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Digital Transformation of Teachers Psychological Readiness and Pedagogical Skills' Impact on Quality of Science and Mathematics Curriculum Delivery for Students' Learning at Secondary School Level in Nigeria

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ABSTRACT

Quality of science and mathematics teaching depends upon the psychological readiness and pedagogical skills of the teachers. However, the outbreak of COVID – 19 pandemics has negatively affected the teaching and learning of science and mathematics and make it more demanding than before hence, the importance of digital transformation in teaching and learning cannot be overemphasized. The study investigated the science and mathematics teachers' psychological readiness and pedagogical skills in this pandemic era. The population of the study comprised of science and mathematics teachers in senior secondary schools in Ekiti State, Nigeria. Purposive sampling techniques were used to select a total of 1,600 science and mathematics teachers at equal representation from all the Local Government Area Councils of the State. Instruments used include Psychological Readiness Checklist (PRC) and Pedagogical Content Knowledge Instrument (PCKI) adapted from Lee Shulman (1996). The two instruments were validated, and the reliability coefficient was 0.87 and 0.88 respectively. The findings showed that psychological readiness of science and mathematics teachers were below average with that of mathematics teacher showed a lower ratio while the pedagogical content knowledge coefficient of science and mathematics teachers were above average with that of science teachers showed a higher ratio. Qualification has effect on science and mathematics teachers' psychological readiness and pedagogical skills while gender does not have a significant influence. It is then recommended that periodic training and retraining of science and mathematics teachers is bedrock to effective and efficient teaching of this subject matter in schools.

KEYWORDS: *Psychological readiness, Pedagogical content knowledge, science and mathematics, digital teaching and learning, COVID-19*

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INTRODUCTION

The actualization of any national objectives is dependent on teachers and other stakeholders to ensuring that the talents of their citizenry are exploited to the fullest. Teachers are the implementer of any educational program, and the success and failure of such program is a product of the competence, attitude, and readiness of the teachers.

The process of transforming the science and mathematics education system is accompanied by an increase in requirements for teachers. Much attention needed to be paid to the readiness of the future teachers' specialists for successful solution of their professional tasks. The mismatch between the professional expectations of a teacher as a specialist, who can solve teaching and learning problems and the level of his professional readiness to do it, is one of the frequent contradictions in the teaching profession. One solution to the problem of formation of psychological readiness is the realization of innovative digital technologies, aimed at creating the

conditions in which the teacher becomes ever ready to educational activities and can be more fully realizing his potential.

Psychological readiness according to Botagoz, Zhanat, & Zhubakova, (2015) is a mental phenomenon by means of which the stability of activity of the person in poly-motivated space is explained in the form of mindset (as projections of last experience to a situation "here and now"), the conscious assessments of the situation and behaviour caused by the previous experience in the form of motivational readiness (opportunity to realize sense and value of what he does) and in the form of professional and personal readiness for self-realization through personalization process.

Pedagogical Content Knowledge (PCK) is the integration of subject expertise and skilled teaching of that subject. PCK was first developed by Lee Shulman in 1986…. Teachers must keep specific method in mind when preparing to teach a subject. Shulman (1986) defined PKC as teachers' interpretations of subject matter knowledge in the context of helping the students learning. PKC affect how teachers think about their subject matter knowledge. Teachers' understanding of subject matter will influence learner's learning.

Currently, there are several approaches to the concept definition of the "psychological readiness". In bibliographic sources there is a great variety in approaches to definitions and components of this concept. At the same time, many studies are focused on consideration of the concept "psychological readiness" from the standpoint of readiness to carry out an action.

According to Vorobyova, (2011), readiness literally means two values. The first is consented to make something as the voluntary and conscious decision directed to activity; the second is a description of a state at which everything is ready for something, and which will provide implementation of the decision. The leading component of readiness is a psychological readiness which is understood as complex construct, as an alloy of functional and personal components providing motivational and mental readiness and ability of the subject to implementation of professional activity.

