



Investigation of Teachers' Preparedness for Flipped-Classroom Pedagogy for Science, Technology, Engineering and Mathematics Education Development in Post-Pandemic Era, Gombe State

¹Timayi, J. M., ¹Chomo, H. J., ¹Gwandum, S. G., ²Luther, E. H

¹Department of Mathematics and Computer Science,

²Department of Education,

College of Education Billiri, Gombe State

ABSTRACT

Investigation of teachers' preparedness for flipped-classroom pedagogy for science, technology, engineering and mathematics education development in post-pandemic era, Gombe state. The study was guided by four objectives and research questions. The survey design was used on a population of 350 primary school teachers from which 161 were selected to participate in the study. The Teachers' Flipped-Classroom Preparedness Questionnaire (TFCPQ) with a reliability index of 0.85 was used to collect data from the teachers. Data collected was analyzed using descriptive statistics of mean and standard deviation scores. The result revealed that although the demographic profile (gender, age and years of experience) of teachers are normally distributed, their level of preparedness for the flipped classroom pedagogy was poor owing to level of technology usage and prior knowledge, confidence in the use of technology, lack of proficiency at basic computer operation, software usage, learning management systems, video recording and flipped classroom instruction which are skills essential in the flipped classroom model need for STEM pedagogy. The study recommended that teachers should be trained on the use of technology (projectors, computer, camera usage, video making etc) and computer software (word processing, spreadsheets, Power Point presentations, graphics, Google Classroom etc) towards flipped classroom model implementation.

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INTRODUCTION

The Covid-19 pandemic came and met most nations of the world ill-prepared. Many countries were swept off their feet with every sector of their economy affected adversely. In Nigeria, one of the sectors worst hit by the pandemic was the educational sector. The sector witnessed the closure of all schools (primary, secondary and tertiary) by a government order enforced by law enforcement agencies. Many children and parents were left at the mercy of learning at home which was strange, difficult and not feasible. The post-pandemic era brought about a shift in paradigm in learning with many

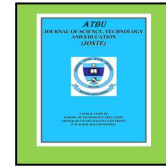
nations adopting pedagogical approaches to compliment the already status quo of traditional method (TM) of learning (face-to-face). Many of these adopted techniques of learning converge in the blended methods and technologically enable learning. One of such methods is the flipped learning which essentially involves taking lessons from group space to individual space (Lin & Chen, 2016). The flipped classroom refers to a model of learning which reverses how time is spent in and out of the class to shift the ownership of learning from teachers to learners (Shu, 2015). It also refers to educational software, video recordings, screen casting software, demonstrations, and

Corresponding author: Timayi, J. M

✉ timavijoe@gmail.com

Department of Mathematics and Computer Science, College of Education Billiri, Gombe State.

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slide presentations with animations for the students to watch and read (Unamba et al (2016).

Makrodimos et al (2017) observed that flipped-classroom activates students, offers more opportunity for interaction, brought better learning outcomes and turned learning into a more 'cheerful' and energetic process. Even though the flipped-classroom learning is laudable with great advantages and applicability at all levels of educational system, there is a need to check its workability in Gombe state where the sitting governor in 2021 declared a 'state of emergency' on educational sector. It has been observed that many teachers have not yet taken to technology enabled pedagogy.

There is a social and political pressure in developing countries on teachers to use ICT to improve the access to and the quality of education available to learners (Dele-Ajayi et al., 2021). Added to that, integrating technology is a daunting task to achieve especially for teachers in a developing country like Nigeria where the demand for education remains a struggle in the face of dwindling resources (Ifinedo et al., 2019). Another study by Nwafor et al (2023) reported that teachers' competence in the use of digitalized learning tools such as zoom facilities, google classrooms, and video clips is very low. These factors and many more affect teachers' readiness and preparedness in their acceptance to technology enabled pedagogy among learners.

