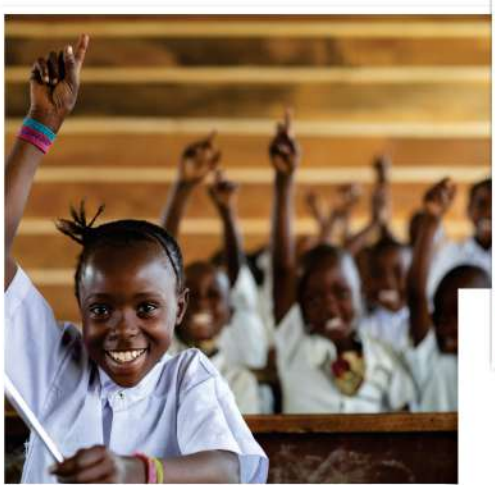
2025 Electronic Book (E-Book) of Association of Science Educators Anambra (ASEA)

http://jisepublications.org

INNOVATIVE STRATEGIES FOR TEACHING VOCATIONAL, SCIENCE, TECHNOLOGY AND MATHEMATICS EDUCATION: CLASSROOM PRACTICES



PROF. JOSEPHINE N. OKOLI

INNOVATIVE STRATEGIES FOR TEACHING VOCATIONAL, SCIENCE, TECHNOLOGY AND MATHEMATICS EDUCATION: CLASSROOM PRACTICES

PROF. JOSEPHINE N. OKOLI

INNOVATIVE STRATEGIES FOR TEACHING VOCATIONAL, SCIENCE, TECHNOLOGY AND MATHEMATICS EDUCATION: CLASSROOM PRACTICES

EDITOR
PROF. JOSEPHINE N. OKOLI

INNOVATIVE STRATEGIES FOR TEACHING VOCATIONAL, SCIENCE, TECHNOLOGY AND MATHEMATICS EDUCATION:

CLASSROOM PRACTICES

A publication of Association of Science Educators Anambra (ASEA)

Printed in Nigeria in the year 2025 by:

Love Isaac Consultancy Services
No 1 Etolue Street, Ifite Awka, Anambra State, Nigeria
+234-803-549-6787, +234-803-757-7391

ISBN: 978-978-695-938-2

Copyright

PREFACE

The electronic book (e-book) acknowledges that traditional methods in Vocational, Science, Technology and Mathematics Education: Classroom Practices may not be sufficient to equip students with the necessary skills for a rapidly evolving technological landscape.

Therefore, it advocates for the adoption of Innovative teaching approaches that promote a more dynamic and effective learning experience.

Prof. Josephine N. Okoli
Faculty of Education,
Science Education Department,
Nnamdi Azikiwe University Awka, Anambra State, Nigeria.

TABLE OF CONTENT

FOREWORD

This book entitled "**Innovative Strategies for Teaching Vocational, Science, Technology and Mathematics Education: Classroom Practices",** is a book of readings on various innovative classroom pedagogies. It is a welcome literature for Education System and a very important resource book for teachers who are functioning in the disciplines of Vocational Education, Science, Mathematics and Technology education and training. It is a compendium of most of the **active learning strategies** aimed at producing graduates who have been prepared for adaptation to the conditions of the 21st century world of fluidity. The 21st century world accommodates soft skills which the individual can edit from time to time as the conditions of socio-cultural, economic and technological environments change constantly and uncontrollably. A century in which cross-border job openings are important means of employment, a century where attitude is more important than subject-based excellence, a century where collaboration, innovation and creativity are irreducible demands by employers of labour, a century where adaptive skills are critical for entrepreneurship, creation of jobs and wealth.

All categories of teachers at all levels of education would find this resource book interesting and professionally helpful for their teaching practice. Because conditions of the modern world are in perpetual flux, teachers have to re-skill in order to produce adaptive graduates and the era of lecture method is literally over. It is these modern innovative instructional strategies that would enable teachers to produce such graduates who would survive and then succeed in the 21st century global economy.

This book would also be very useful to researchers and innovators in the envisioned pedagogic paradigm shift of this era. I therefore, proudly recommend this book, a compendium on innovative pedagogies to all classes of teachers and researchers on pedagogies and curriculum reforms in the modern era.

Prof. Zephrinus C. Njoku
Faculty of Education,
Science Education Department,
University of Nigeria, Nsukka, Nigeria.

BIODATA OF CONTRIBUTORS

Chika M. Okonkwo is a staff of Chukwuemeka Odumegwu Ojukwu University, Igbariam, Anambra State, Nigeria. She obtained her M.ed in measurement and evaluation from Imo state university, Nigeria. Currently she is a PhD student in measurement and evaluation from Michael Okpara University of Agriculture Umuahia, Abia State, Nigeria. She is a researcher who have contributed in some Journals. Chika M. Okonkwo has attended conferences and workshop. She is a member of learned societies such as Teachers Registration Council of Nigeria (TRCN) and Association of behavioural Research Analysis and Psychometricians (AB-ReAP).

Mrs Anaekwe Grace U. (MSTAN) is a lecturer at Federal College of Education (Technical) Umunze, Anambra State. She attended Girls High School Uga (1983). She later proceeded to Federal College of Education (Technical) Umunze, Anambra State where she obtained her National Certificate in Education (NCE) in Home Economics in 1995. Mrs Anaekwe continued with her academic pursuit at Nnamdi Azikiwe University, Awka, Anambra State, where she got her Bachelor's Degree in Education (B.ed) in Adult / Health Education in 2003. At University of Nigeria Nsukka, she bagged her Masters in Education (M.ed) in Public Health in 2017. She had attended many conferences with paper presentations. She belongs to many professional bodies including Teachers Registration Council of Nigeria (TRCN), Science Teachers Association of Nigeria (STAN). Mrs Anaekwe Grace is married and the marriage is blessed with many children.