Despite distinction in approaches to determination of psychological readiness, most authors proceed from a common position that it is the "difficult synthetic construct" consisting of a complex of the various, interconnected elements (Botagoz, Zhanat, & Zhubakova, 2015).

Stability and quality of professional activity is caused by features of psychological readiness of the expert. Psychological readiness is a set of both internal and external conditions, first, personal qualities of the specialist teacher: intellectual, motivational, emotional, and professional values that provide readiness for professional activity. It is a certain internal confidence and determination, a condition of mobilization which is formed during a vocational education and that provides success in activity. At the same time psychological readiness is a condition of efficiency of professional activity.

The core of psychological readiness model is based on general principals of Lomov's conception (Lomov, 1984) about cognitive, communicative, and regulatory subsystems in the structure of human's psychological system. The model structure consists of the following units: a professional "Self - Concept"; motivation; personal characteristics and qualities; activity - significant properties and qualities. Relying on modern educational paradigms and understanding of man as a subject of development and self-development, we can say that the formation of psychological readiness of teachers requires the activation of their self-process (Popov et al., 2008).

To be psychologically ready, that is to be confident in your ability to perform as you want; one's fears need to be under-control. This does not mean you can't have fears. It means your fears don't have the power to change what your body is physically able to do.

Readiness implies a degree of single-mindedness and eagerness. Individuals learn best when they are physically, mentally, and emotionally ready to learn, and they do not learn well if they see no reason for learning. Students who are exhausted or in ill health obviously cannot learn much.

Educational environment of secondary school is the area where teachers and students have the full opportunity to express their activity and initiative. Such an understanding of studying processes of teachers or students as subjects of educational activity is directly connected with such concept as "competence". Accordingly, there are two basic levels of competency assessment. First - it is educational, which includes the period of vocational training, i.e., an assessment of training a competent specialist. The second - labor, i.e., assessment of the effectiveness of the professional specialist. Some of researchers (Baydenko, 2004; Bosova, 2005; Vvedensky, 2003; Volodina, 2008; Zeer, 2005; Zimnaya, 2003; Markova, 1996; Mitina, 2002; Tatur, 2004) understand under the competence the set of qualities that reflect the flexibility and readiness to adapt to the professional environment. Professional

competence is closely connected with the question of professionally important qualities.

Technological Pedagogical Content Knowledge is a framework to understand and describe the kind of knowledge needed by a teacher for effective pedagogical practice in a technology enhanced learning environment. Addressing content knowledge, pedagogical knowledge, and technology knowledge concurrently provides a framework for technology integration in a curriculum.

Lee Shulman (1986) defined PCK as teachers' interpretations of subject matter knowledge in the context of helping the students learning. PCK affect how teachers think about their subject matter knowledge. Teachers' understanding of subject matter will influence learner's learning. According to William F. McComas, (2014) the concept of PCK is the teachers' understanding of "the most useful forms of representation of the most powerful analogies, illustrations, examples and demonstrations – in a word, the ways of representing and formulating the subject that make it comprehensive to others"

Elements (Components) of Pedagogical Content Knowledge according to Shulman (1986) include:

- Understanding the knowledge
- Understanding the teaching, and
- Understanding of technology

Roles (importance) of Pedagogical Content Knowledge in classroom instructions are:

- It involves teachers' competence in delivering the conceptual approach
- Gives relational understanding and adaptive reasoning of the subject matter

PCK is a type of knowledge that is unique to teachers and is based on the way teachers relate their pedagogical knowledge (what they know about teaching) to their subject matter knowledge (what they know about what to teach). Content knowledge is the body of knowledge and information that teachers teach, and the students are expected to learn in each subject or content area, such as mathematics, science, or social studies.

Science is a multi-disciplinary enterprise of human activity which entails a systematic investigation and understanding of nature and the universe. These science-based activities culminate in the discoveries of knowledge which are essential for human development. Science as a body of knowledge is contemporarily divided into three parts, namely: Natural sciences (physical and life science), Social sciences and formal sciences. Mathematics is considered as one of the most important core subjects in the school curriculum. As such, it is a subject that is taught almost every day of the week in Nigeria secondary schools.