The level of preparedness of teachers and pupils of primary school is very important in the actualization of the flipped-classroom learning to foster an environment for Science, Technology, Engineering and Mathematics (STEM) development among pupils. Yang (2014) opined that modern technology makes it possible to implement the flipped classroom which fosters students' learner autonomy and cooperative learning. However, the existing problems in practicing flipped classroom such as lack of technology, poor performance in the flipped learning video, poor performance in classroom design, and poor monitoring of students' work at home needs to be addressed. Not many study addressed the issues of teachers' and students' preparedness for flipped classroom

implementation. According to the main idea of preparedness for flipped classrooms is an expectation of teachers to create videos lectures capable of teaching students in advance of an actual class. The video may be online (websites) or offline (VCDs/DVDs) and other medium.

Kazu and Kurtoğlu (2022) in their study found overall positive preparedness among teachers with regard to self-efficacy in controlling learners, technological self-efficacy and self-efficacy for planning classroom time. Also, teachers who owned computers and perceived themselves as being competent users of ICT are more likely to be able to implement flipped classroom pedagogy. Another study by Muniandy et al. (2022) reported that the readiness of teachers to implement the flipped classroom was at a high level due to institutional support, technology self-efficacy and beliefs on the flipped strategy. Consequently, the study suggested that teachers should equip themselves to increase readiness in implementing flipped classrooms. Yet, a study Lorenzo (2022) on teachers' readiness on the implementation of flipped classroom technology instruction reported that the teachers are knowledgeable on various flipped classroom technologies and use them frequently. Also, research established a relationship between the demographic profile (gender, age and years of experience) and level of proficiency on the use of flipped classroom technology.

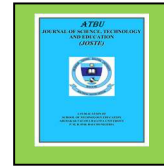
Moreover, Rahman et al (2015) demonstrated the need for the students to be prepared prior to the teaching and learning which makes for a success and meaningful flipped classroom. These holds were teachers' perception on training and use of technology is seen as a catalyst that can foster improvement in their teaching and instructional delivery in classrooms (Aminu & Samah, 2019). Teachers unpreparedness makes students passive in the flipped classroom. Timayi et al. (2024) observed that without a good initiative of the flipped classroom, the students are left as mere spectators. This study is an investigation of teachers' preparedness for flipped-classroom pedagogy for science, technology, engineering

Corresponding author: Timayi, J. M

✉ timayijoe@gmail.com

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and mathematics educational development in post-pandemic era, Gombe state.

Statement of the Problem

The advent of the Covid-19 pandemic affected the educational sector of Nigeria such that schools were closed and learning was inhibited adversely. The traditional method of learning (face-to-face) was found to be limited since physical presence of teachers and pupils was needed for lesson delivery. Pedagogy suffered because Nigeria was ill-prepared for the pandemic which took the nation unaware. Many nations having learnt from the pandemic era had a shift in paradigm by complimenting the traditional method with technologically enabled methods, one of which is the flipped classroom learning to address this problem. The flipped classroom learning takes pedagogy from the group spaces to the individual spaces. This checks the frustration students experience in the traditional method classroom which is teacher-centered.

Consequently, there is a need for Nigeria to embrace the flipped classroom learning at all level of educational system. Nigerian students have also been observed to have great affinity for technological devices that help in learning such as smart phones, videos (online and offline) etc. The success of the flipped-classroom depends on the teachers and the pupils. Hence, this study investigated teachers' preparedness for flipped-classroom pedagogy for science, technology, engineering and mathematics educational development in post-pandemic era, Gombe state.

Objectives of the Study

The objectives of the study are to:

1. determine teachers' technology usage and prior knowledge needed for the flipped-classroom pedagogy.
2. determine the extent of teachers' confidence on the use of technology required for flipped-classroom pedagogy.

3. determine teachers' level of proficiency needed for flipped-classroom pedagogy.
4. determine teachers' preparedness in using the flipped-classroom for STEM pedagogy.

