



Assessment of Chemistry Teachers' Professional Development on the Use of Emerging Technologies in Minna Metropolis, Niger State

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ABSTRACT

This study investigated the professional development of chemistry teachers in relation to the use of emerging technologies in Minna Metropolis, Niger State. Three research objectives were formulated to guide the study, and these were further translated into corresponding research questions. A descriptive research design was employed. The population comprised 112 chemistry teachers within Minna Metropolis. Data were collected using a researcher-developed questionnaire, which was validated by two experts—one from the Department of Science Education and the other from Educational Technology. The reliability of the instrument, determined using Cronbach's Alpha, yielded a coefficient of 0.82. Descriptive statistics, specifically mean and standard deviation, were used to analyze the data and answer the research questions. The findings revealed that while many chemistry teachers are professionally trained, they lack institutional training in the use of emerging technologies. Based on these findings, the study recommends that chemistry teachers should receive both professional and institutional training to effectively integrate emerging technologies into their teaching practice.

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INTRODUCTION

The 21st century presents itself with technological challenges (emerging technologies), and opportunities for the students, and it is important for the teachers to reach them with the tools that speak to the students especially when teachers engage in professional development regularly. Professional development is a platform that can specifically educate teachers regarding the efficacy of emerging technologies that can be woven into instruction to make it more interesting, interactive and collaborative for students. There is a need to emphasize the need for effective training of teachers on the use of emerging technologies that can significantly improve teacher-student communication in the diverse educational environment preparing and supporting both face-to-face and online teachers

to meet the diverse student needs is vital for the success of learning. In this process of learning, teachers are trying to adapt their teaching practice to a technologically mediated medium, by making use of the technological tools that enhance the quality of instruction. Teachers need to use other means of reaching out and communicating with their students and one aspect of technology that can be harnessed is emerging technologies. One cannot undermine the role of technology in the 21st century and the need for trained professionals that will serve as facilitators in diverse educational settings. Okan (2020) views emerging technologies as, 'tools, concepts, innovations, and advancements utilized in diverse educational settings to serve varied education related purposes.

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When educators discover new teaching strategies through professional development, they are able to go back to the classroom and make changes to their lecture styles and curricula to better suit the needs of their students. However, these changes are hard to evaluate because they are typically implemented gradually. Professional development for teachers makes them more efficient in their presentations and course evaluations by exposing educators to new delivery methods, evaluation styles and record-keeping strategies. In the words of Chris, (2021) Professional Development (PD) refers to the continued education or training of a person in order to advance and maintain his/her career. The study also reported that professional development is often collaborative and more intensive than casual learning. Acker *et al.* (2023) conceived PD as an on-going, planned learning development process which enables teachers' expansion of teaching potentials; contribute to work-based and professional development. It aids teachers' maintenance and enhancement of knowledge expertise and competence of teachers throughout their job careers. Chemistry teachers' professional development on the use of emerging technologies is the key to the realization of meaningful teaching and learning process. Kari (2023) stated that teacher professional learning is of increasing interest as one of the way to support the increasingly complex skills students need to learn in preparation for further education and work in the 21st Century. As a result of this, sophisticated forms of teaching are needed to develop students' competencies such as deep mastery of challenging content, critical thinking, complex problem-solving, effective communication, collaboration and self-direction. Effective professional development is needed to help teachers learn and refine the pedagogies required to teach these skills. Professional development is conceived in two perspectives, Institutional Professional Development (IPD) and Self-Professional Development (SPD).

Institutional Professional Development is the act of institutional governing bodies such as the Ministries of Education (MOE), Parent

Teachers Association (PTA), Universal Basic Education Commission (UBEC) among other agencies sponsoring teachers on professional development. Ligami (2021) affirmed that Institutional Professional Development cannot be treated as an individual responsibility and that dedicated institutional support is essential. This further placed a clarion call on educational governing bodies to stand up to the responsibility of developing teachers' skill in order to prepare and develop learners who can compete favourably in a competence-based work environment.