COVID-19 is a virus infectious disease that originated from China which has killed hundreds of thousands of people both old and young. The virus has infected tens of millions of people in over 200 nations across the world sparing no continent irrespective of social, economic, and technological advancement. Its person to person's transmission through contact with the nose, mouth, eyes by hand or other means of infection has necessitated the closure and lockdown of all social, economic, cultural, and educational institutions worldwide. Mostly affected is locked and key of all educational institutions at all levels worldwide with learners compelled to remain at home. The most concern situation is that no cure has been found for this deadly virus infection across the globe. It is reported that the signs of the infection contain dry cough, fever, tiredness, shortness of breath, headache and general body weakness owed to the incentive of supplementary pains in the body (Zhong, 2020). A great threat of a novel corona virus otherwise known as COVID-19 pandemic rocked the entire world in the wake of the year 2020. COVID-19, which was first reported in December 2019 in Wuhan China, declared as Public Health Emergency of International Concern in January 2020 and later a pandemic in March 2020 by the World Health Organisation (WHO) (Web news, 2020; World Health Organisation, 2020). The virulent disease has revealed that we cannot persist to fuss things the same way as we used to and things must adjust in the short, medium to long period. This describes for synchronized effort for all stakeholders surrounded by the educational segment to investigate alternatives for the solution (Olaitan; Abdullahi; Tolorunju; Ayodele; Akinjo & Oluwafemi, 2020).

UNESCO Director-General, Andrey Azoulayals cited by VOA News (2020), warned that "the global scale and speed of the educational disruption due to coronavirus is unparalleled and, if prolonged, could threaten the right to education". No doubts, unplanned school closures can cause severe problems for students, educators, parents, and the society at large. It could negatively affect the academic interest and performance of students.

However, several studies especially in Asia and Europe (Bao et al., 2020; Brooks et al., 2020; Kang et al., 2020; Shigemura et al., 2020) have reported serious psychological distress experiences of members of the society in response to the COVID-19 pandemic and in Nigeria, Abayomi; Olusols & Samson, (2020) also carried out a study on

psychological distress experiences of Nigerians during Covid-19 pandemic; the gender difference.

The process of transforming the science and mathematics education system is accompanied by an increase in requirements for teachers. Much attention needed to be paid to the readiness of the future teachers' specialists for successful solution of their professional tasks. The world is rapidly being shaped using digital technology in both school and workplaces. However, there exist gap in its use during a pandemic situation where schools are locked and key.

While education is a tool for achieving desirable social change that can lead to meaningful growth and development of the nation, instruction is the only means by which this can be transferred or imparted to the target group. Building the standard of digital literacy (e-learning) among teachers is expected to have to have a master plan that defines the minimum skills of teachers and implement a standardize approach toward training and certifying them. Effort to enhance digital based education must begin with the teachers and the educator wish is the main purpose of this study. The study will access other of e-learning technologies as alternative to face-to-face teaching and learning during a pandemic situation. This will involve development, selection, and use of e-learning materials by teacher for teaching. So also, the study will determine the level of psychological – pedagogical readiness of teachers from their disciplines, analysis of dynamics of levels of the psychological – pedagogical readiness of teachers from a subject by subject which will eventually leads to the training of the teachers in the development, selection, and use of e-learning technologies.

Statement of the Problem

In a typical 21st Century classroom set-up, web resources are used to disseminate information rather than the face-face encounter while students equally receive or access the information out of class via same (Asebiomo, 2014). According to Oyekale, (2012), the advantages of web base instruction include:

- Freeing the teacher to use class time to develop more hands-on approaches to the difficulties of the materials at hand, or to answer questions and encourage deeper discovery that the teacher would not otherwise have time to engage in.
- Enabling the students spend time in class practicing with the guidance of the teacher rather than listening to a "talking head"