Research Questions

The following research questions were formulated as a guide to the study:

1. What is the extent of teachers' technology usage and prior knowledge needed for the flipped-classroom pedagogy?
2. What is the teachers' confidence level on the use of technology required for flipped-classroom pedagogy?
3. What is the teachers' level of proficiency needed for flipped-classroom pedagogy?
4. What is the teachers' level of preparedness in using the flipped-classroom for STEM pedagogy?

METHODOLOGY

The study adopted the survey research design on a population comprised of 354 primary school teachers from Billiri and Kaltungo LGA of Gombe State. The two LGAs have a similar terrain, life style, tribe and livelihood. 161 primary school teachers participated in the study. A readiness scale adapted from Lorenzo (2022) and Kazu & Kurtoğlu (2022) modified and tagged: The Teachers' Flipped-Classroom Preparedness Questionnaire (TFCPQ) was used to collect data from the teachers.

TFCPQ has five sections (5). Section A: Demography of participants (gender, age and years of service). This was basically a nominal scale of 'Yes' or 'No'. Section B: Teachers technology usage and prior knowledge. This was based on the ratings of 'Very Confident', 'Confident' and 'Not Confident'. Section D: Extent of teachers' confidence on use of technology. This follows similar ratings of 'Very Confident', 'Confident' and 'Not Confident'. Section E: Teachers level of proficiency and preparedness to using flipped classroom technology to teach. This

Corresponding author: Timayi, J. M

✉ timayijoe@gmail.com

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was based on five point Likert type ratings of: 'Strongly Agree', 'Agree', 'Disagree' and 'Strongly Disagree'. The validity of TFCPQ was determined by experts in the field of Science Education while its reliability was computed to be 0.85 using the Split-Half method. Hence, TFCPQ was deemed usable in the study. It took at least 15 minutes to administered TFCPQ to the teachers and explain

some items on the questionnaire to them. Data collected was analyzed using descriptive statistics (mean and standard deviation scores) using the statistical Package for Social Science (SPSS version 28.0).

RESULTS

Table 1: Demography of participants

S/No	Source	Frequency	%
1	Gender		
	Male	67	41.6
	Female	94	58.4
	Total	161	100.0
2	Age Range		
	20 – 29	16	9.9
	30 – 39	38	23.6
	40 – 49	76	47.2
	50 – 59	27	16.8
	60 and above	4	2.5
	Total	161	100.0
3	Years of Service		
	1 – 10	38	23.6
	11 – 20	80	49.7
	21 and above	43	26.7
	Total	161	100.0

The demographic data (gender, age range and years of service) of the participants is presented in Table 1. The gender profile shows that majority of the participants 94 (58.4%) are female teachers. 67 (41.6%) of the participants are male teachers. Also, most of the teachers 76 (47.2%) are within the age range of 40 – 49 while 4(2.5%) in the age range of 60 years and above. Generally, many of the teachers are young people. In addition, 80(49.7%) of the teachers have put in 11- 20 years of service while

43(26.7%) served 21 years and above. Only 38 teachers served between 1-10 years.

Research Question One: What is the extent of teachers' technology usage and prior knowledge needed for the flipped-classroom pedagogy.

Corresponding author: Timayi, J. M

✉ timayijoe@gmail.com

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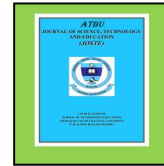


Table 2: Teachers' technology usage and prior knowledge

S/No	Item	N	Mean	SD	Decision
1	Do you have a computer?	161	1.58	.495	Accepted
2	Do you have an android phone/video camera device?	161	1.29	.453	Rejected
3	Can you make a video lesson?	161	1.50	.502	Accepted
4	Would you like to use technology in teaching your class?	161	1.06	.230	Rejected
5	Would you like to use video lesson in your teaching of STEM?	161	1.07	.263	Rejected
6	Have you seen a power point lesson before?	161	1.37	.485	Rejected
7	Have you watched a lesson on CD/DVD before?	161	1.28	.450	Rejected
8	Have you seen a lecture from a projector before?	161	1.20	.405	Rejected
9	Have you seen or attended an online lecture before?	161	1.48	.501	Rejected

