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EXTENT OF UTILIZATION OF COLLABORATIVE TEACHING AND PROFESSIONAL DEVELOPMENT PROGRAMMES BY SCIENCE TEACHERS

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ABSTRACT

The study investigated the extent of utilization of collaborative teaching and participation in professional development programs by science teachers in Anambra State, Nigeria. Six research questions guided the study. The study employed a descriptive research design. Purposive sampling technique was used to select sixty schools out of the 261 government owned secondary schools in Anambra State and all the science teachers in the sixty schools were used for the study making a sample of 360. The instrument used for the study was a structured validated questionnaire which has a reliability coefficient of 0.81 using Cronbach Alpha technique. Data collected were analyzed using mean, frequency and percentages. Results of the analysis revealed that most of the science teachers used for the study does not participate in professional development programs in the last three years. They also agreed that they use collaborative teaching to a very low extent. They also agreed that lack of time for shared planning, lack of respect and trust among others were the barriers to adequate collaboration among science teachers in secondary schools. It was recommended among others that professional development program should fit into the teacher's schedules and include learning during the school session and during the holidays. Also the government and school principals should pinpoint and provide purpose for collaboration among teachers. Conclusion was also made.

Keywords: Science Teachers, Collaborative Teaching, Professional Development, Science Education, Education

Introduction

Education is a means for individual growth and national development. Education is an important channel to implore the human intellect and skills for productive employment. It is a process of improving an individual in knowledge, skills, behavior and attitudes in order to be useful to himself and to others (Ezeugbor, Okeke – James & Emengini, 2019). Science education is the process that involves the act of teaching which build citizens that could make reasoned decisions about scientific issues (Okafor, 2003). Science education is a process of learning that places emphasis on skills acquisition and use of various scientific processes. Science education can be said to be the teaching and learning of science subjects in an undifferentiated manner which stresses the fundamental unity of science (Omiko, 2005). Science education is a field of science that is concerned with the sharing

of science contents and processes with individuals who are not considered traditionally to be members of scientific community (Obialor and Osuafor, 2019). The individuals could be students, adults within the general public or a whole community. Science education usually begins with an introduction to basic science related concepts early in a child's education

Science teachers teach students in primary and secondary schools specific science subjects (Madison, 2023). They play a key role in developing future leaders in science and technology by fueling the curiosity of students and exploration into topics of interest. Teaching science requires hands- on experiments and investigation, providing students with opportunities to learn science concepts through multimedia materials, field trips and non-conventional teaching approaches (Science teachers guide, 2022). To make the teaching of sciences effective, a good science teacher according to Thirumagal (2017) should have the following characteristics:

- Nurture students curiosity
- Encourage scientific thinking
- Develop scientific literacy
- Integrate science with other subjects
- Use classroom assessments to support students learning.

It is expected that science teachers that have the following characteristics can give their students high quality teaching. High quality teaching can make a significant difference in students learning. A high quality science teacher requires meaningful, on- going professional development. There is a general need to continuously update the knowledge of our teachers and also support the Professional development of serving and newly employed teachers in our educational system (Duru, 2015). This is because when they finish their own education before or soon after beginning their teaching career, research in pedagogy has continued and new effective methods of teaching have been discovered and researched. In an effort to keep abreast of the continuing shift of knowledge, many states and organizations offer professional development for teachers.

Professional development according to Bouchillon (2022), is the training completed by current professionals in order to continue building knowledge as a teacher both experienced and new teachers. To Antley (2022), professional development refers to continuing education and career training after a person has entered the workplace in order to help them develop new skills, stay up- to-date on the current trends and advance their career. According to Indeed Educational Team (2021), professional development is improving yourself through learning and training to advance your career. Ferguson (2022) sees professional development as the skills and knowledge an employee gains to optimize her personal growth. Professional development can refer to many different types of relevant educational or training opportunities relevant to the professional teachers work. It helps teachers in staying up to date on new trends within the field and applying new practices to their current methods. It helps them to achieve career advancement and enhance their professional effectiveness and teaching skills. Professional development programs for teachers cover a wide range of topics related to teaching as improving classroom structure, planning a curriculum and keeping students engaged.