Obiefuna, Grace Chigozie is a Biochemistry graduate. She holds a Post Graduate Diploma in Education with Master's degree in Biochemistry and a lecturer at Federal College of Education (Technical) Umunze, Anambra State. She is a successful academician with an ample wealth of knowledge and skills in teacher training techniques, writing and explaining innovative ideas on education related issues in order to motivate others. Grace has written and published many Journal articles in education and health niches. She finds it fulfilling attending conferences, seminars, and workshop; so as to become more relevant in her field of study and career. She is a member of professional bodies such as Science Teachers Association of Nigeria (STAN), Teachers Registration Council of Nigeria (TRCN) and was recently certified by La Plage Mata Verse, an international institute, as an educator with skills in the use of artificial intelligence for curriculum development.

Ekpenyong Effiong Ibok is a lecturer in Department of Mathematics and Computer Science Education, Faculty of Science Education, University of Calabar, Calabar. He obtained Ph.D in Mathematics Education from University of Calabar. He is a qualified Licensed Teacher with publications in International and National Journals, a registered member of Teachers Registration Council of Nigeria (TRCN), Mathematical Society of Nigeria (MSN) and Mathematical Association of Nigeria (MAN). Dr. Ibok is a Mathematics pedagogy, Research consultant and Data analytics.

Idaka Etta Idaka is a lecturer in the Department of Curriculum and teaching University of Calabar, Calabar. She obtained PhD in Curriculum Studies, Elementary Education from University of Calabar. She is a qualified Licensed Teacher with publications in International and National Journals, a registered member of Teachers Registration Council of Nigeria (TRCN), Curriculum Organization of Nigeria (CON). World Council for Curriculum and instruction (WCCI).

Iwuala Patricia Ebere Chilebe is a lecturer in the Department of Curriculum & Teaching University of Calabar, Calabar. She had her PhD from Abia State University Uturu. She has many publications in International and National Journals published to her credits. As a trained teacher, she's registered with Teachers Registration Council of Nigeria (TRCN), a member of Curriculum Organization of Nigeria (CON).

Nweke Phina Amaka is a lecturer in the Department of Educational Foundations. School of Education, Federal College of Education (Tech) Asaba, Delta State. She obtained her M.ED in Educational supervision and planning from the National Open University of Nigeria in the year 2017. She is a member of Teachers Registration Council of Nigeria (TRCN), Nigerian Association for Educational Administration and Planning (NAEAP). She has made contributions in many chapters in a book and journals. She has attended conferences where she has presented papers.

Emmanuel C. Onyekwe is a lecturer in the Department of Educational Foundations, School of Education, Federal College of Education (Technical), Asaba, Delta State, Nigeria. He obtained his M.Ed in Educational Administration from Delta State University Abraka, Delta State Nigeria, in the year 2010. He has contributed in book chapters and Journals. He is a member of some learned societies such as Philosophical Association of Nigeria (PEAN) and Teacher's Registration Council of Nigeria (TRCN).

Iwenzu Ngozi Caroline is a lecturer in the department of educational foundation in school of Education, Federal College of Education (Tech) Asaba, Delta state. Mrs Ngozi has contributed in some books chapters, journals and also attended conferences where she has presented papers. She is a member of learned societies such as Teachers registration council of Nigeria (TRCN), Nigerian Association for Educational Administration and planning (NAEAP), and Association of Educational management and policy practioners (AMEAPP).

Uloaku. V. Egbuchiwe is a lecturer in the Department of Educational Foundations, school of Education, Federal College of Education (Technical) Asaba, Delta State, Nigeria. She obtained her M.Ed in Education Management and planning from Imo state university, Owerri in the year 2023. She is a seasoned scholar who has contributed in many book chapters and journals. She has attended conferences where she has presented papers. She is a member of Teachers Registration Council of Nigeria (TRCN), Nigerian Association for Educational Administration and planning (NAEAP).

Regina Ijeamasi Enebechi is a lecturer in the Department of Science Education, Nnamdi Azikiwe University, Awka. She holds a Ph. D in Science Education/ Biology from the University of Nigeria Nsukka, she has a multidimensional experience in research. She is a seasoned scholar and a prolific writer who has authored many articles in reputable local and international journals, published many textbooks and contributed in many book chapters. She is a member of editorial board of many local and international journals. She has been actively involved in both conducting and reviewing academic work. She has produced many science teachers and educators with various degrees (NCE, B.Sc(Ed) and M.Sc(Ed) who are currently teaching at primary, secondary and tertiary levels of education. She is a member of science teachers association of Nigeria (MSTAN), Member Teachers' Registration Council of Nigeria, Fellow Corporate Administrative Institute (FCAI). Dr. Enebechi has received so many awards.

Ehumadu Rophina Ifeyinwa Chima is a lecturer in the department of Home Economics Education, Federal College of Education (Technical), Umunze. She obtained her Ph.D in Home Science Education from the department of Agricultural/ Vocational Education, Micheal Okpara University of Agriculture, Umudike in the year 2021. She has to her credit published articles in reputable journal sites. Dr. Ehumadu Rophina Ifeyinwa Chima has attended conferences where she has presented papers. She is a licensed teacher with teacher registration council of Nigeria (TRCN) and a member of Home Economics professional association of Nigeria (HPAN).

James C. Ogoke is a lecturer in the Department of mathematics, School of Sciences, Alvan Ikoku University of Education Owerri, Imo State, Nigeria. He obtained his PhD in Mathematics Education from Nnamdi Azikiwe University, Awka, Anambra State in Nigeria in the year, 2022.

He is a seasoned scholar who has contributed in many book chapters and journals. Dr. Ogoke to his credit, has attended conferences where he has presented papers. He is a member of many learned societies such as Teachers Registration Council of Nigeria (TRCN), Science Teachers Association of Nigeria (STAN), Mathematics Association of Nigeria (MAN), Science Educator Association of Nigeria (SEAN).