Table 2 is on teachers' technology usage and prior knowledge. The result shows that most teachers have a computer (M=1.58, SD = 0.495) and they can make a video lesson (M=1.50, SD = 0.502). In addition, the teachers do not possess android device/video cameras (M=1.29, SD = 0.453), would not like to use technology in teaching (M=1.06, SD = 0.230) or even use video lesson in teaching of STEM (M=1.07, SD = 0.263). Moreover, the teachers have not seen a power point lesson (M=1.37, SD = 0.485) nor watched a lesson on CD/DVD (M=1.28, SD = 0.450). Also,

the teachers have never seen a lecture from a projector (M=1.20, SD = 0.405) and have not seen or attended an online lecture (M=1.48, SD = 0.501). Generally, the teachers' technology usage and prior knowledge is poor and may not meet the necessary requisite expected for a flipped class operation.

Research Question Two: What is the teachers' confidence level on the use of technology required for flipped-classroom pedagogy?

Table 3: Extent of Teachers Confidence on the Use of Technology

S/No	Item	N	Mean	SD	Decision
1	Computers and other technology for my classroom are sufficiently available	161	2.27	.707	Accepted
2	I have a computer with internet access available for use at school/home	161	2.25	.759	Accepted
3	I can collaborate with other teachers on issues of instruction that involves teaching with technology.	161	1.78	.686	Rejected
4	I will participate in mentoring/peer observation/coaching relative to the integration of technology in the classroom.	160	1.82	.570	Rejected
5	I participate in a network of teachers that discusses/addresses technology in the classroom.	161	1.96	.749	Rejected
6	My school provides on-site technology support.	161	2.30	.805	Accepted
7	I will put a lot of effort into implementing technology into the classroom.	161	1.71	.627	Rejected

Corresponding author: Timayi, J. M

timayijoe@gmail.com

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S/No	Item	N	Mean	SD	Decision
8	I have the knowledge to create a lesson/unit using the flipped classroom model.	161	1.88	.705	Rejected
9	Using technology enhances students' learning.	161	1.50	.582	Rejected
10	My school provides staff development to assist with technology integration including flipped classrooms.	159	2.06	.752	Accepted
11	I feel confident in my ability to use technology.	161	1.63	.609	Rejected
12	I expect my technology activities to be successful.	161	1.69	.645	Rejected
13	My school administrators will support teaching with technology	161	1.65	.654	Rejected
14	I am confident that I could create a unit utilizing a flipped classroom strategy.	161	1.84	.576	Rejected

Table 3 show the extent of teachers' confidence on the use of technology. The result revealed availability of computers/other technology (M=2.27, SD = 0.707), internet access (M=2.25, SD = 0.759), on-site support (M=2.30, SD = 0.805) and staff development for flipped classroom (M=2.06, SD = 0.752). It was also observed that teachers may have issues collaborating with their peers on teaching with technology (M=1.78, SD = 0.686), integrating technology into classroom (M=1.82, SD = 0.570), networking with other teachers (M=1.96, SD = 0.749), implementing technology in classrooms (M=1.71, SD = 0.627) and creating lessons using the flipped classroom Model (M=1.88, SD = 0.705).

Furthermore, the teachers are not confident in the flipped classroom to enhance students learning (M=1.50, SD = 0.582), their ability to use technology (M=1.63, SD = 0.609),

not optimistic in the success of technology activities, belief that school administration may not support teaching with technology (M=1.65, SD = 0.654) and lacked the confidence to create a unit using the flipped classroom model (M=1.84, SD = 0.576). The foregoing shows that the teachers lack confidence in the use of technology, collaboration and networking needed for integrating technology in classrooms. Moreover, the teachers are not open to mentoring and coaching, and belief that school administration may not support teaching with technology in classroom. These features are all important for the implementation of the flipped classroom model in schools.