However, in a situation where the door of the classroom has been locked and key due to an invisible plague or pandemic such as COVID-19, the appropriate time for e-learning globally is now. Circumstantially, education enterprise who supposed to have solution to all issues remains in comatose in the face of the world pandemic and especially in Nigeria. When other institutions and establishments find alternative means to get their business and enterprise going in the wake of this pandemic, education sectors in Nigeria such as primary, secondary, and tertiary institutions have been closed to the detriment of the learners and the nation in general. Even when some institutions made efforts to keep teaching and learning going at the pandemic era, many contending challenges such as teachers competent and readiness to use digital technology, students and teachers content knowledge and willingness to embrace e-learning technology, expensive and irregular internet facilities, parent awareness and poverty level, and lack of policy by the education stakeholders to drive the digital literacy education has been contending challenges. Hence, there is need to revisit our education policies and curriculum to align with the new World trend reality.

The important direction of modernization of education system is the integration of digital technology in teaching and learning. In the conditions of introduction of digital education, it was found out that modern schools' teachers are not ready to accept the needs of such transformational education. The problem consists not only in creation of the adapted education environment (the room, the equipment, etc.), but also in absence of experts trained teachers for the development of digital learning such as e-learning modules and the effective implementation of digital learning materials developed. The digital education demands from teachers an adequate attitude towards the understanding of digital concept, ability to provide psychological and pedagogical support, and an ability to open creative potential of learners through e-learning materials. In this connection, there is a question of need of high-quality preparation of pedagogical staff for digital educational institutions. High-quality realization of e-learning educational needs of each teacher irrespective of his physical, mental, and intellectual capacities depends on competences of the teacher.

In an e-learning environment, teachers are more of mentor and guide and less of orators and lecturers while students are expected to conduct research on their own and come to the community experience (the classroom) ready for question, practice, or collaborate with fellow students (Asebiomo, 2014). In e-learning environment, the wall of the classroom becomes less physical and replaced with digital devices, the amount of knowledge a student can acquire is on the increase with the use of technology.

The mismatch between the professional expectations of a teacher as a specialist, who can solve teaching and learning problems and the level of his professional readiness to do it, is one of the frequent contradictions in the teaching profession. One solution to the problem of formation of psychological readiness is the realization of innovative digital technologies, aimed at creating the conditions in which the teacher becomes ever ready to educational activities and can more fully realize his potential.

The psychological factors required in teachers are social anticipation, resistance to socio-psychological stress, social tolerance, professional orientation, responsibility, and communication skills; their weight and characteristics must be considered when designing a system for training teachers and as they develop teacher readiness as an independent variable is an effort made by the teacher, especially the subject of building construction to help create optimal learning conditions so that the goals of teaching can be achieved, with the following indicators: 1) Preparation of material, 2) Manage teaching and learning etc.

In this research we are standing on the Shadrikov's theoretical position, that professionally important qualities are the individual qualities of a man, which determine the success and effectiveness of his professional activity (Shadrikov, 1986). Since the constructed model was developed and tested as method of formation of psychological readiness and pedagogical content knowledge of teachers for professional work.

The purpose of the study is to reveal the structure of the psychological readiness and Pedagogical Content Knowledge of Science and Mathematics Teachers Digital Teaching and Learning Transformation in the New Normal or in the Post COVID-19 World.

Objectives of the Research

- Access psychological readiness level of science and mathematics teachers to e-learning modules development, selection, and use.
- Investigate science and mathematics teacher's pedagogical content knowledge and skills of e-learning modules development, selection, and use.
- Assess to digital education infrastructures available for science and mathematics teachers in the study area.
- Recommend turn-around digital innovation strategies for science and mathematics teachers' way forward to digital literacy.
- Formulate implementation/innovative strategies that will encourage experience sharing among science and mathematics teachers; and
- Identify ways for the review of education policy and curriculum to accommodate digital innovations.