Tina Uchenna Otumegwu is a lecturer in the Department of Educational Psychology, Guidance and Counseling, Federal College of Education (Technical), Omoku, Rivers State, Nigeria. She holds a Ph.D. and M.Ed. in Measurement and Evaluation from Imo State University, Owerri, and a B.Sc. (Ed.) in Mathematics from the University of Nigeria, Nsukka. She has several years of teaching experience at the secondary school level in Imo State and worked as an examiner for the West African Examinations Council (WAEC) and the National Examinations Council (NECO) for seven years. Dr. Otumegwu has published widely in both local and international journals and has contributed chapters to academic books. She has also presented papers at various academic conferences. She is a member of several professional bodies, including TRCN, ASSEREN, and IAIIEA.

Achugamonu Pius Chukwuma is a lecturer in the Department of Mathematics Education in Faculty of Science Alvan Ikoku Federal University of Education Owerri, Imo State. He obtained his PhD in statistics from Imo State University Owerri, Imo State. He is a seasoned lecturer who collaborated with others in production of different textbooks in his area and courses in mathematics education too. He has presented papers in different conferences, Journal publications and in chapter contributions too. Currently he is a member of World Bank Analytics fellowship committee in community development in Nigeria. Achugamonu Pius C**.** had run so many programs with the world Bank Analytics fellowship.

Nwankwo Glory U is a lecturer in the Department of Integrated Science Education, School of sciences, Federal College of Education (Technical) Umunze, Anambra State, Nigeria. She is a graduate of Science Education (Integrated science option), holds a Master's degree and PhD in same option. She is a certified educator with skills in leading health, safety and environment and an experienced scholar who has co-authored numerous textbooks, contributed in many book chapters and journals. To her values, Dr. Nwankwo has attended a lot of conferences, seminars, and workshops so as to boost her career. She is a member of many professional associations such as Teachers Registration Council of Nigeria, Science Teachers Association of Nigeria (FSTAN – membership).

Suleiman Dambai Mohammed is a Reader in Science Education Department of Science Education Faculty of Education Federal University of Lafia, Nasarawa State. I obtained my Ph.D in University of Abuja-Nigeria in 2016. I'm a registered member with STAN; TRCN; and National Research Institute (NRI).I have over 30(thirty) publications in National and International Journals; Text books and Chapter contributions in both Local and International. I'm married with children.

Perekeme Peresuode is a lecturer in the Department of Mathematics, School of Science, College of Education, Warri, Delta State, Nigeria. He obtained his PhD in Mathematics Education from Nnamdi Azikiwe University, Awka, Anambra State, Nigeria, in 2024. He is a seasoned scholar who has contributed to many book chapters, proceedings, and journals. Dr. Perekeme has also attended conferences where he presented papers. He is a member of several learned societies, including the Mathematical Association of Nigeria (MAN), Teachers' Registration Council of Nigeria (TRCN), Science Teachers Association of Nigeria (STAN), Nigerian Mathematical Society (NMS), Computer Science Association of Nigeria (COAN), Association for the Promotion of Academic Researchers and Reviewers (APARR), Nigeria Statistical Association (NSA), Forum for Academic and Educational Advancement, and the Association of Science Educators Anambra (ASEA).

Ifeoma B. Okafor is a lecturer in the department of Biology Education, School of Sciences, Federal College of Education (Technical), Umunze Anambra State, Nigeria. She obtained her Ph.D. in Science Education (Biology) from Nnamdi Azikiwe University, Awka, Anambra State, Nigeria. She is a seasoned scholar who has co-authored numerous textbooks, contributed in many book chapters and journals. She is a member of the editorial board of Anambra State STAN Journal. Dr. Ifeoma Blessing Okafor to her credit has attended seminars, workshops and conferences where she has presented papers. She is a member of many learned societies such as Teachers Registration Council of Nigeria (TRCN), Organisation of Women in Science for the Developing World (OWSD), Women in Colleges of Education (WICE) and Fellow, Science Teachers Association of Nigeria (FSTAN). She is the National Secretary STAN Basic Science Panel Junior. She is also the treasurer of STAN Anambra State Chapter.

Chukwuma C. Ekechukwu a lecturer in Biology Department, School of Secondary Education (Science), Federal College of Education (Technical), Asaba, Delta State, Nigeria. He is currently a post graduate student at Chukwuemeka Odumegwu Ojukwu University, Igbariam, Anambra State, Nigeria.

Caroline I. Okorie is a lecturer in the Department of Computer Science Education. Faculty of Education and Arts Madonna University Nigeria Okija, Anambra State. She obtained her Ph.D in Education Measurement and Evaluation from Imo State University (IMSU) in Nigeria in the year 2017. She is a seasoned scholar who has contributed in many Book chapters and Journals. Dr. Okorie to her credit, has attended conferences where she has presented papers. She is a member of many learned societies such as: Association for Academic Review and Development (AARD) African Journal of Science Technology and Mathematics Education (AJSTME) Association of Education al Researchers and Evaluators of Nigeria (ASSEREN) Primary and Tertiary Teacher Education Association of Nigeria (PATTEAN).

Tukur Madu Yemi is a distinguished academic in Mathematics Education at the Federal University of Kashere, Gombe State, Nigeria. With over two decades of experience in teaching, research, and academic leadership, he has made significant contributions to the advancement of mathematics education and educational policy in Nigeria. He earned his Ph.D in Mathematics Education from Universiti Utara Malaysia (UUM), a globally recognized institution renowned for its academic innovation and excellence. His research interests include mathematics pedagogy, curriculum development, educational research methodology, and higher education reform. Dr. Yemi has served in various academic and administrative capacities, including Deputy Dean, Head of Department, and Chair of several university committees. He actively mentors both undergraduate and postgraduate students and has published widely in reputable national and international Journals. Beyond academia, he is a committed public intellectual who contributes regularly to national discourse through opinion pieces in leading Nigerian newspapers. Notable among his recent writings are:

"Delayed Salary Payment for Nigerian University Staff: A Matter of Urgency and Dignity"

"The Almajiri Crisis: Rethinking Education for Northern Nigeria"

"Time Management in Academic Research: A Guide for Postgraduate Students"

Dr. Yemi is a frequent participant in national and international conferences, where he shares research-based insights on improving educational access, quality, and governance.