Others may focus on program enhancement such as learning administrative skills which can keep one if the person wants to move up to a position of school principal. Such programs can help teachers deal with social and emotional stress related to teaching. A good professional development (PD) is one that focuses on teaching strategies associated with specific curriculum content and supports teacher learning within their classroom contexts (Hammond, Hyler & Gardner, 2017). In many states, teachers are mandated to participate in PD program such as workshops, conferences, seminars and continuing education offered at local colleges. Some associations can offer their member's opportunities for PD such as Science Teachers Association of Nigeria (STAN) in Nigeria. STAN organizes yearly conference and different subject panel workshops for science teachers in primary, secondary and higher institutions of learning. Professional development for science teachers is important for information, communication and technology (ICT) teaching skills, students discipline and behavioral problems, instructional practices, subject matter, student counseling, teaching special learning needs students, students assessment practices, teaching in a multicultural setting, classroom management and so on. High quality PD creates space for teachers to share ideas and collaborate in their learning, often in job –embedded contexts that relate new goal instructional strategies to teachers, students and classroom

Collaboration is the process of working together to achieve a goal. In teaching, the common goal is always improved learner outcomes. Collaboration is a partnership, a union, the act of producing or making something together. It can take place between two people or many people, strangers or best friends (Ultimo, 2021). To collaborate is to commit to the possibility of producing an outcome greater than one that would be developed by a single person. According to BIT.AI Blog (2021), collaborative teaching is the way by which two or more teachers teach, instruct and mentor the same group of students together. Collaborative teaching according to Okafor (2015), refers to a range of teaching and learning approaches. Collaboration can be implemented across all instructional levels and subject areas. It allows teachers to impart information to a broader range of learners using approaches that spark student's imaginations while supporting individual learning differences. Research shows that teachers who work together and learn from each others are more successful in improving student's outcomes than those who work alone (Gates, 2018).

Effective collaboration may involve working constructively professionally with people you don't naturally get on with. To approach collaborative teaching the right way, teachers are expected to

1. Talk with co-teachers beforehand.
2. Prepare lesson plans together.
3. Clearly layout their expectations and,
4. Understand the needs of their students.

All these can be achieved using different types of collaborative teaching such as simultaneous teaching, instructional stations, teach and re-teach etc. Teachers collaboration involves teachers working together to lead, instruct and mentor students with the goal of improving students learning and achievement (Bouchrika, 2022). Collaboration in teaching is important because it leads to professional development,

improved school culture, better use of data to guide decisions, increased time and efficiency and shared sense of responsibility. Therefore teachers collaborate to create a better learning experience. Thus teacher's collaboration positively imparts students' achievement and allows them as educators to explore new territory. It helps brainstorm creative ideas (Gates, 2018). The presence of two or more educators in one classroom allows teachers to provide added support to the students who need it. It also leads to lower student teacher ratio. This can be an advantage for not only experimental education students but also for struggling mainstream students thereby improving their academic performance.

Even though most teachers and school administrators agree that teachers professional development and collaboration leads to improved outcomes for both the teachers and students. Many schools in Anambra state and Nigeria generally and our government are still not providing enough time for teachers to work together during school hours and undergo professional development programs and this has affected those teachers in that they do not teach with innovative methods such as using ICT in teaching and other creativity methods that can help to make students self reliant when they graduate. They continue to teach with the old teaching methods even in this era of internet and technological knowhow. They do not find it necessary to collaborate with their colleagues to learn these new innovative methods. Therefore the researchers want to assess the extent of utilization of collaborative teaching and participation in professional development programs by science teachers in Anambra state.

Research Questions

The following research questions guided the study:

1. What is the percentage of science teachers that participated in professional development programs in the last three years in secondary schools in Anambra State?
2. What are the reasons why most science teachers in secondary schools do not participate in PD programs in the last three years in Anambra state?
3. What are the strategies that will enhance adequate science teacher's participation in PD programs in secondary schools in Anambra state?
4. To what extent do science teachers in secondary schools in Anambra State utilize collaborative methods in teaching?
5. What are the barriers to adequate collaboration among science teachers in secondary schools in Anambra state?
6. What are the strategies that will enhance adequate collaboration among science teachers in secondary schools?

