUVEs), mixed reality experiences, and Twitter and blogging.

We have a duty to ensure that all of our students have an appropriate familiarity with the technology that is so rapidly remaking the world. The new teaching methods used in place of traditional methods are:

- ✓ Student-centred learning: a) inquiry-based learning. b) project-based learning, c) personalized learning.
- ✓ Active engagement and collaboration: a) collaborative learning, b) flipped classroom, c) experiential learning, d) gamification.
- ✓ Technology integration: a) blended learning, b) digital literacy, c) using technology to personalize learning.
- ✓ Fostering 21st century skills: a) critical thinking, b) problem-solving, c) collaboration
- ✓ Modern teaching practices

Through technology, learning takes place throughout the day, both in and out of school, which impacts positively on the learners. Learning can take place anytime, anywhere and anyplace.

In using technology, one must:

- Be flexible with location and duration: use technology to vary the pace and space used to make learning more engaging and conduct virtual visits to other places using interactive internet resources.

- Make learning more mobile: make use of mobile technologies such as mobile phones, GPS, data bloggers and handheld computers.
- Support the use of social networks technology to allow learners to collaborate safely and responsibly in the creation and management of their own learning.
- Create learning platforms: enable access to your study materials at any time using learning platforms and virtual learning environments.
- Engage in wider audience: learn from other institutions through video conferencing and social networks. Allow learners as creators of content to present to a wider and authentic audience.
- Use learners' technical expertise: listen to what learners have to say about technology, how they use it in their day to day lives, and it helps their learning.

Different teaching methods

1. What does it take to be a science teacher in the 21st century world?
   The science teacher should be able to use digital tools and resources to enhance learning (Simulation, online labs). He/she applies diverse teaching strategies to accommodate different learning styles. They are Digital Gurus, Adaptive workers, Champion Collaborators, Innovative Thinkers, Lifelong learners and Influencers.
2. What does 21st century learning entail? What are the 21st century skills? These encompasses a broad set of skills, knowledge and competencies that prepare students for success in a rapidly changing world. Such skills include critical thinking and problem solving, collaboration, technology literacy, creativity and innovation
   The impact of the rapid change in society to education is that education should prepare generation to have a certain skill needed by the society. These skills are called 21st century skills. Partnership for 21st Century Skills consist of life and career skills, learning and innovation skills, and information media and technology skills (Primastuti & Atun, 2018).

In Nigeria, **Where Are We Now?** we have witnessed important steps toward integrating digital tools into education, including:

- The launch of programme to integrate ICT into educational system.

- Distribution of devices to schools under UBEC's digital education initiative.
- Government and private-led teacher training programs in ICT.
- Community programmes like NGOs and private sector initiatives as they organize workshops, seminars and community outreach programmes. Some of the NGOs like NERDC (Nigerian Educational Research and Development Counsel) , ADF(African development foundation)

Let us celebrate some **positive trends and strides**:

- The emergence of **virtual science labs** that simulate experiments at a fraction of the cost of physical labs.
- Development of **teacher-friendly platforms** like Google Classroom, Zoom, and WhatsApp for interactive science lessons.
- Use of **augmented reality (AR) and gamification** to make complex science concepts like genetics, astronomy, and electricity more engaging.
- The rise of **teacher influencers and digital science educators** on platforms like YouTube and TikTok, who are inspiring new ways to teach and learn.

## DEVELOPING 21ST CENTURY SKILLS IN LEARNERS

There is need for radical shift in thinking, perception and behavior. As educators, we want to help our students understand, identify and form their mental habits and expand their learning potential.

**21st century learners could be developed through:**

- Encouraging the learners to engage on real-world projects that require critical thinking and problem-solving known as Project-based Learning(PBL). For instance, students could be assigned a project to investigate an environmental impact. Students can also collaborate by working in teams.
- Through integrating subjects to show connections between disciplines. This enhances creativity and critical thinking among learners.
- Teach students how to use digital tools and resources in lesson through technology integration.
- Encouraging collaboration among the learners by creating group assignments that require teamwork and collective problem-solving. It will give them opportunities for brainstorming to bring in their creativity
- Expose them to flexible learning environment where there is allowance for different learning styles, where they can collaborate, use blended learning model that combine online and face-to-face instruction.

These expose and prepare the learners for the complexities of the 21st century.

