The influence of STEAM education in post Covid-19 era on students' mastery and application of knowledge in music in secondary schools in Anambra State, Nigeria

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Abstract

One major function of our education system is to equip and prepare students' for life challenges. The traditional classroom instruction characterized by reading, writing, memorization and recalling of information can no longer achieve this in a post-covid 19 era, thus need for STEAM education. This study investigated the influence of steam education on post covid-19 era on students' mastery and application of knowledge in Music in secondary schools in Anambra state. Adopting the quasi experimental research design, the study made use of a sample of 37 respondents. Two research questions and two null hypotheses guided the study. The hypotheses were tested at 0.05 significant level. Data used in the study were generated from copies of the researcher structured questionnaire administered and retrieved from the respondents. The instrument was validated by three experts in the field of education. Reliability of the instrument was determined using Cronbach alpha and an alpha coefficient of 0.79 was obtained. The research questions were answered using mean and standard deviation while t-test was used to test the null hypotheses at 0.05 level of significance. The results of the study revealed that steam education has a significant positive influence on students' mastery and application of knowledge in music. Based on the findings, the researchers recommended that since the future is quite uncertain in Nigeria, steam education should be embrace to replace the traditional classroom instruction in order to equip our students' with skills and capacities for self reliance, problem solving and adjustment in life.

Keywords: Steam education, post covid-19, students' mastery and application of knowledge.

Introduction

Nothing could be disruptive to an economy like a pandemic. This was exactly the situation that nations across the globe including Nigeria witnessed in January 2020 following the outbreak of new Coronavirus disease, Covid-19 which the World Health Organization (WHO) declared as a pandemic. The pandemic was a really difficult time for any government and anybody anywhere. As the pandemic runs its course in Nigeria, the Nigerian Centre for Disease Control (NCDC) came up with non-pharmaceutical interventions such as regular hand washing with sanitizers, wearing of face mask and social distancing to control the spread of Covid-19. Social distancing has included closure of schools, markets, churches, and banning of social/public gatherings. This gradually affected the educational, industrial, social, economic, and health sectors of the economy resulting on untold hardship on the

people, mass retrenchment of workers, closure of industries thus posing a serious risk to the future of our youths.

Lathan (2020) also observed that the Covid-19 pandemic has affected societies and economies around the globe which pose multiple and complex scientific, moral, social and political challenges to various agents in the Post Covid-19 period. Kimberly (2020) also noted that covid-19 pandemic has led to a dramatic loss of human life across the globe and presents an unprecedented challenge to public health, food systems and the world workforce. Kimberly further observed the devastating impact of the pandemic on economic and social sectors of the economy and thus suggests the need to develop long-term sustainable strategies to address the post-covid 19 challenges. Still supporting the above statement, Gulbin and Unsal (2020) opined that the mental health and well being of children and youths have been greatly endangered and in ways that could have lasting repercussions in post-covid 19 period. They observed the impact of covid-19 on societies/economies globally which has permanently reshape our world as it continues to unfold and thus suggests that while the fallout from the crisis is both increasing familiar risks and creating new ones, there is need to adopt strategies to adjust and cope with these challenges.

The above is a clear evidence of complexities and uncertainties in the future and so the urgent need to equip our youths who are the future leaders of tomorrow with the necessary tool for successful adaptation/adjustment. Quality and productive education has been recognized by educationists and thus remains the only veritable tool for national development and adjustment in life. The purpose of education has always been in essence to equip the youths with skills and attitudes needed to develop in an orderly, sequential way into members of the society. Orji and Maekae (2013) noted that education is an indispensable tool which would not only assist in meeting the nation's all round needs but also vital for inculcating desired knowledge and skills for national development in an individual. Abdulghani (2014) assert that education develops human personality, thoughts, relationship with others and prepares people for life experiences such as post-covid 19 challenges. Peng-Wei and Chung-Ho (2021) assert that education for national development is geared towards developing the students' concepts and their abilities to face a future sustainable environment through interdisciplinary teaching and collaboration. Futhermore, Bhawna (2020) noted that education helps individuals in developing and fostering qualities required for the resurgence and development of a nation, increasing production by equipping individuals with the latest knowledge of science and technology.