Research Method

A descriptive survey design was adopted for the study. The research was carried out in the 261 government owned secondary schools in the six education zones of Anambra state. All the science teachers from all the secondary schools formed the population for the study. The sample comprised of 360 science teachers. Purposive sampling technique was used to select 10 schools from each of the six education zones of Anambra state making it a total of 60 schools. All the science teachers in the 60 schools were used for the study making it a of total 360 science teachers.

The instrument used to collect data was a structured questionnaire developed by

the researchers based on the literature and research objectives. The instrument had 2 parts (A and B). Part A elicited information on the respondents' personal data. Part B contained information on the science teacher's extent of utilization of collaborative teaching and participation in professional development programs, and the strategies for adequate participation in professional development programs and use of collaborative method in teaching for improved academic achievement. The response pattern adopted for answering the questionnaire was a four point Likert type scale of strongly Agree (SA) = 4 points, Agree (A) = 3 points, Disagree (D) = 2 points and Strongly Disagree (SD) = 1 point for research questions 1,2,3,5 and 6 and a four point Likert scale type of Very High Extent (VHE) = 4 points, High Extent (HE) = 3 points, Moderate Extent (ME) = 2 points and Low Extent (LE) = 1 point for research question 4. The initial draft of the instrument was given to three lecturers, two from the department of science education and one from department of educational management and policy, all from Nnamdi Azikiwe University Awka for face and content validation. These experts were requested to rate the instrument in terms of ambiguity of language and relevance to the purpose of study and research questions. Their criticisms were noted while their suggestions were considered and incorporated in the final draft of the questionnaire. The reliability coefficient of the instrument was estimated using Cronbach Alpha technique and the coefficient index was estimated at 0.81.

A total of three hundred and sixty eight (368) copies of the questionnaire were administered by hand by the researchers and three research assistants and 360 copies of the questionnaire were collected. Data were analyzed using mean, frequency and percentages. The criterion mean was 2.50. A mean of 2.50 and above was regarded as accepted while a mean of less than 2.50 was regarded as rejected

Presentation of Results

The results of the study was presented in tables according to research questions

Research question I: What is the percentage of science teachers that undertook PD programs in the last 3 years in secondary schools in Anambra state?

Table I: Percentages of science teachers that undertook PD programs in the last 3years in Anambra state.

S/N	PD Programs	Frequency (F)	Percentage (%)
1	Seminars	190	52.8
2	Conferences	200	55.6
3	Webinars	60	16.7
4	Qualification programmers	290	80.6
5	Skill- based training	88	24.4
6	Mentoring or peer observation and coaching	93	25.8
7	Periodic workshops	280	77.8
8	Research (individual & collaborative)	156	43.3
9	Observation visits to other schools	28	7.8
10	Reading professional literature eg (journals, evidence –based papers etc)	118	30.6

Analysis from table 1 shows that science teachers only attends qualification programs, periodic workshops and conferences to a good extent hence their percentages were 80.6, 77.8 and 55.6 respectively while others have low percentages especially observation visits to other schools and webinars whose percentages are 7.8 and 16.7 respectively.

Research Question2: What are the reasons why most science teachers in secondary schools do not undertake PD programs in the last 3years?

Table 2: Mean scores of science teachers on the reasons why most of them have not attended PD programs in the last 3years

S/N	Items	SA	SA	D	SD	Mean	Decision
1.	Inability to assess the quality of PD programs	28	84	76	172	1.91	Disagreed
2.	Too expensive	99	150	95	16	2.92	Agreed
3.	Conflict work schedule	178	117	64	01	3.31	Agreed
4.	Family Responsibilities	165	128	44	23	3.21	Agreed
5.	Lack of employers support	68	128	92	72	2.53	Agreed
6.	Do not have the prerequisites	55	40	176	89	2.17	Disagreed
7.	Failure to align state & local policies towards a coherent set of international policies	78	95	171	16	2.65	Agreed
8.	Dyfunctional school cultures	90	28	73	169	2.11	Disagreed
	Grand mean					2.60	

Data on table 2 revealed that most of the items on that table were reasons why teachers do not attend PD programs in Anambra state but rejected that items 1, 6 and 8 are among the reasons why they don't attend PD programs

Research Question3: What are the strategies that will enhance adequate science teachers' participation in PD programmers in secondary schools?