Research Question Three: What is the teachers' level of proficiency needed for flipped-classroom pedagogy?

Table 4: Teachers' Level of Proficiency needed for Flipped Classroom Technology

S/No	Item	N	Mean	SD	Decision
1	Basic Computer operation	161	1.62	.580	Rejected
2	Word Processing (Microsoft word)	161	1.73	.581	Rejected
3	Spreadsheets (Microsoft excel)	161	1.89	.712	Rejected
4	Presentation Software (Microsoft power point)	161	1.84	.771	Rejected
5	Computer Input Devices (scanner, printers cameras)	161	1.83	.657	Rejected
6	Learning Management Systems (google classroom)	161	1.88	.736	Rejected
7	Video Recording (Online/ Offline)	161	1.80	.663	Rejected
8	Flipped Classroom Instruction	161	1.87	.593	Rejected

From Table 4, it was observed that the proficiency level for flipped classroom among the teachers was generally poor evidenced by basic computer operation (M=1.62, SD = 0.580), word

processing (M=1.73, SD = 0.581), spreadsheets (M=1.89, SD = 0.712) and presentation (M=1.84, SD = 0.771). Other faulty proficiency level observed are: use of computer input devices

Corresponding author: Timayi, J. M

timayijoe@gmail.com

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(M=1.83, SD = 0.657), learning management systems [google classroom] (M=1.88, SD = 0.736), video recording [online and offline] (M=1.80, SD = 0.663) and flipped classroom instruction (M=1.87, SD = 0.593). The result shows that teachers are not proficient. In other words, they lack the needed proficiency level needed in basic computer operation, software

usage, learning management systems, video recording and flipped classroom instruction.

Research Question Four: What is the teachers' level of readiness in using the flipped-classroom for STEM pedagogy?

Table 5: Preparedness to Using Flipped Classroom Technology to Teach

S/No	Item	N	Mean	SD	Decision
1	Flipped classroom model can be used to teach STEM	161	1.75	.539	Rejected
2	I would like to explore Flipped classroom model of teaching for STEM	161	1.78	.474	Rejected
3	I would like to compliment the conventional teaching with Flipped classroom model of teaching for STEM.	161	1.78	.474	Rejected
4	Flipped classroom model of teaching will benefit my pupils in STEM	161	1.54	.536	Rejected
5	Flipped classroom model of teaching will improve my pupils performance in STEM	161	1.47	.537	Rejected
6	Flipped classroom model of teaching will expose me to a new way of teaching STEM lessons	157	1.59	.599	Rejected

The preparedness of the teachers to the use of flipped classroom in teaching is presented in Table 5 is epileptic because the teachers' belief that flipped classroom can be used to teach STEM is limited (M=1.75, SD = 0.539), use of flipped classroom model to teach STEM (M=1.78, SD = 0.474), complimenting flipped classroom model and conventional teaching (M=1.78, SD = 0.474). In addition, the teachers do not really belief flipped classroom model will benefit (M=1.54, SD = 0.536) and improve (M=1.47, SD = 0.537) pupils in STEM pedagogy. They also belief flipped classroom model will not expose them to teaching STEM lessons (M=1.59, SD = 0.599). Summarily, the teachers are not prepared for flipped classroom pedagogy

DISCUSSION OF FINDINGS

From Table 1, majority of the participants are female teachers who are not technology friendly compared to their male counterparts. However, many of the teachers are below 50 years of age and have put on at least twenty years of service. The implication of this is that many of these teachers are expected to be

able to implement the flipped classroom model in their teaching.