Self-Professional Development (SPD) is referred to as the state of self-willingness, self-motivation and self-readiness among Chemistry teachers to train themselves on the use of emerging technologies to teach. This is a situation where the concerned teachers did not receive any incentive from the governing bodies of the school or the school management. Michael (2020) argued that SPD reduces the mismatch between the IPD and individual teachers' needs. This implies that the institutional sponsored professional development might not address the immediate classroom needs of the teacher. Hence, the needs for individual teachers to identify their individual needs based on their classroom and subject dynamics and self-develop towards it. Michael (2020) further argued that individualized professional development gives teachers responsibility, choice and involvement in the planning of their learning experiences. Micube (2022) identified 21st century classroom management, communication, information, creative and innovative skills and media awareness as the possible factors that may affect Professional Development and advocated for SPD being induced by governing institutions at all levels of education especially for Chemistry teachers.

Chemistry is a branch of science that studies the properties, composition, and behaviour of matter. It explores how substances interact with each other, how matters change during chemical reactions, and the principles that govern these processes. Chemistry examines different forms of matter, which include solids,

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liquids, gases, and plasma. It investigates the structure and properties of atoms and molecules, which are the building blocks of matter. It studies how substances combine or break apart to form new substances. This involves understanding reactants, products, reaction mechanisms, and energy changes associated with these processes (Ababio, 2024)

Chemistry plays a critical role in various industries, influencing numerous aspects of production, product development, and environmental management. Its applications span across different sectors, including pharmaceuticals, agriculture, food processing, manufacturing, energy, and environmental science (Adesoji, 2021)

The importance of chemistry in industries cannot be overstated. It underpins innovation, enhances product quality, ensures safety, and promotes sustainability across various sectors. As industries continue to evolve and face new challenges, the role of chemistry will remain central to addressing these issues and driving progress. For these importance to come to stay, the instructional content should be delivered with the use of modern 21st Century technologies. This will make the students to be abreast of technologies they can use to function well on their various job. Twenty-first Century technologies are electronic devices that can be used for instructional delivery within and outside the classroom for the teaching of Chemistry.

When teachers, particularly Chemistry teachers are well professionally developed with 21st century techno-pedagogies, their level of awareness rises especially in the area of technological tools for teaching and learning processes. Awareness is the state of being conscious of professional development on the use of emerging technologies. Awareness is the ability to directly know and perceive the utilization of emerging technologies. It is a fundamental experience by teachers (Guertin, 2019). Ligami (2021) reported that IPD provides an opportunity to promote resource-based learning approaches, has the potential to offer quality courses, promotes information literacy skills among students, and

allows assessment for and of learning. Education being the tool of change needs to be modernized.

However, it cannot achieve its aims unless the institutional staff is professionally developed. Education undergoes many socioeconomic changes; educational institutions including teachers need to change as well. Thus, the employees/professionals need training and professional development that matches the sophisticated changes within their environment, society, culture in general and education system in particular. Therefore, it is always recommended to learn and get training in the form of simulation or workshop (Khan, 2021).

When teachers are fully aware of the existence of emerging technologies, then, the utilization is questioned. Utilization is the actual use of emerging technologies within the classroom or outside the classroom for effective teaching. Utilization is the use of emerging technologies such as social media, social networking, learning management system to achieve professional development (Garwood, 2023).

Statement of the Research Problem

Chemistry is a subject enshrined in the senior secondary school education curriculum and also provides foundation knowledge for students who may further their studies in since related courses in tertiary institution. Over the years, Chemistry teachers have not embrace emerging technologies to boost their professional development and instructional delivery.

Micube (2023) asserted that "our students have changed radically. Today's students are no longer the people our educational system was designed to teach". The teachers do not believe that the present generation of learners can learn from digital technologies, because they did not learn by that means. This has become a big challenge to the teachers. Field observation revealed that Chemistry teacher's instructional delivery is laden with the conventional methods. This is not in tandem with the 21st century needs of the learners and instructional delivery specifications of an ICT driven society. Therefore,

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this work aimed at assessing Chemistry teachers' professional development on the use of emerging technology studies in Minna metropolis

Purpose of the Study

The purpose of the study is to assess Chemistry teachers' professional development on the use of emerging technologies in Minna metropolis, Niger State. Specifically, the objectives of the study are to:

1. Assess Chemistry teachers' institutional professional development on the use of emerging technologies in Minna metropolis.
2. Examine Chemistry teachers' self-professional development on the use of emerging technologies in Minna metropolis.
3. Find out Chemistry teacher's use of emerging technologies for teaching in Minna metropolis.