Table 3: Mean scores of science teachers on the strategies that will enhance their adequate participation in PD programs

S/N	Items	SA	A	D	SD	Mean	Decision
1.	Steps must be taken to build awareness of the importance of PD & access provided for interested science teachers	160	152	16	32	3.22	Agreed
2.	Providers & support mechanism need to be in place to ensure the training occur	101	151	92	16	2.94	Agreed
3.	High quality PD materials for teachers should be developed to ensure providers use best standard and research based tools	80	100	112	68	2.53	Agreed
4.	PD programs should be based on the needs of science teachers involved in the program	176	116	68	0	3.30	Agreed

5.	PD should be integrate in the school curriculum	125	185	41	09	3.18	Agreed
6.	PD for teachers should actually involve teachers in observing, analyzing & applying feedback to teaching practices	66	125	95	74	2.51	Agreed
7.	PD for teachers should concentrate on specific issues of science content & pedagogy	125	151	54	30	3.03	Agreed
8.	PD programs should help science teachers address difficulties they have in subject matter and skills	131	185	35	09	3.27	Agreed
9.	PD should engage science teachers in the transformative learning experiences that confront deeply held knowledge and beliefs of students	79	94	172	15	2.66	Agreed
10.	PD programs should maintain a sustained focus overtime, providing for continuous improvement of teachers	88	105	161	06	2.76	Agreed
	Grand Mean					2.94	Agreed

Analysis from table 2 showed that all the science teachers used for the study agreed that all the items on the table were among the strategies that will improve science teachers' participation in PD programs

Research question 4: To what extent do science teachers in secondary schools utilize the different collaborative methods in teaching?

Table 4: Mean scores of science teachers on their extent of utilization of different types of collaborative methods in teaching

S/N	Items	VHE	HE	ME	LE	Mean	Decision
1.	Simultaneous teaching	32	40	116	172	1.81	LE
2.	Supplemental teaching	20	76	88	176	1.83	LE
3.	Instructional stations	38	34	100	188	1.78	LE
4.	Teach and re- teach	25	93	169	73	2.19	ME
5.	One teach, one assist & support	58	43	173	86	2.20	ME
6.	Team teaching	89	36	147	88	2.35	ME
7.	One teach one observe	19	57	208	76	2.05	ME
	Grand mean					**2.03**	

Analysis from table 5 showed that all the science teachers used for the study utilize collaborative teaching only to low or moderate extent in their teaching hence their mean extent of utilization was below the accepted mean (2.03).

Research question 5: What are the barriers to adequate collaboration among science teachers in secondary schools in Anambra state?

Table 5: Mean scores of science teachers on the barriers to adequate collaboration among science teachers in secondary schools

S/N	ITEMS	SA	A	D	SD	MEAN	DECISN.
1.	Lack of respect and trust	168	131	41	20	3.24	Agreed
2.	Lack of time for shared planning	162	88	68	42	3.03	Agreed
3.	Poor listening skills	76	68	29	187	2.09	Disagree
4.	Internal competitiveness	192	104	36	28	3.28	Agreed
5.	Knowledge deficits	82	102	111	65	2.56	Agreed
6.	Lack of alignment around goals	162	153	14	31	3.24	Agreed
7.	Conflicting assumptions	67	128	95	71	2.54	Agreed
8.	Different mindsets	93	62	151	54	2.59	Agreed
9.	Organizational silos	128	188	36	8	3.21	Agreed
	Grand mean					**2.86**	

Research Question 6: What are the strategies that will enhance adequate collaboration among science teachers in secondary school?