Table 2, showed that generally, teachers' technology usage and prior knowledge was observed to be poor and may not meet the necessary requisite expected for a flipped class operation. This finding corroborates with Dele-Ajayi et al. (2021), Ifinedo et al. (2019) who reported on the difficulty of teachers to integrate technology into their classroom delivery which will in turn affect their preparedness to implement the flipped classroom model.

From Table 3, it was revealed that the teachers lack confidence in the use of technology, collaboration and networking needed for integrating technology in classrooms. Moreover, they are not open to mentoring and coaching, and belief that school administration may not support teaching with technology in classroom. Although this finding negates Lorenzo (2022) who observed that teachers are knowledgeable on various flipped classroom technologies and use them frequently. This also confirms the studies of Ifinedo et al. (2019) and Dele-Ajayi et al. (2021) who asserted that Nigerian teachers are struggling

Corresponding author: Timayi, J. M
 ✉ timayijoe@gmail.com

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with acceptance and integration of technology in their teaching.

In Table 4, the result clearly shows lack of proficiency among teachers in terms of basic computer operation, software usage, learning management systems, video recording and flipped classroom instruction. These skills are very essential in the flipped classroom model. This finding negates Kazu and Kurtoğlu (2022) and by Muniandy et al. (2022) who reported teachers being proficient and believed in the flipped classroom model. In particular, it follows that the teachers have not understood that technology fosters better learning environment in the 21st century classrooms as demonstrated by Makrodimos et al. (2017) and Aminu & Samah (2019).

On the issue of preparedness of teachers toward using the flipped classes for STEM pedagogy as presented in Table 5, the result shows that teachers are not prepared for flipped classroom pedagogy. This finding may be due to their demographic profile (Table 1) which shows that majority of the teachers are women who are alien to technology. This agrees with Lorenzo (2022) who established a relationship between the demographic profile (gender, age and years of experience), readiness and level of proficiency on the use of flipped classroom technology. The result also negates Kazu and Kurtoğlu (2022) who reported that preparedness among teachers is a function of their self-efficacy in controlling learners, technological self-efficacy and self-efficacy for planning classroom time. It was also seen that ownership of computers gives room for competency in the use of ICT needed for flipped classroom pedagogy. In addition, these teachers may lack institutional support, technology self-efficacy and have wrong beliefs of the flipped strategy which when corrected may lead to a positive preparedness as opined by Muniandy et al. (2022).

CONCLUSION

The study concludes that although the demographic profile (gender, age and years of experience) are normally distributed, their level of preparedness for the flipped classroom pedagogy

is poor. This was due to the teachers' technology usage and prior knowledge which was observed as not meeting the requisite expected for a flipped class operation. In addition, the teachers lack confidence in the use of technology, collaboration and networking needed for integrating technology in classrooms. Moreover, they are not open to mentoring and coaching, and belief that school administration may not support teaching with technology in classroom.

Another revelation from the study was the lack of proficiency among teachers in terms of basic computer operation, software usage, learning management systems, video recording and flipped classroom instruction which are skills essential in the flipped classroom model. On the issue of preparedness of teachers toward using the flipped classes for STEM pedagogy, the result shows that teachers are not prepared for flipped classroom pedagogy.

RECOMMENDATIONS

Based on the findings of the study, the following were recommended:

1. School Administration and teachers should be orientated on the use of technology in classroom pedagogy.
2. Teachers should be trained on the use of technology (projectors, computer, camera usage, video making etc) and computer software (word processing, spreadsheets, Power Point presentations, graphics, Learning Management Systems: Google Classroom etc) towards flipped classroom model implementation.
3. Teachers should be encouraged to pursue proficiency in use of technology in classroom. This will bring about the requisite knowledge for flipped classroom pedagogy.
4. Regular workshops and seminar should be organized by the government and other private initiative in conjunction with the Parents Teachers Association to promote/ popularize the flipped classroom learning among learners.

Corresponding author: Timayi, J. M

timayijoe@gmail.com

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Corresponding author: Timayi, J. M

✉ timayijoe@gmail.com

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