Emmanuel C. Nwigboji is a lecturer in the Department of Science Education, Alex Ekwueme Federal University, Ndufu-Alike, Ebonyi State, Nigeria. He holds a Master's degree in

Mathematics Education from Nnamdi Azikiwe University, Awka, Anambra State, which he obtained in 2017. He is currently pursuing his Ph.D. in Mathematics Education at the same institution. A dedicated scholar and researcher, Mr. Nwigboji has made significant contributions to academia through his authorship of numerous book chapters and scholarly journal articles. He has actively participated in academic conferences, where he has presented insightful papers on contemporary issues in science and mathematics education. Mr. Nwigboji is a registered and active member of several professional and academic bodies, including the Teachers Registration Council of Nigeria (TRCN), the Science Teachers Association of Nigeria (STAN), the Mathematical Association of Nigeria (MAN), and the Science Educators Association of Nigeria (SEAN). His commitment to advancing science and mathematics education in Nigeria underscores his professional engagements and academic endeavors.

Uzoamaka Chimuanya Okafor-Agbala is a lecturer in the Department of Science Education, Nnamdi Azikiwe University, Awka, Anambra State, Nigeria. She obtained her PhD in Mathematics Education from Nnamdi Azikiwe University, Awka, Anambra State in Nigeria in the year 2023. She has to her credit published articles in reputable Journal sites. Dr. Okafor-Agbala have attended conferences where she has presented papers. She is a licenced teacher with Teachers Registration Council of Nigeria (TRCN) and a member of Science Teachers Association of Nigeria (STAN).

John B. Moses is a lecturer in the Department of Science Education, Faculty of Education, Niger Delta University, Wilberforce Island, Bayelsa State, Nigeria. He obtained his PhD in Science Education from Nnamdi Azikiwe University, Awka, Anambra State, Nigeria. He is a seasoned scholar who has contributed in many book chapters and journals. Dr. Moses to his credit has attended many conferences where he has presented papers. He is a member of many learned societies such as Teachers Registration Council of Nigeria (TRCN), Science Teachers Association of Nigeria (STAN).

Tamaraudeiyefa Tobi is a Post Graduate student in the Department of Science Education, Faculty of Education, Niger Delta University, Wilberforce Island, Bayelsa State, Nigeria.

Madu Cletus Ifeanyi is a lecturer in Department of Mathematics FCE(T), Bichi. Obtained PhD in Pure Mathematics from ABU Zaria. He is a qualified Licensed Teacher with publications in International and National Journals, a registered member of Teachers Registration Council of Nigeria (TRCN), Mathematical Society of Nigeria (MSN) and Mathematical Association of Nigeria (MAN).

Abur Cletus Terhemba is a lecturer in the Department of Mathematics, Federal College of Education (Technical) Bichi Kano State Nigeria. He obtained his Masters Degree in Mathematics Education from Benue State University Makurdi, Nigeria in the year 2018. He has to his credit published articles in reputable journal sites. Mr. Abur Cletus Terhemba has attended conferences where he has presented papers. He is a licensed teacher with Teachers Registration Council of Nigeria (TRCN) and a member of Mathematical Association of Nigeria (MAN).

Maxwell Chukwunazo Obikezie is a distinguished academic who lectures at the Department of Science Education, Nnamdi Azikiwe University, Awka. He is an active member of the Science Teachers' Association of Nigeria (STAN) and holds a valid registration with the Teachers' Registration Council of Nigeria (TRCN), reflecting his commitment to professional excellence and ethical standards in teaching. A prolific scholar, Dr. Obikezie has authored numerous articles and book chapters in the fields of chemistry, chemistry education, science education, and general education. His research work is widely recognized in both domestic and international academic circles, and he has attended many conferences globally, where he has presented and published papers on various educational and scientific topics. In addition to his research and teaching

pursuits, Dr. Obikezie is a reputable reviewer and editor for several scholarly journals, contributing significantly to the advancement of scientific and educational scholarship. He is known for his expertise as a sound chemistry teacher and a dedicated researcher, with a focus on improving science education and fostering innovative teaching methodologies. His dedication to academia, research, and teacher development makes him a highly respected figure in the fields of chemistry and science education.

Fadip Audu Nannim is a Postdoctoral Research Fellow at the University of the Free State, Bloemfontein, South Africa, and a Lecturer in the Department of Computer and Robotics Education at the University of Nigeria, Nsukka. He earned his Ph.D. in Computer and Robotics Education from the University of Nigeria, Nsukka. Dr. Nannim is a dedicated scholar with a strong publication records, having co-authored textbooks and numerous peer-reviewed journal articles. He serves as a reviewer and editor for various local and international academic journals. Dr. Nannim is an active member of several professional bodies, including the Teachers Registration Council of Nigeria (TRCN), the Computer Educators Association of Nigeria (CEAN), the South African Education Research Association (SAERA), and the Nigerian Institute of Management (NIM) Chartered.

Moeketsi Mosia is Associate Professor and ETDP-SETA Research Chair in Mathematics Education at the University of the Free State, where he also serves as Vice-Dean: Teaching & Learning. A leading scholar of mathematics education and higher-education policy, he sits on the ministerial task team drafting a national "teaching mathematics for understanding" framework, the Umalusi Assessment Standards Committee, and the CHE Accreditation Committee. Formerly Director of the UFS Centre for Teaching and Learning and Head of Natural Science Teaching at Sol Plaatje University, Prof Mosia pairs rigorous research with strategic leadership to advance mathematics teaching, curriculum quality, and student success across South Africa.

