

APPRAISAL OF 21ST CENTURY SKILLS POSSESSED AND UTILIZED BY SECONDARY SCHOOL BIOLOGY TEACHERS FOR CLASSROOM DELIVERY IN ANAMBRA STATE

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Abstract

The study investigated 21st century skills possessed and utilized by secondary school Biology teachers for classroom delivery in Anambra State. The study guided by four research questions, adopted a descriptive survey research design. The population comprised of the 534 Biology teachers, from the 256 government-owned secondary schools in Anambra State. Using the Taro Yamane's formula, a sample of 229 Biology teachers were estimated and drawn from the population using simple random sampling technique. An instrument titled "Twenty-First Century Skills for Classroom Delivery Questionnaire "TCSCDQ", developed by the researchers from piecemeal and available literature, was used to collect data. TCSCDQ validated by three experts, was subjected to pilot testing to yield a reliability coefficient value of 0.78, by Cronbach's alpha estimation. Data collected were analyzed using frequency counts, percentages and mean scores. The findings revealed that Biology teachers in secondary schools possess and utilize several 21st century skills, however, they neither possessed nor utilized the skills of digital literacy, entrepreneurship, technical proficiency and networking. It was also revealed that the challenges faced by teachers in utilizing 21st century skills to teach Biology are; limited resources, current Biology curriculum, large class size, inadequate training, poor internet connectivity, current educational policies and resistance to change of traditional teaching methods. Based on the findings, the study recommended among others that government at all levels should ensure the provision of adequate modern teaching resources and instructional materials that enable the application of 21st century skills, that are essential for effective classroom delivery.

Keywords: 21st Century Skills, Classroom Delivery, Secondary School Biology Teachers

Introduction

Globally, education in the 21st century has been recognized as a fundamental aspect of human development that plays a crucial role in shaping societies and fostering economic growth and development. Prasad and Gupta (2020) defined education as a tool which provides people with knowledge, skill, technique and information, enabling them to know their rights and duties toward their family, society as well as the nation. It is the process of transmitting what is worthwhile to citizens of a society, equipping them with the skills to fight against injustice, violence, corruption and many other bad elements in the society. Considering the premise, Sharma and Ankit (2023) reported that the importance of education to man and nation building cannot be overemphasized, which may be likened to why developing countries like Nigeria, in efforts to boost human capital for sustainable development, has made concerted efforts through the introduction of education to its citizens at a subsidized rate. At the helm of implementation of education, are the teachers, whom are often referred to as experts trained to effectively transfer knowledge and inculcate skills in learners, all geared towards helping them become useful members of the society.

In every organized educational process, the desire of every teacher at the end of any lesson, is to achieve the stated objectives through effective classroom delivery. Classroom delivery, according to Uwatt (2019), refers to the process in which teachers deliver lessons for the purpose of achieving their pedagogical objectives effectively. It is a multi-dimensional activity that involves planning, developing and implementation of skills, techniques and strategies to achieve positive learning outcomes (Ushie & Daniel, 2022). Ushie and Daniel maintained that in any effective classroom delivery, the teacher strives to achieve stated objectives through getting a deeper understanding of the learners, the material to be taught, its scope and organization, the techniques to be used, the reinforcers to employ, the learning environment, and the evaluation practices to be implemented. To achieve the premise, Kolling and Shumway-Pitt (2022) asserted that it falls on the teacher to equip herself with the pertinent skills needed for the comprehension of the material to be taught as well as organize the information (lesson) in a way that makes it easier for both her and the students, to teach and learn, from simple to complicated and from familiar to unfamiliar. Supporting the premise, Ajadi (2024) opined that these skills of effective communication, collaboration, creative thinking, analysis, innovation, digital literacy and critical thinking, often referred as 21st century skills, when applied in the teaching process help educators improve their professional knowledge, competence and attitudes so that they might in turn, improve the teaching and learning activities.