Research Questions

Based on the above objectives, the study raised the following research questions:

1. What is Chemistry teachers' institutional professional development on the use of emerging technologies in Minna metropolis?
2. Do Chemistry teachers' self-professional development on the use of emerging technologies in Minna, Metropolis?
3. Do Chemistry teachers' use of emerging technologies for teaching in Minna metropolis?

METHODOLOGY

This study adopted descriptive survey research design. A descriptive survey research design is aimed at finding, describing and reporting events without manipulation. The study tries to find out the views of respondents through the use of questionnaire. This study involves the gathering of quantitative data using questionnaire for teachers in selected secondary schools in Minna Metropolis on the assessment of Chemistry

teachers' professional development on the use of emerging technologies. The population of the study comprised of Chemistry teachers in Minna metropolis. A total of 112 Chemistry teachers in secondary schools in Minna Metropolis comprising of Bosso and Chanchaga Local Government Areas. The sample size for this study was 112 Chemistry teachers from 25 secondary schools in Minna metropolis of Niger State. a random sampling technique was employed to carefully select participants in the study, Assessment Chemistry Teachers' professional development on the use of emerging technologies in Minna metropolis. The sample is in conformity with Krejcie and Morgan (1970) sample determination table which address the need for a representative statistical sample in empirical research. It is an effective method of determining sample size for a given population for easy reference.

The instrument that was used for data collection in this study was a researcher designed questionnaire titled, Chemistry Teachers' Professional Development on the Use of Emerging Technologies (CHEMTUT). Section A comprised the demographic information. The respondents are to tick where it is appropriate. Section B comprises of awareness of emerging technologies among Chemistry teachers for teaching. Section B will be responded to using Highly Aware (4), Fully Aware (3), Aware (2) and Not Aware (1). Section C will measure use of emerging technologies for teaching among Chemistry teachers using 4- point rated scale of Strongly Agree =4, Agree =3, Disagree =2 and Strongly Disagree =1. Section D will also measure means of professional development acquisition. It will be responded to using Self-Professional Development (self-sponsored) =4, Self-Development and Free Online =3, Institutional Professional Development =2 and Institutional-Professional Development (Not sponsored) =4.

The instruments titled Chemistry Teachers' Professional Development on the Use of Emerging Technologies (CHEMTUT) was used for data collection was validated by two experts, one from Department of Educational Technology

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and Science Education Department, Federal University of Technology, Minna. The reliability coefficient obtained was 0.82 which indicate that the instrument was adjudged to be reliable for the purpose of this study. The result indicate strong reliability and validity of the measurement instruments used in the study. Orientation was given to the respondents on the aim and objectives of the study and how to fill the questionnaire, to ascertain that the appropriate data was collected. The researcher then administered the questionnaire to the respondents and retrieved them immediately. 86 questionnaires were printed for the study. The study lasted for six (6) weeks. The data collected was and analyzed using simple descriptive statistics. The research questions were answered

using mean and standard deviation. The decision mean for the descriptive statistics will be 2.5 because the questionnaire is a four-point rated scale with the use of Statistical Package for Social Sciences (SPSS) Version 23.

RESULTS

Research Question One: What is Chemistry teachers' institutional professional development on the use of emerging technologies in Minna metropolis?

To determine whether Chemistry teachers' institutional professional development on the use of emerging technology in Minna Metropolis, analysis of mean and Standard deviation was carries out as shown in table 4.1.