Research Questions

1. Do Nigerian science and mathematics teachers have the skills required to use digital technologies?
2. What is the psychological readiness of science and mathematics teacher for digital technology innovation?
3. What is the pedagogical content knowledge and skills of science and mathematics teacher in the development, selection, and use of e-learning technologies?
4. What type of support, training, and professional development do science and mathematics teacher need to cope with 21st century pedagogy?
5. Are there adequate digital technology infrastructures available for science and mathematics teachers to effectively implement e-learning policy?
6. What is the role of other stakeholders in education to encourage effective implementation of digital innovation among science and mathematics teachers?
7. How can science and mathematics teachers share digital literacy information?
8. What are the ingredients needed for the review of education policy and curriculum to make teaching and learning of science and mathematics digital compliant?

Research Methodology

Survey design was used for the study because survey reveals current conditions and shows needs for improvement. The population of the study consisted of all science and mathematics teachers at senior secondary schools in Ekiti State, Nigeria. The sample for the study was 800 science and 800 mathematics teachers purposively selected from all the sixteen Local Government Area Council of the State. Teachers' qualification and gender were other variables considered in the selection of participating teachers. Instruments used include Psychological Readiness Checklist (PRC), Pedagogical Content Knowledge Instrument (PCKI) adapted from Lee Shulman (1986) among others. The two instruments were validated, and the reliability coefficient was 0.87 and 0.88 respectively. The duration for the study was thirty-two days at the average of two days per Local Government Area. The study was conducted by the researcher with the assistance of a research assistant. In all, 98% of instrument used were recovered from the respondents which were treated with necessary statistical tools to address various research questions.

Data Analysis

Question 1: Do Nigerian science and mathematics teachers have the skills required to use digital technologies?

Table 1: Percentage Knowledge of Science and Mathematics Teachers on Skills possessed for Digital Technologies

S/N	Digital skills knowledge	Science Teachers 784 (%)	Mathematics Teachers 784 (%)
1	Communication	538 (68.6)	605 (77)
2	Handling information content	430 (54.9)	578 (73.7)
3	Transaction	374 (47.7)	426 (54.3)
4	Problem solving	467 (59.6)	579 (73.9)
5	Online safety	267 (34)	345 (44)
6	Social media	389 (49.6)	452 (57.7)
7	Search Engine Marketing (SEM)	226 (28.8)	356 (45.4)
8	Data analytics	349 (44.5)	673 (85.8)
9	Email marketing	158 (20.2)	645 (82.3)
10	Content marketing	458 (58.4)	563 (71.8)
11	Mobile marketing	542 (69)	673 (77)
12	Strategy and planning	367 (46.8)	542 (69)
13	Social selling or marketing	306 (35)	683 (87)
14	Pay-Per-Click Marketing (PPC)	256 (32.7)	469 (59.8)
15	Video Recording	570 (72.7)	720 (91.8)
16	Coding Techniques	325 (41.5)	679 (88.9)
17	Clouding Techniques	224 (28.6)	398 (50.8)
18	Artificial intelligence	128 (16.3)	436 (56.6)

Table 1 above shows that mathematics teachers digital skills possessed to use digital devices, communication application, and networks to access and manage information in all areas of study is higher than that of the science teachers. Science teachers however showed the better used of digital devices with respect to mobile marketing [542 (69)] as against their inability for artificial intelligence [128 (16.3)]. On the other hand, mathematics teachers displayed the knowledge of digital skill for video recording [720 (91.8)] while online safety [345 (44)] became the least skills for digital devices.

Question 2: What is the psychological readiness of science and mathematics teacher for digital technology innovation?

Table 2: Percentage Psychological Readiness of Science and Mathematics Teachers for Digital Technology Innovation

S/N	Psychological Factors Required in Teachers	Science Teachers 784 (%)	Mathematics Teachers 784 (%)
1	Social Anticipation	576 (73.5)	590 (75.3)
2	Resistance to Socio-psychological Stress	605 (77.2)	623 (79.5)
3	Social Tolerance	685 (87.4)	569 (72.6)
4	Professional Orientation	467 (59.6)	562 (71.7)
5	Responsibility	562 (71.7)	653 (83.3)
6	Communication Skills;	601 (76.7)	677 (86.4)

Table 2 shows Percentage of psychological readiness of science and mathematics teachers for digital technology innovation. Social tolerance makes the best factor for mathematics teachers (87.4%) while communication skills was the best factor for mathematics teachers (86.4%). However, all the factors score above 50% margin for both science and mathematics teachers with professional orientation took the least position for science teachers (59.6%) and professional orientation for the mathematics teachers (71.7%). This inferred that psychological readiness is of higher realm for both the science and mathematics teachers

Question 3: What is the pedagogical content knowledge and skills of science and mathematics teacher in the development, selection, and use of e-learning technologies?