## CHALLENGES AND SOLUTION

**In** Nigeria today, many science educators are aware of 21st century skills and prepared to teach the skills but are faced with so many challenges.

1. Infrastructure, Technical issues and Access: Limited access to technology and reliable internet connectivity can be a barrier to effective use of digital literacy in Nigeria. Ensuring that all students have access to devices could be difficult. Also hardware malfunctions can disrupt the learning process.

2. Teacher Training: Lack of support and training for science educators is a barrier. Teachers may need training to effectively integrate the 21st century technology into their teaching practices.
3. Digital Divide: Not all students have equal access to technology, creating a gap in opportunities and outcomes.
4. Power: unstable power supply.
5. Distractions: Digital devices can be distracting, leading to decreased focus and productivity.
6. Resource Constraints: Many challenges of accessing modern technology are faced by many schools.
7. Cyber security and Social dynamics: Digital classrooms are vulnerable to cyber threats, compromising student data and safety.
8. Teaching Knowledge: Resistance by some teachers.
9. Poor Internet: Unreliable internet connections and cost.
10. Speed of change: integration of old and new methods of teaching.
11. Sociological concerns and Policy support: Government policies and funding initiative is not there, fundamental rights (policy design/implementation).
12. Curriculum Limitation: Existing curriculum might not have integrated the needed skills thereby limiting the integration.
13. Misuse of AI

**Way Forward/ Recommendations**

In Nigeria, empowering science educators for digital literacy for 21st century entails:

1. Professional Development/Teacher training: Provide teachers with ongoing training and support to develop their digital literacy and teaching skills.
2. Infrastructural Development: Invest in robust infrastructure, including reliable internet connectivity and devices, to support digital learning. Also Provision of strong internet connectivity instead of relying on one internet source only, diversification of connection may help.
3. Digital Equity: Implement strategies to address the digital divide, such as device lending programs or internet access initiatives.
4. Blended Learning: Combine traditional teaching methods with digital tools to create a balanced and effective learning environment.
5. Digital Citizenship Education: Integrate digital citizenship education into the curriculum to teach students about responsible digital behavior.
6. Continuous Monitoring and Evaluation: Regularly monitor and evaluate the effectiveness of digital classroom initiatives and make adjustments as needed.
7. Collaboration and Partnerships: Foster partnerships between schools, industry, and community organizations to leverage resources and expertise.
8. Keep students safe online: Address security concerns using different techniques- create e-portfolios, group chat, and etc.
9. Address incessant disruption of power supply: There is need to have a back-up power supply.
10. Community involvement in educational initiatives to create a robust support system for student is needed.

## CONCLUSION

The educator's ability to adapt to technological advancements, promote inclusive practices and foster critical thinking will significantly impact students' engagement with Science and their understanding of the world.

Technology provides students with easy-to-access information, accelerated learning, and fun opportunities to practice what they learn. It enables students to explore new subjects and deepen their understanding of difficult concepts.

Technology should not just replicate what we do already; it should offer new ways of working and offer learners new ways of interacting with information and gaining knowledge, understanding and skills.

In conclusion, embracing digital literacy for science educators is essential to equip students with the skills they need to thrive in the 21st century. By effectively integrating technology in their teaching, they can create more engaging and effective learning experiences that prepare students for the challenges and opportunities of the future.

One key word to take home is that 21st century science teacher is not just a transmitter of facts, but a designer of learning experiences.

Digital literacy is the bridge that will connect our teachers and learners to global knowledge, prepare them for future careers, and empower them to solve real-world problems with creativity and confidence. By promoting digital literacy and developing 21st century skills, we can prepare ourselves for the challenges and opportunities of the future (Science Resource 2023)

Let us not wait for the future. Let us **equip our science educators now**—with the skills, tools, and mindset needed to thrive in this digital age. As we encourage digital literacy in our classroom, our students will be empowered to become not only knowledgeable scientists but also informed citizens capable of contributing to our society.

Together, we can transform science education in Nigeria—and prepare a generation of learners ready for discovery, innovation, and leadership.

Once again I welcome every one of you to the Maiden Annual Conference of Association of Science Educators, Anambra(ASEA) holding here in Awka. I am strongly convinced that the recommendations arising from this conference with the caliber of scholars here present will go a long way in addressing the current concern about technology integration.

**THANK YOU**

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