Table 4.1: Analysis of Mean and Standard Deviation of Chemistry Teachers' Institutional Professional Development on the Use of Emerging Technology in Minna Metropolis

S/N	Emerging Technologies	Mean	STD	Decision
1	Microsoft PowerPoint	3.44	0.61	Institutionally Developed
2	Microsoft Excel	3.36	0.52	Institutionally Developed
3	Multimedia Projector	3.28	0.68	Institutionally Developed
4	Digital Camera	3.35	0.55	Institutionally Developed
5	Electronic Whiteboard	3.41	0.58	Institutionally Developed
6	Interactive Response System	3.22	0.69	Institutionally Developed
7	Laptop	3.36	0.53	Institutionally Developed
8	Media Player/MP3	3.35	0.63	Institutionally Developed
9	Digital Podium	3.47	0.61	Institutionally Developed
10	Smart Devices	3.37	0.65	Institutionally Developed
11	Audio Books	3.36	0.59	Institutionally Developed
12	Google Meet	3.29	0.72	Institutionally Developed
13	Zoom	3.40	0.56	Institutionally Developed
14	Smart TV	3.45	0.52	Institutionally Developed
15	Microsoft Word	3.47	0.50	Institutionally Developed
16	Facebook	3.45	0.56	Institutionally Developed
17	WhatsApp	3.40	0.52	Institutionally Developed
18	Electronic Mail	3.45	0.67	Institutionally Developed
19	Twitter	3.36	0.64	Institutionally Developed
20	TikTok	3.44	0.62	Institutionally Developed
21	Grand Total	3.38	0.60	Institutionally Developed

The result in the table 4.1 shows the Chemistry teachers' institutional professional development on the use of emerging technology in Minna Metropolis response shows that all the

item 1 to 20 reveal that most Business studies teachers are developed institutionally. Item 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19 and 20 with their mean greater than 2.5 0 with grand mean total of 3.38. There is no disparity in

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their standard deviation since the standard deviation follow the same pattern with grand total of 0.60

Research Question Two: What is Chemistry teachers' self-professional development on the

use of emerging technologies in Minna, Metropolis?

To determine whether Chemistry teachers' self-professional development on the use of emerging technologies in Minna, Metropolis? Analysis of mean and standard deviation was carried out as shown in the table 4.3

Table 4.3: Analysis of Mean and Standard Deviation of Chemistry Teachers' Self-professional Development on the Use of Emerging Technologies in Minna Metropolis

S/N	Emerging Technologies	Mean	STD	DECISION
1	Microsoft PowerPoint	3.36	0.53	Highly Developed
2	Microsoft Excel	3.37	0.62	Highly Developed
3	Multimedia Projector	3.38	0.63	Highly Developed
4	Digital Camera	3.30	0.61	Highly Developed
5	Electronic Whiteboard	3.35	0.67	Highly Developed
6	Interactive Response System	3.35	0.57	Highly Developed
7	Laptop	3.37	0.66	Highly Developed
8	Media Player/MP3	3.40	0.58	Highly Developed
9	Digital Podium	3.33	0.60	Highly Developed
10	Smart Devices	3.28	0.66	Highly Developed
11	Audio Books	3.24	0.70	Highly Developed
12	Google Meet	3.34	0.58	Highly Developed
13	Zoom	3.27	0.77	Highly Developed
14	Smart TV	3.37	0.70	Highly Developed
15	Instagram	3.42	0.58	Highly Developed
16	Facebook	3.43	0.56	Highly Developed
17	WhatsApp	3.44	0.56	Highly Developed
18	Electronic Mail	3.34	0.61	Highly Developed
19	Twitter	3.34	0.63	Highly Developed
20	TikTok	3.42	0.81	Highly Developed
21	Grand Total	3.01	0.53	Highly Developed

Table 4.3 shows the results of self-professional development of Chemistry Teachers'. The results show that most of Chemistry teachers develop themselves after institutions have spent resource on them by putting the knowledge into practice while teaching in the classrooms. All the items in Table 4.3 shows it means to be greater than 2.50. Item 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19 and

20 have their mean greater than 2.50 with grand total of 3.01. The standard deviation did not show any disparity since they follow the same pattern with their grand total 0.53

Research Question Three: What is chemistry teachers' use of emerging technologies for teaching in Minna metropolis?