This then calls for introduction of a system of education that will encourage students' divergent and critical thinking, exploration of facts, constructive reasoning, take thoughtful risks, become resilient problems solvers among others thus empowering them to be manufacturers, inventors, employers and generally self dependent. The traditional classroom instruction characterized by reading, writing, memorization, recalling of facts can no longer handle the demands of post Covid-19 challenges, thus need for STEAM education.

National Science Foundation (2013) emphasized that the 21st century scientific and technological innovations have become increasingly important as we face the challenges of both globalization and a knowledge-based economy thus, to succeed in this new information-based and highly technological society, students' need to develop their capabilities on STEAM. Also, the United Nations Department of Education (2020) noted that in an unpredictable, ever-changing and increasing complex world, it is more important than ever that our nations' youths are prepared to bring knowledge and skills to solve problems, apply knowledge, make evaluations and take decisions and this can only be achieved through STEAM education.

STEAM is an acronym for Science, Technology, Engineering, Arts and Mathematics. STEAM is a successor as well as an extension of STEM education. Michelle (2013) pointed out that stem focused on improving science and mathematics as an integrated discipline and emphasize on technology. STEM is often taught apart from art between two or more subjects in school. STEM education is an effort to incorporate several disciplines: Science, technology, engineering and mathematics in teaching a lesson/concept. North Carolina State University (2022) reported that STEM classrooms are

accommodating and equip the students with sense of belonging which makes them active participants in classroom activities.

STEAM simply involves integration of art into science technology, engineering, mathematics. In STEAM education, lesson contents are taught to students' by including the art element. Wandari, Wijaya and Rika (2018) explained STEAM education as that type of education in which the students' understanding and interest in related subjects such as Science, Technology, Engineering, Arts and Mathematics foster their creativity, thinking and problem solving capacities and understand human society in the future. Henriksen, Mishra and Fisser (2016) recognized creativity as a powerful force in shaping human society, progress and knowledge and therefore opined that education needed to face complexities of post-covid 19 should be the type that encourages students' creativity, innovation, exploration and invention of ideas.

Close observations of global events and situations points towards complexities and proper adjustment requires the need to develop the knowledge and skills to solve real-world problems, acquire capacity for adaptation/adjustment, build up mechanism for transfer of information and make informed decisions. This of course can be achieved by teaching the students' using STEAM approach. Some authors and researchers have tried enumerating the benefits of STEAM education. For example, Team (2020) observed as follows:

- Steam education allows students' to ask and probe thought –provoking questions.
- It empowers students' to be curious learners who seek creative solutions to real –world problems.
- Steam education helps students' to develop soft and hard skills vital for success in academics, career and adjustment in life.
- With steam education, students are provided with inter-disciplinary learning model which enhances their application of knowledge and finally
- Steam education prepares students' on graduation to face real life problems with more creativity, critical thinking and effectiveness.

Milligan (2019) also writing on the benefits of steam education noted as follows:

- Steam education fosters on inclusive learning environment in which all students' are able to engage and contribute.
- It encourages fact finding, divergent thinking and explorations.

Supporting the above statement, Lu, Wu and Huang (2022) noted that STEAM application is for creative thinking and such any learning instruction based on STEAM guarantees instant understanding and retention effects. Lathan (2020) noted that Arts as a component of STEAM can be applied and fine arts (Sculpture, painting, craft and graphics), Communication (advertising, multimedia, social media and literature), Performances (theatre, film, drama, music and dance), Lifestyle (fashion, interior design and product design) and Character (culture, behaviour and attitude). The integration of art in learning can be done by means of learners communicating the idea of science through visual information, drama and images which enhances their understanding of concepts and problem solving skills. Team (2020) observed that when students connect their learning with art practices, they rely less on memorization and more on truly comprehending the material they are studying by applying the tools of creation and inquiry from arts to projects. Hanif, Wijaya, Winarno and Salsabila (2021) opined that practices such as modeling, developing explanations and engaging in critique and evaluation (argumentation) have too often been underemphasized in the context of mathematics and science education and posited that incorporation of arts in steam education to bridge the gap.

Practical and creative education is necessary for handling the threat of post Covid-19. That is where STEAM education comes in. In a STEAM education programme, students' explore through curiosity, play and activity based oriented tasks thus equipping them with necessary knowledge and skills for succeeding in life (Michelle, 2013).