Maria Tsakeni is an Associate Professor and Head of the Mathematics, Natural Sciences and Technology Education Department in the Faculty of Education at the University of the Free State in South Africa. She is an NRF (South Africa) C2 rated researcher. Her area of research is in instructional and curriculum innovations in STEM classrooms. She is a member of the SAARMSTE and SAERA conferences, and she was the Chairperson of the Local Organising Committee for SAARMSTE 2023. She was also a member of the SAERA 2024 Local Organising Committee. She attends international conferences such as the ESERA, IOSTE, ECE, AERA and WERA.

Stephen Chinedu Nwafor is currently a postdoctoral Research Fellow in the Department of Mathematics, Natural Sciences, and Technology Education at the University of the Free State's Faculty of Education in South Africa. He teaches at Nnamdi Azikiwe University in Awka, Anambra State, Nigeria, in the Department of Science Education. He is a member of the Teacher Registration Council of Nigeria (TRCN), the Science Teachers Association of Nigeria (STAN), and the International Forum of Researchers and Lecturers (IFRL). He has participated in both national and international conferences. His research interests include understanding the psychological aspects of learning among science students, Gender issues in STEM, Pedagogical and technological innovations in STEM, and entrepreneurship in STEM.

Mohammed Idris is a lecturer in the Department of Biology Education, Alvan Ikoku Federal University of Education Owerri, Imo State, Nigeria. He obtained his master's in Science Education from University of Ilorin, Nigeria. He is a seasoned scholar who has contributed in many journals. Mr Mohammed to his credit, has attended a deluge of conferences where he has presented papers. He is a member of many learned societies such as Teachers Registration Council of Nigeria, (TRCN) and Science Teacher Association of Nigeria (STAN).

Abel Idoko Onoja is the current Head of Department of Basic Science, Alvan Ikoku Federal University of Education Owerri, Imo State, Nigeria. He is a Lion and obtained his higher degrees, Ph.D and Master's in Science Education Biology from Benue State University, Makurdi, Nigeria. He is a renowned scholar who has contributed over 40 journal articles to different academic body. Abel Idoko Onoja to his credit, has attended several conferences and workshops where he presented scholarly articles in science education and general science. He has authored many books and contributed many book chapters in edited books and book of readings. He is a licenced teacher and member of many learned societies such as Teachers Registration Council of Nigeria (TRCN), Science Teachers Association of Nigeria (STAN), Curriculum Organization of Nigeria (CON), World Council for Curriculum and Instruction (WCCI), Gender Studies Association of Nigeria (GSAN) and Educational Assessment and Research Network in Africa (EARNIA). As a staunch member of Alvana Volunteer Services, he has facilitated in many community service outreach to enhance the usage of 21st Century Instructional Strategies by Primary and secondary school teachers. Dr Abel Idoko Onoja is a research consultant and member of various Editorial Board such as Alvana Journal of General Studies (AJOGS) and Wukari Journal of Educational studies. The author has a keen interest in the development of science process skills in learner to facilitate the acquisition of knowledge which guarantees academic freedom.

JohnBosco Onyekachukwu Okekeokosisi (MSTAN) is a lecturer in the Department of Computer Science Education, School of Secondary Education (Science), Federal College of Education (Technical) Asaba, Delta State, Nigeria. He obtained his PhD in Computer Science Education from Nnamdi Azikiwe University, Awka, Anambra State, Nigeria. He is a seasoned scholar who has co-authored numerous textbooks, contributed in many book chapters and journals. He is a member of editorial board of many local and international Journals. Dr Okekeokosisi, to his credit, has attended a deluge of conferences where he has presented papers. He is a member of many learned societies such as Teachers Registration Council of Nigeria, Science Teachers Association of Nigeria (STAN) and Association of Science Educators Anambra (ASEA). He is the Vice-Chairman, Science Teachers Association of Nigeria (STAN), Anambra State Chapter.

MaryAnn Chigozie Ofordum is a lecturer in the department of Physical and Health Education in Federal College of Education (Technical), Umunze. Dr. M.C. Ofordum obtained her Ph.D. in Public Health Education from Enugu State University of Science and Technology, Enugu (ESUT) in the year 2021. She has attended many conferences and presented many papers. She has twenty -three journal publications with reputable bodies and has one published textbook. Dr. M.C. Ofordum is a member of many professional bodies such as Teachers Registration Council of Nigeria (TRCN), Science Teachers Association of Nigeria (MSTAN), Nigeria Association for Health Educators (NAHE), Science Educators of Nigeria (MSEAN), Women in Colleges of Education (MWICE) among others.

Odunayo Abigael Bamisebi is a chemistry educator at Sharpstown High School, Houston Independent School District, Houston , Texas, United States. She obtained her Bachelor's degree in Chemistry Education in 2014 and her Master's degree in Chemistry Education in 2018, both from the University of Lagos, Akoka, Yaba, Nigeria. She is a seasoned teacher and educational leader with years of experience across both Nigeria and the United States. She has taught Chemistry, Biology, mathematics, and Integrated Science at the secondary and college levels, and served as a part-time lecturer in Science Education at Awori District College of Education, Ota Campus. Odunayo has made significant contributions to science education. She also served as the STAN COVID-19 Education Project Coordinator, leading a groundbreaking remote learning initiative that impacted over 5,000 students during the pandemic. She has presented papers at conferences and served as a keynote speaker at educational forums. Her interests include inquiry-based learning, blended learning, STEM education, and teacher training. She is a member of several professional bodies, including the Science Teachers Association of Nigeria (STAN), and

has been nominated for the prestigious STAN Fellowship, Teachers Registration Council of Nigeria (TRCN), ROYAL FELLOW member of the International Organization for Academic and Scientific Development (IOASD), member of National Science Teaching Association (NSTA), member National Education Association Texas, member Texas State Teacher Association (TSTA). She is also a passionate advocate for teen empowerment, career development, and spiritual growth among youths.