21st century skills are essential skills needed for individuals to thrive in a globalized and increasing technological society, as they are beneficial not only for students' academic success, but also for their future advancement and overall personal development. John and Okonkwo (2025) defined 21st century skills as the knowledge, skills and attitudes necessary to be competitive in the twenty-first century workforce, participate appropriately in an increasingly diverse society, use new technologies and cope with rapidly changing workplaces. In the same vein, Onyeme et al. (2023) noted that 21st century skills refer to the abilities deemed essential for success in the modern world and encompasses a range of competencies required for navigating the complexities of today's society, workforce, and technology-driven environments, especially in the teaching of science subjects, such as Biology, in schools.

Biology is a branch of science that deals with living organisms and their vital processes. Anyigor et al. (2025) defined biology as a natural science that studies the living world; how it functions, what these functions are, how living things came into existence and their interaction with each other and their environment. Nwuba and Osuafor (2021) affirmed that biology is concerned with the study of life and living organisms. It is a branch of science that deals with the study of living organisms, how they interact with each other and their environment (Nwuba, et al., 2024). Based on these definitions, it is safe to say that biology is one of the core science subjects in secondary schools, whose sound knowledge is needed in our everyday lives as well as in many fields of study and industries such as medicine, pharmacy, nursing, agriculture and engineering (Uzoma and Okoli, 2019).

Consequently, Mbaegbu et al. (2020) opined that biology is a creative subject, thus, biology teachers need to be prepared to teach the subject in various ways in order to give the students the opportunity to explore, as well as meet the demands of the 21st century. To this end, Edeh (2019), stressed that the integration of 21st century skills into teaching and learning is no longer a choice, but a need for educators considering the level of infusion of technology into education, which demands for flexibility in methodology, and the need to enhance creativity and innovations in learning. Ogbonnaya et al. (2020) identified key 21st century skills utilized by teachers to make students relevant in their environment to include collaborative skills, digital skills, thinking skills and problem-solving skills. Similarly, John and Okonkwo (2025) stated that innovativeness, critical thinking, communication, digital literacy, collaboration and problem solving are among the 21st century skills used by teachers to ensure that students can actively use technological tools, adapt to changing environments and reach self-realization.

The importance of utilizing 21st century skills for teaching biology cannot be

overemphasized. 21st century skills are not only essential for preparing students for success in a rapidly changing world, but are also vital for fostering a more engaging, interactive and creative learning environment for teachers and learners. Edeh (2019) opined that the integration of 21st century skills enable teachers to act more as facilitators of knowledge, providing guidance and supervision to students rather than being sole holders of knowledge as reflected in the traditional teaching method. These skills also help teachers understand their students in terms of their nature of learning and interaction in the classroom so as to effectively utilize these skills in their teaching and learning in the classroom (Ogbonnaya et al., 2020). Inyang and Uchegbue (2024) asserted that 21st century skills among science teachers will generally aid "self and ubiquitous learning", that is being able to learn from anywhere at any time. This is very important as the world of science is constantly evolving with new breakthroughs and skills. Considering these benefits, one can categorically affirm that being competent in 21st century skills help teachers stay up-to-date with current events and information which can be shared to educate, challenge and inspire learners in the classroom.

Despite the significant benefits of integrating 21st century skills into teaching and learning, studies have revealed many challenges hindering the utilization of 21st century skills for teaching and learning in secondary schools in Nigeria. Iwuoha et al. (2024) emphasized that Nigeria's teacher training curriculum is inadequate in equipping educators with the necessary skills to implement modern learning strategies, such as constructivist learning, learner-centered instruction, and integrating technology into the teaching process. In their study, Iwuoha et al. further highlighted a significant disconnect between the training teachers receive and the practical realities of teaching in the 21st century, creating a substantial shortfall in addressing learners' needs and preparing them to meet societal challenges. Furthermore, Iwuoha et al. (2024) stated that most public secondary school teachers in Nigeria currently operate in poor working conditions with minimal opportunities for professional development. This lack of support significantly hampers their ability to meet the demands of 21st-century education, highlighting the urgent need for improved training and working environments to boost productivity. It is therefore against this background that this study is being conducted to ascertain the 21st century skills possessed and utilized by biology teachers for teaching Biology in public secondary schools in Anambra State.

Research Questions

The following research questions guided the study:

1. What 21st century skills are possessed by secondary school Biology

teachers for classroom delivery in Anambra State?