From the foregoing, the whole point of steam education is to inspire inquiry and curiosity, empower students' to ask thought-provoking questions that promote creativity and exploration especially when

it comes to problem solving situations as in post-covid 19 era. The traditional education system characterized by "rote learning" is what our students' who are the future leaders do not need any longer in this challenging society. Every learning activity should be intentional, meaningful, useful, and ensures students' development and advancement through the unit. Vallikat (2021) assert that learning activities that should handle post-covid 19 challenges should be such that should enable students' engage with and develop their skills, knowledge and understanding in various ways. Shelby, Jack, Noam, Susannah and Rachels (2020) also noted that learning should involve meaningful activities as in STEAM education to engage students' in active, constructive, intentional, authentic and cooperative ways.

Unfortunately in most secondary schools in Anambra state where this research is carried out, learning process is still in the form of direct transfer from teacher to students', where as students' will learn better if the learning process is meaningful to enhance transfer of knowledge. Supporting this statement, Ming-Chia, Hui-Chun, Sheng-Wen, Meng-Jun and Shih Wei (2022) emphasized that when classroom instructions are accompanied with various learning activities ranging from seeing, hearing among others, students' achievement will be enhanced. In Educational Psychology, the main purpose of any learning is that a person who acquires some knowledge or skill will be able to transfer such knowledge and skills to real life situations and adapt himself/herself more effectively. The purpose of any teaching-learning interaction is to bring about a generalization and applications of what has been learned in specific situations to real life situations and acquire a general capacity to adapt. Experiences, habits, knowledge gained in one situation help us to the extent to which they can be generalized and applied to other situations.

Supporting the above statement, Shidiq, Rochintaniawati and Sanjaya (2017) noted that learning activities cannot be separated from the mastery concept. Ability in mastering the material can be seen from the mastery concept. They assert that the mastery concept is the students' ability to understand the meaning of learning and apply it in their daily life. Anderson and Krathwohl (2001) also observed that mastery of concept can improve students' intellectual skills and help them in problem solving which is meaningful learning.

Students' mastery of content and application/transfer of knowledge is vital to their adjustment and successful living in a post-covid 19 era and therefore the need for an educational programme that will achieve this objective to help salvage the future of our youths. A curriculum that is STEAM based has real-life situations (in Science, Technology, Engineering, Arts and Mathematics) to help students learn. An activity -based learning/programs empowers students' acquisition of problem solving skills. This study therefore intends to find out the influence of STEAM education on post-covid 19 era on students' mastery and application of knowledge in secondary schools in Anambra state.

Statement of the Problem

The regular education system practiced in most secondary schools in Anambra state does not focus enough on teaching students' to solve real world/life problems and it is not inter-disciplinary, nor collaborative enough in its approach. We are in a global/digital technology era- the 21st century and therefore the need to prepare our students' to face the world that is plagued by systematic, pervasive and confounding global challenges. Every sector of the economy namely health, education, economic and political has gone digital. For example job interviews, buying and selling (economic activities) as well as appraisal of workers among others are done on-line. There is an urgent need to provide students with quality education such as STEAM based education programme which will utilize inter-disciplinary activities in Science, Technology, Engineering, Arts and Mathematics to equip them with the necessary skills and attitudes for adjustment in post-covid 19 era. However, a student knowledge and mastery of content is what empowers transfer/application of knowledge for problem solving. The problem of this study therefore is to find out the influence of STEAM education on post-covid 19 era on students' mastery and application of knowledge in music in secondary schools in Anambra state. The study was guided by two research questions and two null hypotheses:

Research Questions

1. What is the mean difference in the rate of mastery of concepts in music between students' in pre-test and post-test groups?
2. What is the mean difference in the rate of application of concepts in music between students' in pre-test and post-test groups?
3. There is no significant mean difference in the rate of mastery of concepts in music between students' in pre-test and post-test groups.
4. There is no significant mean difference in the rate of application of concepts in music between students' in pre-test and post-test groups.