Table 3: Percentage pedagogical content knowledge and skills of Science and Mathematics Teachers for Digital Technology Innovation

S/N	Pedagogical content knowledge and skills in Teachers	Science Teachers 784 (%)	Mathematics Teachers 784 (%)
1	Understanding the knowledge	521 (66.5)	602 (76.8)
2	Understanding the teaching,	632 (80.6)	568 (72.5)
3	Understanding of technology	436 (55.6)	602 (76.8)
4	Teachers' competence	480 (61.2)	534 (68.1)
5	Relational understanding	497 (63.4)	564 (71.9)
6	Adaptive reasoning of the subject matter	452 (57.7)	579 (73.9)

Table 3 above reflected the pedagogical content knowledge and skills of Science and Mathematics Teachers for Digital Technology Innovation in the areas of knowledge, teaching, technology, competence, rational understanding, and adaptive reasoning. The mathematics teachers showed more understanding in all the skills except teaching where science teachers showed higher knowledge with 80.6% compared with 72.5% attributed to mathematics teachers.

Question 4: What type of support, training, and professional development do science and mathematics teacher need to cope with 21st century pedagogy?

Table 4: Mean Ratio of support, training, and professional development of science and mathematics teacher to cope with 21st century pedagogy

S/N	Statement (Trend)	Mean	Rating
1	Intellectual	3.43	2
2	Motivational	3.04	3
3	Emotional	2.86	4
4	Professional	3.88	1

Table 4 showed the mean ratio of support, training, and professional development of science and mathematics teacher to cope with 21st century pedagogy. All trend showed positive rating higher than the average mean ration of the group with professionalism coming first with mean score of 3.88 followed by intellectual (3.43) while emotional readiness of science and mathematics teachers took the last seat with mean value of 2.86.

Question 5: Are there adequate digital technology infrastructures available for science and mathematics teachers to effectively implement e-learning policy?

Table 5: Opinion of Respondents on the availability of Digital Technology Infrastructures available to effectively implement e-learning Policy

N = 1568

SN	Statement (Opinion): Are these digital Infrastructures available for your Use?	Yes	No
1	Internet: telephone lines, fiber optic cable etc.	788	780
2	Technology infrastructure: hardware system, software, network connections, servers	952	616
3	Digital infrastructure : code, polices, standard, cloud - centrique	689	879
4	Transportation systems	869	699
5	Communication networks	1020	548
6	School buildings	1235	333

Table 5 showed the opinion of the respondents on the availability of digital technology infrastructures available to effectively implement e-learning policy. The highest demanding infrastructure the respondents said to be available for their use is school buildings with 1235 responded affirmatively for its availability. 1020 respondents however agreed that communication networks were available for use in their teaching and learning of science and mathematics. Digital infrastructures such as hard and soft wares servers were least available for the teachers use with a respondent's value of 689.

Question 6: What is the role of other stakeholders in education to encourage effective implementation of digital innovation among science and mathematics teachers?

Table 6: Opinion of Respondents on the role of other stakeholders in education to encourage effective implementation of digital innovation