2. What are the 21st century skills utilized by secondary school Biology teachers for classroom delivery in Anambra State?
3. What are the challenges faced by secondary school Biology teachers in utilizing 21st century skills in teaching in Anambra State?
4. What are the solutions to the challenges faced by secondary school Biology teachers in utilizing 21st century skills in teaching in Anambra State?

Methods

The descriptive survey research design was adopted for the study. The population consists the 534 biology teachers in the 265 government-owned secondary schools in Anambra State, in the 2024/2025 academic session. A sample of 229 Biology teachers, used in the study, estimated using Taro Yamane formula, was drawn from the population using simple random sampling technique. An instrument titled "Twenty-First Century Skills for Classroom Delivery Questionnaire "TCSCDQ", developed by the researchers from piecemeal and available literature, was used to collect data. TCSCDQ contained two sections; Section A and B. Section A elicited responses on demographic information while Section B contained items structured to provide answers to the four research questions. The scale of Possessed (P) and Not Possessed (NP) was used to provide answers to research questions 1; Utilized (U) and Not Utilized (NU) to provide answers to research question 2; while the scales of Strongly Agree (SA), Agree (A), Disagree (D) and Strongly Disagree (SD) were used to provide answers to research questions 3 and 4.

TCSCDQ validated by three experts, was subjected to pilot testing to yield a reliability coefficient value of 0.78, by Cronbach's alpha estimation. Data collected, from respondents using google forms and face-to-face delivery, were analyzed using frequency counts, percentages and mean scores. For taking decision on items in research questions 1 and 2, a percentage value of 50% was considered as "Possessed (P)/ Utilized (U)" while a percentage value below 50% was considered "Not Possessed (NP)/Not Utilized (NU). For research questions 3 and 4, the decision rule was based on the midpoint mean score of 2.50. That is, a mean score of 2.50 and above was considered as significant and regarded as "agreed" while a mean score below 2.50 was considered insignificant and was regarded as "disagreed".

Results

RQ1: What 21st century skills are possessed by secondary school Biology teachers for classroom delivery in Anambra State?

Table 1: Respondents Frequency counts and Percentages scores on Possessed 21st century Skills

S/N	ITEMS	Possessed		Not Possessed		Decision
		F	%	F	%	
1.	Creativity skill	132	57.64	97	33.62	Possessed
2.	Digital literacy skills	102	44.54	127	55.46	Not Possessed
3.	Collaborative Skills	208	89.53	21	9.17	Possessed
4.	Communication Skills	216	94.32	13	5.68	Possessed
5.	Problem-solving skills	192	83.84	37	16.16	Possessed
6.	Leadership Skills	181	79.04	48	20.96	Possessed
7.	Adaptability Skills	198	86.46	31	13.54	Possessed
8.	Information Literacy Skill	171	74.67	58	25.33	Possessed
9.	Initiative Skill	178	77.73	51	22.27	Possessed
10.	Global Awareness Skill	165	75.05	64	27.95	Possessed
11.	Entrepreneurial Skill	87	37.99	142	62.01	Not Possessed
12.	Interpersonal Skill	152	66.38	77	33.62	Possessed
13.	Innovation Skill	201	87.77	28	12.23	Possessed
14.	Research Skills	156	68.12	73	31.88	Possessed
15.	Time Management Skills	196	85.59	33	14.41	Possessed
16.	Analytical Thinking Skills	188	82.10	41	17.90	Possessed
17.	Technical Proficiency Skill	104	45.41	125	54.59	Not Possessed
18.	Networking Skill	97	42.36	132	57.64	Not Possessed
19.	Metacognition Skill	156	68.12	73	31.88	Possessed
20.	Social Responsibility Skills	189	82.53	40	17.47	Possessed

Table 1 shows the frequency counts and percentage scores of responses of respondents on the 21st century skills possessed by Biology teachers in public secondary schools. The analysis of data showed that the respondents indicated that they possessed creativity skills, collaborative skills, communication skills, leadership, problem-solving, adaptability, initiative, research, information literacy skills, initiatives skills, global awareness skills, interpersonal skills, innovation skills, analytical thinking skills, metacognition skills and social responsibility skills. However, the results also revealed that the respondents indicated that they do not possess digital literacy, entrepreneurship, technical proficiency and networking skills.