Table 4.4: Analysis of Mean and Standard Deviation of Chemistry Teachers' use of Emerging Technologies in Minna Metropolis

S/N	Emerging Technologies	Mean	STD	DECISION
1	Microsoft PowerPoint	3.34	0.63	Highly Use
2	Microsoft Excel	3.42	0.81	Highly Use

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3	Multimedia Projector	3.36	0.53	Highly Use
4	Digital Camera	3.37	0.62	Highly Use
5	Electronic Whiteboard	3.38	0.63	Highly Use
6	Interactive Response System	3.30	0.61	Highly Use
7	Laptop	3.35	0.67	Highly Use
8	Media Player/MP3	3.35	0.57	Highly Use
9	Digital Podium	3.37	0.66	Highly Use
10	Smart Devices	3.40	0.58	Highly Use
11	Audio Books	3.33	0.60	Highly Use
12	Google Meet	3.28	0.66	Highly Use
13	Zoom	3.24	0.70	Highly Use
14	Smart TV	3.34	0.58	Highly Use
15	Microsoft Word	3.27	0.77	Highly Use
16	Facebook	3.37	0.70	Highly Use
17	WhatsApp	3.42	0.58	Highly Use
18	Electronic Mail	3.43	0.56	Highly Use
19	Twitter	3.44	0.56	Highly Use
20	TikTok	3.34	0.61	Highly Use
21	Grand Total	3.52	0.52	Highly Use

Table 4.4 reveal the analysis of mean and standard deviation of the use of emerging technologies in teaching of Chemistry. The results reveal that Chemistry teachers use emerging for teaching and learning with value of mean of 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19 and 20 greater 2.50 with the grand total of 3.52. The standard deviation shows that there is no disparity in the result since the standard deviation following the same pattern.

Findings on the Emerging Technologies for Teaching and Learning of Chemistry By Chemistry Teachers

Analysis of mean and standard deviation has shown that Most Chemistry teachers have been developed institutionally on the use of emerging technologies, Chemistry teachers are fully aware of emerging technologies, Most Chemistry teachers compliment the effort of institution by improving on the development given to them by institutions and Most chemistry teachers make use of emerging technologies during teaching and learning processes. These findings support the findings of Jeffrey et al 2020, who says most teachers are been trained by

Kenya Government for effective performance in the class also the work of Syviel saw *et al* 2020, support these findings which says most South Africa teachers were trained to use emerging technologies for effective performance in class during teaching and learning. The institution of each were asked to nominate teachers for training every term of academic session which help the government. The government effort is supported by every teacher sponsored by putting into practice what they have learnt in the training sometimes consulting the expert for more explanation on the learnt software this finding supported findings of Syvie, *et al* 2020 most teachers in South Africa develop themselves after government sponsored them for academic training and go against the findings of Mathieu,(2021)and Philip (2022) who says Edo state teacher are the one responsible for their training and government did not sponsor most of the their teachers for technological development.

CONCLUSION

It has been asserted that students' performance in Chemistry is poor in spite of the importance of the subject towards technological

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and commercial development of dear our nation. The major cause of the performance is attributed to inappropriate of teachers' to adopt, adapt, trained, support and availability of emerging technology in the our nation. It is against this background that this study is to assess of Chemistry teachers' professional development on the use of emerging technologies in Minna Metropolis, Niger State.

Conclusion arising from the findings of this study indicates that emerging technologies which Chemistry teachers employ in teaching and learning chemistry determine the performance of chemistry students in which institutions, Chemistry teachers have spent a lot of resource on for better performance. Both chemistry teachers and government have identified the emerging technologies as a teaching tools that improve students' performance. Emerging technologies are constructively interact freely to learn and consciously depend less their teachers' their achievement could improve in chemistry drastically.

RECOMMENDATIONS

Based on the major findings of this study, the following recommendations are proffered:

1. More teachers should be trained on emerging technologies which would reduced the boredom, increase retention and improve the performance of students
2. More teachers should be encouraged to use emerging technologies when teaching their subject
3. chemistry teachers and other teachers should be trained on how to use emerging technologies
4. The teacher education should geared towards preparation of chemistry teachers to acquire and maintain appropriate emerging technologies which believed strongly enhanced the performance
5. Curriculum developer should embrace and include emerging technologies that

will bring about improvement in learning, acquisition of skills, social interaction and performance skill into student curriculum

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