Method

The research method adopted for this study was quasi experimental design with pre-test and post-test control group design. The population for the study comprised all the 17 government owned secondary schools in Anambra state offering music. The researchers employed purposive random sampling technique to select all the 37 (thirty seven) J.S.S. 3 music students from the chosen school. The instrument for data collection was a researcher structured questionnaire on a modified 4-point likert scale titled "The Influence of STEAM Education on Students' Mastery and Application of Knowledge in Music" (TISESMAKM). The instrument was validated by three specialists in education. Using Cronbach alpha to determine the reliability index of the instrument, a score of 0.80 was obtained.

20 questions based on music content specifically "The Keys/Notes of the keyboard" constructed in multiple choice format was used to measure the students' mastery and application of knowledge. The lesson content – "Keys/Notes of the keyboard" was presented in 4 sub-contents namely:

1. Meaning and characteristics of keyboard.
2. Construction of the keyboard.
3. Features of the keyboard.
4. Tones and semitones.

The experimental procedure was in three stages. In the first stage, the students were taught using the regular/traditional classroom method. At the end, test to determine their ability of early mastery and application of knowledge was administered. During the second stage, Steam approach/based teaching was implemented in 3 contact/lessons with a total of 6 hours of lesson (each contact lasted for two hours). After teaching the lesson content based on STEAM, the students' were given another test to find out the extent of their mastery and application of the concept. At the final stage, the researchers conducted a post-test on both the experimental group and the control group.

Statistical weighted mean and standard deviation was used for answering the research questions. The decision rule was that a mean of 2.50 and above is accepted while a mean below 2.50 is rejected. The null hypotheses were tested using t-test at 0.05 significant level.

Results

Table 1: Mean and Standard Deviation of the Mean Difference in the Rate of Mastery of Music Concepts Between Students' in Pre-test and Post-test Groups.

Groups	N	Pre-test Mean	S.D	Post-test Mean	S.D	Mean Diff.	Remark
Regular	18	43.15	8.83	48.11	10.76	4.96	High
STEAM	19	15.50	7.25	51.00	6.58	35.5	influence

Result in table 1 above shows that the mean score of the pre-test for the regular group is 43.15 while the post-test mean score is 48.11 with a mean difference of 4.96. The STEAM group has a pre-test mean

score of 15.50 and a post-test mean score of 51.00. This signifies a mean difference of 35.5. The result therefore showed that STEAM based education has a high influence on the students' mastery of music concepts in secondary schools in Anambra state.

Table 2: Mean and Standard Deviation of the Mean Difference in the Rate of Application of Music Concepts Between Students in Pre-test and Post-test Groups.

Groups	N	Pre-test Mean	SD	Post-test Mean	SD	Mean Diff.	Remark
Regular	18	47.23	11.13	61.53	10.33	14.3	STEAM has
STEAM	19	20.35	6.11	58.46	12.21	38.11	high influence

Result in table 2 above shows that the regular group has a pre-test and post-test mean scores of 47.23 and 61.53 respectively. The result also shows a mean difference of 14.3 while the STEAM group has a pre-test mean score of 20.35 and a post-test mean score of 58.46 with a mean difference of 38.11. The researchers' therefore concludes from the results that STEAM approach has a high influence on students' application of concepts in secondary schools in Anambra state.

Table 3: T-test Analysis of Mean Difference in Mastery of Music Concepts Between Students' in Pre-test and Post-test Groups.

Groups	N	X	SD	Df	Cal t.	Crit. t.	Remarks
STEAM	19	48.11	10.76	35			
					3.21	1.96	Significant
Control	18	51.00	6.58				

Result in table 3 above shows the value of calculated t is 3.21 while critical t is 1.96. This implies that null hypothesis which states that there is no significant mean difference in the rate of mastery of music concepts between students' in pre-test and post-test groups is rejected because the calculated value of t which is 3.21 is greater than the critical value of t which is 1.96 at 0.05 significant level.

Table 4: T-test Analysis of Mean Difference in Application of Concepts Between Students' in Pre-test and Post-test Groups.

Groups	N	X	SD	Df.	Cal. t.	Crit. t.	Remark
STEAM	19	61.53	10.33				
				35	4.37	1.96	Significant
Control	18	58.46	12.21				

The result in table 4 above revealed that the calculated value of t is 4.37 while the critical value is 1.96. Based on this result, null hypothesis which states that there is no significant mean difference in the rate of application of music concepts between students' in pre-test and post-test groups is rejected and the alternative which is significant is accepted because the critical value of t (1.96) is less than the calculated value of t (4.37) at 0.05 level of significance.