Rq2: What are the 21st century skills utilized by secondary school Biology teachers for classroom delivery in Anambra State?

Table 2: Respondents Frequency counts and Percentages scores on Utilized 21st century skills

S/N	ITEMS	Utilized		Not Utilized		Decision
		F	%	F	%	
1.	Creativity skill	128	55.89	101	44.10	Utilized
2.	Digital literacy skills	99	43.23	130	56.77	Not Utilized
3.	Collaborative Skills	198	86.46	31	13.54	Utilized
4.	Communication Skills	206	89.96	23	10.04	Utilized
5.	Problem-solving skills	181	70.04	48	20.96	Utilized
6.	Leadership Skills	173	75.55	56	24.45	Utilized
7.	Adaptability Skills	170	74.24	59	25.76	Utilized
8.	Information Literacy Skill	164	71.62	65	28.38	Utilized
9.	Initiative Skill	104	45.41	125	54.59	Not Utilized
10.	Global Awareness Skill	154	67.25	75	32.75	Utilized
11.	Entrepreneurial Skill	71	31.00	158	69.00	Not Utilized
12.	Interpersonal Skill	132	57.64	97	42.36	Utilized
13.	Innovation Skill	187	81.66	42	18.34	Utilized
14.	Research Skills	141	61.57	88	38.43	Utilized
15.	Time Management Skills	186	81.22	43	18.78	Utilized
16.	Analytical Thinking Skills	171	74.67	58	25.33	Utilized
17.	Technical Proficiency Skill	88	38.43	141	61.57	Not Utilized
18.	Networking Skill	98	42.79	131	57.21	Not Utilized
19.	Metacognition Skill	152	66.38	77	33.62	Utilized
20.	Social Responsibility Skills	171	74.67	58	25.33	Utilized

Table 2 shows the frequency counts and Percentage scores of responses of respondents on the 21st century skills utilized by Biology teachers in public secondary schools. The results of the analysis revealed that the respondents indicated that they utilize the skills of creativity, communication, leadership, collaboration, problem-solving, adaptability, research, interpersonal and global awareness, analysis, innovation, metacognition and social responsibility in the teaching of Biology. They however also indicated that they do not utilize the skills of digital literacy, entrepreneurship, technical proficiency, initiative and networking in classroom delivery.

RQ3: What are the challenges faced by secondary school Biology teachers in utilizing 21st century skills for classroom delivery in Anambra State?

Table 3: Mean ratings of respondents on the challenges faced in utilizing 21st century skills

S/N	ITEMS	Mean	Decision
1.	Limited resources hinder my ability to integrate technology into teaching	2.64	Agree
2.	I have adequate training to use 21 st century skills to teach Biology	2.47	Disagree
3.	My school has reliable internet connection	2.32	Disagree
4.	Utilizing 21st century skills to implement the current Biology curriculum is a significant task	2.57	Agree
5.	Developing 21st century skills is not a challenge for me	2.45	Disagree
6.	Current educational policies cater for the evaluation of the use of 21st century skills for teaching	2.37	Disagree
7.	Large class size constitutes an issue in the use of 21st century skills for teaching	2.65	Agree
8.	Resistance to change of traditional teaching methods hinders the integration of 21st century skills	2.58	Agree

Table 3 shows the mean ratings of responses of Biology teachers on the challenges faced when utilizing 21st century skills to teach Biology in public secondary schools. The results of the analysis revealed that items 1, 4, 7 and 8 had mean ratings that were above the criterion mean score of 2.50, implying that the respondents agreed that limited resources, current Biology curriculum, large class size and resistance to change of traditional teaching methods are challenges faced by Biology teachers in utilizing 21st century skills to teach Biology in public secondary schools. Also the results showed that responses on item 2, 3, 5 and 6 had mean scores below the criterion mean score of 2.50 indicating that the respondents disagreed that they have received adequate training in the use of 21st century skills to teach, developing 21st century skills is not a challenge, their school has reliable internet and current educational policies cater for the evaluation of the use of 21st century skills for teaching.

RQ4: What are the solutions to the challenges faced by secondary school Biology teachers in utilizing 21st century skills for classroom delivery in Anambra State?