Table 6: Mean scores of science teachers on the strategies that will enhance effective collaboration among them

S/N	Items	SA	A	D	SD	Mean
1.	Ensure there is enough time built into the subject matter schedule for teachers	163	129	43	25	3.19
2.	Always prepare agenda before the meeting & distribute it to all team members prior to the meeting	107	153	92	13	2.96
3.	Create a truly shared vision & goals	173	91	77	19	3.16
4.	Assign rotating roles	194	106	34	26	3.30
5.	Identify group norms	75	92	173	20	2.61
6.	Provide administrators support before, during and after team meetings	170	130	41	19	3.25
7.	Develop a sense of community among team members	120	156	56	28	3.02
8.	Work through conflicts	68	124	96	72	2.52
9.	Ensure consistency of the team	130	216	08	06	3.31
	Grand mean					**3.04**

Data in table 6 showed that all items were among the strategies that will enhance adequate collaboration among teachers in secondary schools; hence their grand mean was 3.04

Discussion of Findings

Results from the analysis above indicated that science teachers used for the study do not participate in enough P.D. programmers in the last 3 years. They only participate in qualification programs, seminars,

conferences and periodic workshops to a good extent even though some researchers have indicated that PD programs is important for teacher development and effectiveness. Anachina, Obi and Unachukwu (2021) maintained that PD for teachers is an important element in teachers' effectiveness and retention. Thus Gulzder (2019) is of the view that teachers should be encouraged to go for qualification programs, workshops etc to update their knowledge.

The teachers used for the study also indicated that they go for conferences, seminars, and workshops at times if it is sponsored by their schools or by the posts primary school service commission (PPSC) such as the science teachers Association of Nigeria (STAN) yearly conferences and workshops. This is in agreement with the study of Wilson (2011) who posited that PD programs are usually provided by individuals and organizations such as STAN outside of the school systems but may also be provided by schools, districts or states.

Science teachers used for the study agreed that most of them do not attend some PD programs because of their conflicting work schedule, family responsibilities; the program is expensive, lack of employers support and so on. This is in agreement with the study of Ugunade, Audu & Wama (2020) who were of the opinion that inadequate funding, poor implementation of staff development policies among others were among the reasons why some science teachers do not undertake PD programs. However, they agreed that for PD programs to be effective and interesting to teachers, it should actively involve teachers in assessing and applying feedback to teaching practice. This is in agreement with the opinion of Ferguson (2022) that PD programs should actively assist teachers in observing, analyzing and applying feedback to teaching practices. Also Elimore (2002) opined that PD programs should be continuously modified to meet the changing needs of teachers and students.

There were low extents of utilization of most of the different types of collaborative teaching methods by the science teachers in Anambra State. Most of them are not aware of these collaborative teaching methods and so do not use them. Hence they agreed that lack of time for shared planning; lack of respect and trust, internal competitiveness among others makes it difficult for them to engage in collaborative teaching. This is in agreement with the study done by Adewale (2021) that even though some science teachers and school administrators agreed that teacher collaboration leads to improved outcomes for both the teachers and the students yet many schools are still not providing enough time for teachers to work together during school hours. However, the science teachers used for the study agreed that the strategies that will help to improve active collaboration among them includes putting enough time into the master schedule for teachers, preparing agenda before the meeting; assigning rotating roles to teachers that will collaborate, ensuring consistency of team work and so on. This is in agreement with the study of Adewale (2021) who opined that for collaborative/cooperative learning to be effective teachers should be assigned rotatory roles and there shall be enough time for teachers' collaboration.

Conclusion

Effective PD enables teachers to develop the knowledge and skills they need to address students learning challenges. A well designed and implemented PD should be considered as

an essential component of a compressive system of teaching and learning that support students to develop the knowledge, skills and competences they need to thrive in the 21st century. PD takes place in PD programs in which teachers learn collaboratively. The strategy of collaborative teaching and learning has been used to enhance teacher's beliefs that they can succeed in implementing innovation in their own school situation. Collaborative teaching provides teachers the opportunity to work with their colleagues to regularly think about their practices and the uncertainties and dilemma of teaching.

Recommendations

1. PD should fit into the teacher's schedules and include learning during the school session and during the holidays.
2. Seminars, workshops and conferences should be organized by the ministry of education, agencies and schools for teachers to educate them on how to implement collaborative learning strategies.
3. Science education community should encourage and conduct systematic research about effective PD programs to add to our knowledge base for particular purpose in various educational contexts.
4. Government should offer science teachers reward or incentives for collaboration among teachers.
5. Access to PD should be expanded so that both new and experienced teachers can benefit to update their knowledge and skills.
6. The government and principals should pinpoint and provide a purpose for collaboration among teachers.

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