Nkiru Naomi C. Samuel, a Fellow of Science Teachers Association of Nigeria (Fstan) and a distinguished educator in Chemistry Education, in the Department of Science Education at Nnamdi Azikiwe University, Awka. She has dedicated her life to the pursuit of knowledge and the advancement of science education. She is renowned for her dedication and contribution to education and the broader educational community. Dr. Nkiru Naomi C. Samuel's contributions extend beyond the classroom; she has published numerous journal articles, contributed in several book chapters and delivered many commissioned papers in workshops, seminars cum in-service trainings for secondary school teachers and has attended several professional conferences, shared her insights and expanded her influence in science education both within Nigeria and internationally. Known for her warm personality and commitment to academic excellence, she remains an inspiration to her students and colleagues alike. She is a member of many learned societies such as Teachers Registration Council of Nigeria (TRCN), Science Teachers Association of Nigeria (STAN), Royal Society of Chemistry (RSC), Women in Chemistry (WIC). She is the current Secretary of Science Teachers Association of Nigeria (STAN), Anambra State Chapter.

Melody Otimize Obili is a multifaceted individual currently pursuing a PhD in Science Education with a research focus in Integrated Science at Chukwuemeka Odumegwu Ojukwu University, Igbariam, Anambra State, Nigeria. Beyond her academic pursuit, Melody has a diverse range of skills. She has attended several conferences and contributed to journals. Melody, is currently the secretary of Police Officers' Wives' Association, a member of Teachers Registration Council of Nigeria (TRCN), Science Teachers Association of Nigeria (STAN) and Association of Science Educators Anambra (ASEA).

Prof. Nneka Rita Nnorom is a professor of science education at Chukwuemeka Odumegu Ojukwu University, Igbarim, Anambra State. She was one time Head of department and dean of faculty. She has over 50 publications and members of various educational bodies.

Anyachor Charles N. is a lecturer in the Department of Agricultural Education, School of Agricultural and Home economics Education, Federal College of Education (Technical), Umunze, Anambra State, Nigeria. He obtained his master's degree (M.Sc) in Agricultural Economics from Imo State University (IMSU) Owerri and presently running his doctoral degree (P.h.D) Programme from the same University. He is a seasoned scholar who has co-authored numerous textbooks, contributed in many book chapters and journals. He has also attended and presented papers in a deluge of local and international conferences. Anyachor, C.N is a member of so many professional bodies such as Teachers Registration Council of Nigeria (TRCN) and Science Teachers Association of Nigeria (STAN) Anambra State chapter.

DEDICATION

This book is dedicated to educators in the world

CHAPTER 19

MULTIPLE INTELLIGENCE STRATEGIES: AN INNOVATIVE INSTRUCTIONAL APPROACH TO TEACHING AND LEARNING IN THE 21ST CENTURY

JohnBosco O.C. Okekeokosisi
MaryAnn Chigozie Ofordum
Odunayo Abigael Bamisebi

Abstract
This study explores the application of Howard Gardner's theory of Multiple intelligence strategies (MIS) in teaching –learning to improve students' understanding and engagement. It focuses on the integration of diverse learning styles and intelligence into classroom activities, emphasizing the importance of individual instruction and assessing students' knowledge through multiple modalities. The researchers equally x-rayed the features of MIS classroom and the reason of its application in teaching and learning. The study recommends among others that diversification of activities to cater to different learning styles should be applied by teachers during instruction. Integration of music, movement and nature-based learning experiences can further enhance various intelligences.
Keywords: Multiple Intelligence Strategies (MIS), Innovative Instructional Approach, Teaching and Learning, 21ST Century

Introduction

Education has been identified as one of the public sectors mostly contribute to human development and advancement. It gives individuals the tools they need to participate in social and economic life (Organization for Economic Co-operation and Development, 2010). Ezra, Inti and Hassan (2025) refers education as the most important agent of change as it contributes immensely to the overall development of any nation. It is no longer just a pathway to opportunity and success but it is a pre requisite for human existence, self0reliance and productive citizens that can transform things around the environment for societal use. It is therefore necessary to give education a solid foundation through effective and efficient teaching and learning, making available instructional materials for teaching and learning, ensuring conducive environment for learning and encouraging learners to apply their different intelligence in learning situation. When education is equipped with and conveyed these opportunities and materials using appropriate teaching strategies, students' motivation, achievement, interest, knowledge, skills, attitude and values could be enhanced.

Instructional strategies (IS) can be referred to as methods teachers use to effectively engage students and impart knowledge, aiming to create an effective learning environment. Edutech (2024) describes instructional strategies as instructional materials and procedures that enables students to achieve the learning outcomes. Mar (2025) added that IS are series of actions with a definable outcome relative to student thinking or learning and a definable beginning and end. These actions can range from teacher-led approaches like lectures and demonstrations to student-centered activities like multiple intelligence strategies (MIS). The goal is to help students not just passively acquire knowledge, skills and values but actively participate in the learning process, develop critical thinking and problem-solving skills.

The term intelligence is commonly used to describe intelligent quotient (IQ). Various authors conceived that abstract reasoning and problem solving were aspects of intelligence. Generally, psychologists tend to agree that intelligence embraces ability to learn, acquire knowledge and ability to adapt to new environment or situations. Hence, intelligence can be referred to as an ability to acquire knowledge and skills (already learnt) and ability to apply the acquired knowledge and skills for sustainable development. According to Karaduman and Cihan (2018), it is the capacity to solve problems through training learners in different areas of intelligence or to fashion out

products – training programmes that are valued in one or more cultural settings. Nevertheless, there are differences in individual perception of the world; and as such individuals acquire information differently. This entails that individuals acquire information and solve problems through various avenues. This underscores the centrality of passing information to individual learners in teaching / learning process; this calls for consideration of multiple intelligence –strategies.