Table 4: Mean ratings of respondents on the solutions to the challenges faced by Biology teachers in utilizing 21st century skills

S/N	ITEMS	Mean	Decision
1.	Reviewing the national curriculum will enhance the integration of 21st century skills for teaching	2.73	Agree
2.	Providing professional development will enable teachers possess relevant 21st century skills	2.64	Agree
3.	Integrating technology into education will enhance the use of 21st century skills for teaching Biology	2.69	Agree
4.	Lack of proper monitoring by school principals does not hamper the utilization of 21st century skills by teachers to teach Biology	2.32	Disagree
5.	Public awareness campaigns will sanitize the general public on the importance of 21st century skills for teaching	2.57	Agree
6.	Lack of collaboration among teachers on the use of various technologies does not hinder the implementation of 21st century skills	2.23	Disagree
7.	Involving students' feedback on the evaluation of teaching methods improves the teaching process	2.63	Agree
8.	Lack of partnership with other professionals like technicians, librarians and laboratory scientists does not hinder the utilization of 21st century skills for teaching Biology	2.23	Disagree

Table 4 shows the mean ratings of responses of respondents on the solutions to the challenges faced when utilizing 21st century skills to teach Biology in public secondary schools. The results of the analysis revealed that items 1, 2, 3, 5 and 7 had mean ratings that were above the criterion mean score of 2.50, indicating that the respondents agreed that reviewing the national curriculum, providing professional development, integrating technology into education, public awareness campaigns and involving students feedback on the evaluation of teaching methods are solutions to the challenges faced in utilizing 21st century skills to teach Biology. Also, the results showed that responses on items 4, 6 and 8 had mean ratings that were below the criterion mean score 2.50, implying that the respondents disagreed that lack of proper monitoring by school principals, lack of collaboration among teachers and lack of partnership with other professionals does not hamper the utilization of 21st century skills by teachers to teach Biology.

Discussion

21st century skills possessed by secondary school Biology teachers for classroom delivery

The result in table 1 shows that the 21st century skills possessed by Biology teachers are creativity, collaborative, communication, leadership, problem-solving, adaptability, initiative, research, information literacy, initiatives, global awareness, interpersonal, innovation, analytical thinking, metacognition and social responsibility skills while the skills of digital literacy, entrepreneurship, technical proficiency and networking were not possessed. The findings are in agreement with the findings of Anekwe (2020) who revealed that teachers in Onitsha and Ogidi Education Zones of Anambra State possess research skills, collaboration skills, initiative skills, innovation skills, communication skills, adaptability skills and problem-solving skills, but do not possess skills in Google classroom and use of electronic productivity devices in the classroom teachings.

In support of the findings above, the findings of John and Okonkwo (2025) showed that the 21st century skills possessed by secondary school teachers in Nigeria are critical thinking skills, creativity skills, communication skills, collaboration skills and digital literacy skills. Furthermore, the above findings agree with the findings of Ude and Onyegegbu (2024) who revealed that the 21st century skills possessed by Science Education lecturers in the University of Nigeria, Nsukka and Godfrey Okoye University, Enugu are learning and innovative skills, communication skills, collaboration skills, information literacy skills, digital literacy skills and life and career skills.

21st century skills utilized by secondary school Biology teachers for classroom delivery

Data from table 2 shows the 21st century skills utilized by Biology teachers in public secondary schools are creativity skills, communication skills, leadership skills, collaborative skills, problem-solving skills, adaptability skills, research, interpersonal skills, global awareness skills, analytical skills, innovation skills, metacognition skills and social responsibility skills. However, the results also showed that Biology teachers do not utilize digital literacy, entrepreneurship, technical proficiency, initiative and networking skills to teach Biology. The findings are in consonance with the findings of Anekwe (2020) which revealed that the 21st century skills utilized by teachers in Onitsha and Ogidi Education Zones of Anambra State are research skills, collaboration skills, initiative skills, innovation skills, communication skills, adaptability skills and problem-solving skills. However, the teachers do not utilize skills 21st century skills involving electronic productivity devices in classroom teachings. The findings are in alignment with the

findings of Ude and Onyegegbu (2024) which found that the 21st century skills utilized by Science Education lecturers in the University of Nigeria, Nsukka and Godfrey Okoye University, Enugu are learning and innovative skills, communication skills, collaboration skills, information literacy skills, digital literacy skills and life and career skills.