Discussion of Findings

The findings of the study revealed that steam education has a high influence on students' mastery of music concepts in secondary schools in Anambra state. Results of the findings shows a mean score of 43.15 for pre-test of the regular group while their post-test mean is 48.11 with a mean difference of 4.96. The steam group has a pre-test mean score of 15.50 and a post-test mean score of 51.00 with a mean difference of 35.5. This could be because majority of the students' in the steam group had better

understanding of the lesson because the steam approach utilized enhanced their exploration, creative thinking, thought-provoking questions and curiosity. The null hypothesis which states that there is no significant mean difference in the rate of mastery of music concepts between students in pre-test and post-test groups is rejected because the calculated value of t which is 3.21 is greater than the critical value of t which is 1.96 at 0.05 level of significance.

The findings of the study corroborates with the existent findings by Wandari et al (2018) that integrated knowledge, mastery of the concept and creativity are enhanced through the application of steam education. They concluded based on the result of steam-based learning implementation that steam –based learning effect significantly to students' concept mastery and creativity in learning lights and optics. They observed that students' concept mastery improved as much as 0.78 with category high improvement after the implementation of steam-based learning. Wandari et al further observed that for students' creativity achievement in every dimension (novelty, resolution, elaboration and synthesis) gained different result. The findings of the study also agrees with that of Peng-Wei et al (2021) who noted that the combination of steam education with virtual reality (VR) aided experience courses, could help to improve the learning satisfaction and outcomes of students as well as arouse their learning motivation. Thus they concluded that steam education provides students' with a well-rounded foundation of skills to help them understand a wide range of concepts. This result is further supported by the findings of Gulbin et al (2020) that steam education positively affected the students' conceptual understanding and reduced the number of misconceptions. They concluded that the study group's post-trial conceptual understanding scores were significantly higher than those of the control group.

The findings of the study showed that steam approach has a high influence on students' application of concepts in music in secondary schools in Anambra state. The result of the findings reveal that the regular group has a pre-test and post-test mean scores of 47.23 and 61.53 respectively with a mean difference of 14.3 while the steam group has a pre-test mean score of 20.35 and a post-test mean score of 58.46 with a mean difference of 38.11. This could be attributed to the fact that the students' understanding and mastery of concepts enhanced their application (transfer of knowledge). The null hypothesis which states that there is no significant difference in the rate of application of music concepts between students' in pre-test and post-test groups is rejected and the alternative which is significant accepted because the critical value of t (1.96) is less than the calculated value of t (4.37) at 0.05 level of significance.

This agrees with the findings of Hanif et al (2021) that integration of knowledge through steam project-based learning has a chance to develop students' concept mastery and also enhance their application of learnt skills in real life situations. Lathan (2020) also noted that steam initiative offers students' high technology skills, equips them with the ability to decompose a complex problem using divergent thinking and then apply the corresponding solution to the real world situations.

Conclusion

The study concludes as follows:

1.   That steam education has a high influence on students' mastery and application of concepts in music in secondary schools in Anambra state.

2.   The study also concludes that there is significant mean difference in the rate of mastery and application of music concepts between students in pre-test and post-test groups.

Recommendations

The researchers' recommend as follows:

1.   There is need for complete overhauling of education system in Anambra state to meet the global challenge of post-covid 19 era. This is because the regular teaching method characterized by "rote learning" does not empower students' exploration, innovations, convergent and divergent thinking, problems solving skills as well as initiative tendencies which are crucial for adaptation in any challenging society and thus steam learning approach should be adopted to replace the regular

teaching method. This is to help students' acquire skills and capacities for self reliance vital in a challenging economy.

2.   Every sector of the economy has gone digital and the future is quite uncertain in Nigeria including Anambra state. There is need to adjust both students' and teachers' schedules to accommodate steam-based lesson plans.

3.   Seminars, workshops and in-service trainings should be organized by stake holders in education (State government, local government, State -post-primary service commission, state ministry of education and Parents- Teachers council among others) for secondary school teachers to equip them with the skills of steam education.

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