Multiple intelligence- strategies (MIS) can be described as how individuals learn and process information in different ways. Okekeokosisi (2024) defined MIS as teaching-learning activities that describe different ways learners learn, acquire information-knowledge and solve their problems through the acquired knowledge and skills. It is teaching-learning activities that gives great consideration to individual differences among learners. Samuel and Abba (2020) viewed MIS as a framework that helps teachers design instruction based activities and provide varied learning experiences tailored for each learner. This implies that MIS embraces instructional techniques that guide, direct, engage, motivate and foster learners' preference to learning. Al-Nakhbi and Barza, (2016) explained that MIS challenges students to understand the world around them and create connections between their lives and their interest. Thus, MIS could be used within the classroom in order to promote learners' achievement and interest in school subjects. It implies that teachers require to provide learners with varied opportunities in the learning environment that could usher in learners' zeal and portray learners' potentials.

The use of MIS in teaching is based on intelligence quotient (IQ) (traditional notion of intelligence) learning theory propounded by Howard Gardner in 1983. Gardner's IQ learning theory states that learners are not born with all of the intelligences they will ever have. This theory challenged the traditional notion that there is one single type of intelligence sometimes known as "g" for general intelligence that only focuses on cognitive abilities. The theory further emphasized on how learners possess different kinds of minds for learning, remembering, performing and understanding in different ways. The theory explained how learners' academic achievement and interest can be improved through multiple intelligence-strategies (MIS) that guide, direct, engage, stimulate and prompt learners during instructional delivery.

The multiple intelligence-strategies as outlined by Gardner (1999) include; Linguistic intelligence, logical mathematical intelligence (Number and reasoning smart), musical intelligence, bodily intelligence, spatial intelligence (Visual), interpersonal intelligence, intrapersonal intelligence (Self-smart), naturalist intelligence, tactile or Kinesthelic intelligence. The nine intelligences of individuals rarely operate independently. They portray how individual natural talents operate in the learning process. Gardner's theory of intelligent quotient has implication for teaching and learning. It implies that teachers require to apply multiple intelligence-strategies in classroom environment. The implication for teachers is to present lesson using a wide variety of instructional techniques that involve active learning. The theory challenges the teachers to create learning environment that offer students opportunity for self-reflection, self-evaluation, group activities and physical activities, so as to cater for diverse learning preferences of the students.

Howard Gardner propounded humanistic theory in 1983. The theory states that learners are not born with all of the intelligence they will ever have. This theory challenged the traditional notion that there is one single type of intelligence sometimes known as "g" for general intelligence that only focuses on cognitive abilities. The theory further emphasized on how learners possess different kinds of minds and therefore learn, remember, perform and understand in different ways. The theory explained how learners' academic achievement and interest can be improved through multiple intelligence-base activities (MIBA) that guide, direct, engage, stimulate and prompt learners during instructional delivery. Such MIBAs as outlined by Gardner (1999) are as follows; linguistic intelligence (Verbal), logical mathematical intelligence (Number and reasoning smart), musical intelligence, bodily intelligence, spatial intelligence (Visual), interpersonal intelligence, intrapersonal intelligence (Self-smart), naturalist intelligence,

Gardner attributed the theory's origin to Behaviorism, Cognitive and Constructivism. This entails that learner's development cannot be isolated from social and cultural activities. The learners' are

seen as central in the learning process. The learners are considered as those that come to the learning environment with different learning experiences. Behaviorism, cognitivism, and constructivism are three prominent learning theories that try to develop efficient learning programs and study the psychology involved in an individual's ability to learn. The three theories lay emphasis on stimulating learners to commitment, desired behaviour, providing direction to behaviour and underlining the tendency to prevail. The theories uphold that variety of activities motivate learning. The activities or factors motivate individual learners through identifying and satisfying individual needs, desires and the aims pursued to satisfy these desires.

Generally, the individual learners must be sufficiently aroused to have interest, have a clear focus on what to be achieved and willing to be committed to the task, realize their aim in order to achieve goals. Simulation like imitation of real world or real life play and computer software generate activities and provide context for dialogue, class interaction, easy production of knowledge and desired behaviour both in the school and in the society. The theory provides learners with the following experiences; scaffolding, problem-solving, adaptation and collaboration.

Scaffolding and problem-solving spur learners to learn, promote learners' interaction with their peers, exchange ideas, lead to knowledge discovery, development of skills and attitudes. Similarly, adaptation provides room for adjustment, foster transformation of prior experiences into meaningful information that leads to in-depth knowledge. Also, collaboration foster team work and peer interaction.

Gardner's learning theory has great implication for learning/teaching. It focuses on the particular intelligence of individual learners which the teacher requires to take cognizance of and encourage each to develop their abilities. The theory challenges teachers to provide basis for variety of activities in teaching-learning process. Furthermore, the theory generates the idea that multiple intelligence activities could promote peer interactivity, increase learning experiences, discovery of new knowledge through different activities and prompts. The implication is that teachers require to provide different opportunities of learning experiences to accommodate individual learners. This provides motivating factors to explore the usefulness of multiple intelligence strategies on students' learning outcome.

Gardner's theory centered on identifying and establishing learners' ability in order to cope with the learning situation. This could help learners understand new concepts or skills by utilizing their preferred learning approach.

Statement of the Problem

Teaching and learning in our recent times does not involve inclusive and engagement of learners during instructional process. Individual learning preferences, abilities and learning styles are not catered for. This resulted to high rate of social vices in the world, high rate of unemployment in Nigeria and unskilled graduates from Nigeria institutions of learning. Thus, this paper seeks to x-ray the importance of multiple intelligence strategies (MIS) when applied in the teaching and learning.

Objectives of the Study

Research on multiple intelligence strategies (MIS) aims to understand how incorporating these strategies impacts student learning, engagement, motivation and academic achievement. Specifically, the research seeks to identify how MIS could improve diverse learning styles, promote student agency, and enhance the teaching-learning process.