Challenges faced by secondary school Biology teachers in utilizing 21st century skills

Table 3 revealed that the challenges faced by Biology teachers in utilizing 21st century skills are limited resources, current Biology curriculum, large class size, inadequate training, poor internet connectivity, current educational policies and resistance to change of traditional teaching methods, This findings is in agreement with the findings of Ajadi (2024) who revealed that while 21st-century pedagogies offer numerous benefits, their utilization for teaching in Nigeria faces numerous challenges such as technological barrier, inadequate training and professional development of teachers, large class size, curricular rigidity, resistance to change, limited resources, inadequate monitoring and evaluation. In support of the findings above, the findings of Joynes et al. (2019) also found that the main challenges associated with the use of 21st Century Skills within a formal school system include issues arising from teacher capabilities, teacher training, school infrastructure and resourcing, school leadership, pedagogic approaches and curriculum models.

Solutions to challenges faced by secondary school Biology teachers in utilizing 21st century skills for classroom delivery

Table 4 revealed that the solutions to the challenges faced by Biology teachers in utilizing 21st century skills to teach Biology are reviewing the national curriculum, providing professional development for teachers, integrating technology into education, public awareness campaigns and involving students feedback on the evaluation of teaching methods, proper monitoring of schools by principals, collaboration among teachers on the use of 21st century skills and partnering with other professionals. This findings corroborates with the findings of Ajadi (2024) who found that for schools in Nigeria to move with time and develop students' skills, increase student engagement in the class, encourage collaborative learning and encourage teachers' professional development , there is a need for government and educational administrators at all levels to reform our educational policies, organize specialized on-the job training for newly employed teachers, invest more in essential technology infrastructure, computers, audio-visual equipment and dependable internet access to allow the utilization of 21st century pedagogy as well as promote 21st century teaching methods in Nigeria.

Conclusion

This study investigated 21st century skills possessed and utilized by Biology teachers to teach Biology in Awka Education Zone. The findings revealed that the 21st century skills possessed and utilized by Biology teachers are; creativity skills, collaborative skills, communication skills, leadership skills, problem-solving skills, adaptability skills, initiative skills, research skills, information literacy skills, global awareness skills, interpersonal skills, innovation skills, analytical thinking skills, metacognition skills and social responsibility skills. However, it was also revealed that they do not possess or utilize digital literacy skills, entrepreneurship skills, technical proficiency skills and networking skills for teaching. It was also revealed that the challenges faced in utilizing 21st century skills to teach Biology are; limited resources, current Biology curriculum, large class size, inadequate training, poor internet connectivity, current educational policies and resistance to change of traditional teaching methods. It was also revealed that the solutions to the challenges faced by teachers in utilizing 21st century skills to teach Biology are; reviewing the national curriculum, providing professional development for teachers, integrating technology into education, organizing public awareness campaigns, proper monitoring of schools, collaboration among teachers and involving students feedback on the evaluation of teaching methods. Based on the findings, this study concludes that Biology teachers in Anambra State possess several 21st century skills, lacking a few, with several challenges hindering effective utilization of 21st century skills for teaching Biology in the State.

Recommendations

Based on the findings, the following recommendations were made:

1. Government at all levels should ensure the provision of adequate modern teaching resources and instructional materials that enable the effective application of 21st century skills that are essential for fostering interactive and experiential learning of Biology.
2. The State Ministry of Education through the Post Primary Schools Commission (PPSSC) and other relevant agencies should conduct regular and periodic workshops and seminars to provide professional training for Biology teachers to build their competencies in the use of 21st century skills to foster creativity and innovative teaching and learning of Biology.
3. Educational agencies should review and adapt the current secondary school Biology curriculum to allow the integration of 21st century skills. Such curriculum reforms should provide clear pathways for experimenting with new teaching methods.
4. School principals should be trained on how to create an enabling school environment that encourages teachers to utilize 21st century skills for teaching and learning in the school. This could be done through incentivizing innovative teaching practices and providing opportunities for professional development.

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