Multiple intelligence strategies and their features

Multiple intelligence strategies are anchored in variety of intelligences by which individual learners function. The activities include observation, oral expression, analytical, creative and practical thinking activities as well as metacognitive processes (Rajadurai and Ganapathy, 2023). Metacognitive processes go beyond critical thinking exercises. The processes of metacognitive among others involve monitoring learner's own thinking and reflecting on the cultural context concerning its value in a culture.

Different activities are encouraged in the application of multiple intelligence setting. Verbal skills are needed to accommodate learners that fall under linguistic intelligence. Learners are engaged in discussion and story-telling. Mathematical skills like learners playing games of logic, creating situation for learners to think, construct, understand and discover new information. Also, counting objects, experimentation in the laboratories, field trips, operation and exhibition of electronics – computers are considered. Learners in musical skills are provided opportunity to listen to music and play musical instrument, sing and compose songs. Making charts, drawing and observation of variety of instructional materials give spatial intelligence learners opportunity to learn. Practical participation in learning exercises offer opportunity to learners who fall under bodily intelligence. Interpersonal skills learners gain knowledge through active participation in group activities like discussion, games and the like. The category of learners under intrapersonal skills are accommodated in the learning process by giving learners opportunity to reflect on their work, interpret their activities and encourage them to have hobbies and interest through appreciation. Activities that accommodate the intrapersonal skilled learners also include giving them sensitive feedback and engaging them to record their ideas and experiences.

Learners under natural skills are exposed to field trip. They can fashion materialistic learning centre in a corner of the classroom (nature corner). The learners can engage in naturalist activities like nature study, collect natural objects and classify them. Multiple intelligence based activities implies that learners personality differences are recognized in the learning process. Learning opportunities are offered to all learners who are proficient in different domains related to learning computer studies. The implication is for computer studies teachers to employ teaching method that gears towards generating individual learner's skills.

Why application of multiple intelligence strategies (MIS) in classroom

Using the theory of multiple intelligence strategies (MIS) in the classroom offers;

- ***Diverse learning pathways:*** The theory of MIS recognizes that people learn in different ways and have different strengths. By incorporating the eight intelligences (linguistic, logical – mathematical, visual-spatial, bodily – kinesthetic, musical, interpersonal, intrapersonal and naturalistic), teachers can present information and activities in a variety of formats, reaching students who might not thrive in traditional learning methods.
- ***Inclusive and Engaging learning:*** By understanding and utilizing different intelligences, teachers can create a more inclusive and engaging learning environment where all students feel valued and can contribute their unique strengths. This can lead to increased motivation, engagement and a deeper understanding of the learnt concept.
- ***Differentiated instruction:*** Multiple-intelligence theory encourages teachers to differentiate instruction, meaning they can modify lessons, assignments and assessments to meet the individual needs of their students. This allows students to learn and demonstrate their understanding in ways that best suit their strengths and learning styles.
- ***Enhanced understanding and retention:*** When learning is tailored to different intelligences, students are more likely to engage with the material and develop a deeper understanding of the concepts. This can lead to improved retention and amore positive learning experience.
- ***Developing diverse skills:*** By encouraging students to explore and develop their various intelligences, teachers can help them develop a broader range of skills and talents, which can be beneficial for their academic and personal lives.
- ***Preparation for the future:*** A diverse and adaptable education that caters to multiple-intelligences prepares students for a world that values a range of skills and abilities. The ability to learn in different ways and apply knowledge in various contexts is crucial for success in today's complex and ever-changing world

Way Forward

For effective implementation of MIS in the classroom, teachers should;

1. Diversify activities to cater to different learning styles
2. Encourage collaboration for interpersonal intelligence
3. Utilize visual and manipulatable resources.
4. Integrating music, movement and nature-based learning experiences can further enhance various intelligences
5. Promoting reflection and self-awareness through journaling and individual activities can foster intrapersonal intelligence

Conclusion

In using MIS in teaching and learning, it can significantly enhance student achievement and engagement through recognizing and catering to diverse learning styles. MIS creates a more inclusive and effective learning environment. This strategies not only improves students learning but also fosters motivation, self-awareness and a deeper understanding of how they learn best.

References

Al-Nakhbi, K. & Barza, L. (2016). The effectiveness of multiple intelligence strategy on sixth grade students' achievement and attitudes towards science. *Proceedings of the Australia-Middle East Conference on Business and Social Science,* 677 – 691.

Ezra, D., Inti, M.M., & Hassan, S. (2025). Effect of smartforge tutor on technical college students' achievement in forging process in Kaduna State, Nigeria. *Kashere Journal of Science and Education, 2(2);* 124-132.

Edutech (2024). Concept of instructional strategy. Retrieved on 4th May from https://www.edtechbooks.org/id/instructional_strate

Gardner, H. (1999). *Cracking open the IQ box.* The American prospect.

Karaduman, G., & Cihan, H. (2018). The effect of multiple intelligence theory on students' academic success in the subject of geometric shapes in elementary school. *The international Journal of higher education, 7(2);* 227-233.

Mar (2025). Defining an instructional strategy. Retrieved on 4th May from https://www.marzanoresearch.com

Okekeokosisi, J.O.C. (2024). Effects of multiple intelligence-based and individualized learning activities on secondary school students' achievement and interest in computer studies in Anambra State. Ph.D Dissertation presented to Nnamdi Azikiwe University College of Post Graduate Sudies.

Organization for Economic Co-operation and Development (2010). *Pathways to success, how knowledge are skill at age 15 shape future lives in Canada.* Paris: OFCD.

Rajadurai, R. & Ganapathy, H. (2023). Effect of use of metacognitive instructional strategies in promoting mathematical problem solving competence amongst undergraduate students in facing competitive examination. *Cogent Social Sciences, 9 (21);* 73 -103

Samuel, I.R. & Abba, A. (2020). Effects of multiple intelligence learning strategies and gender on students' achievement in genetics in Katsina State, Nigeria. *International Journal of innovative social and science education research, 8(4);* 59-67.