N = 1568

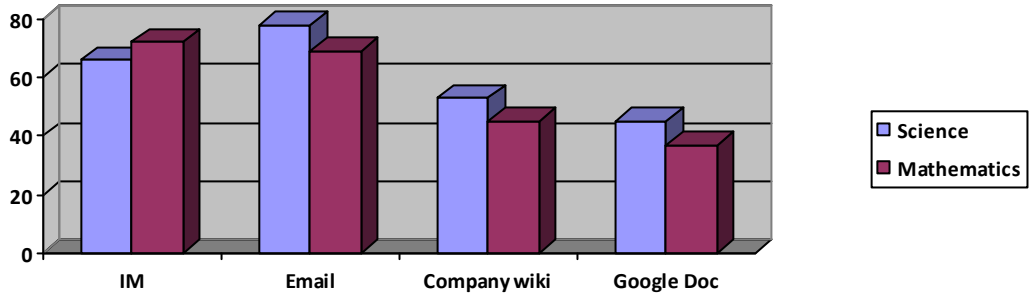
SN	Statement (Opinion): Do the following Stakeholders have role to encourage effective implementation of digital innovation among science and mathematics teachers?	Yes	No
1	Teacher	1550	18
2	Parent	987	581
3	Head teacher/Principal	1520	48
4	Area Education Officers	982	586
5	Commissioner/Minister of Education	900	668
6	State/National Assembly Committee on Education	920	648
7	Science and technology Ministries	896	672
8	NGO	852	716

Table 6 reflected the role played by stakeholders to encourage effective implementation of digital innovation among science and mathematics teachers. Teacher took the lead of the most important stakeholder in the implementation of digital innovation among science and mathematics teachers with 1550 respondents accented to the fact. This is closely followed by head teacher/principal that polled 1520 and coming least but with above average scores is the Non-Governmental Organization (NGO) with 852 of the respondents saying Yes.

Question 7: How can science and mathematics teachers share digital literacy information?

Table 7: Bar Chart representation of ways science and mathematics teachers share digital literacy information.

Virtual communication:



In-person communication:

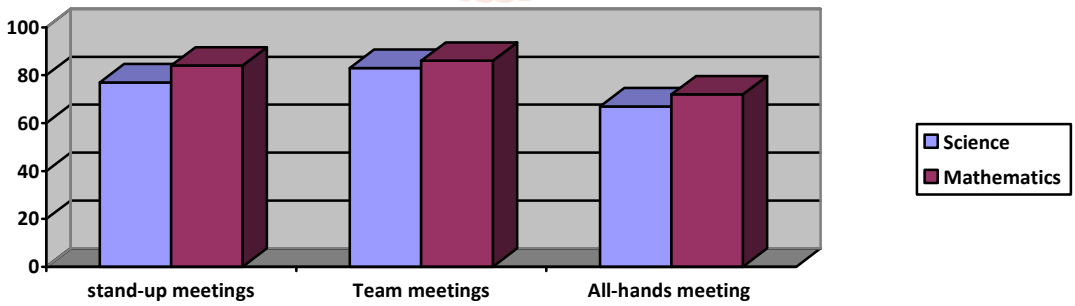


Figure 7 above represented the ways science and mathematics teachers share digital literacy information. Out of the two broad ways identified - virtual and in-person communications, science teachers showed more knowledge of the former from its components of email, company wiki and google doc 78, 53 and 45 percentage respectively against 69, 45, 37 percentages respective for mathematics teachers. However, mathematics teachers took the lead in instant messages (IM) with 77% as against 63% for science teachers. For the in-person communication type, mathematics took head in all its three components (84, 86, and 72 percentage respectively as against 77, 83, and 67 percentages for the science teachers.

Question 8: What are the ingredients needed for the review of education policy and curriculum to make teaching and learning of science and mathematics digital compliant?

Table 8: Influence of review of education policy and curriculum to make teaching and learning of science and mathematics digital compliant

Factors	Agree	Disagree	Total	X^2	Df	P	Remark
Education Policy	130	110	240	3.039	1	0.031	S
Curriculum Review	60	180	240				

p<0.05

Table 8 presented the Influence of review of education policy and curriculum to make teaching and learning of science and mathematics digital compliant with X^2 of 3.031 at p<0.05 and indicated a significant analysis.

Summary of Findings

The findings showed science teachers demonstrated the better used of digital devices with respect to mobile marketing as against their inability for artificial intelligence. however, mathematics teachers displayed the knowledge of digital skill for video recording with little knowledge of online safety among the digital devices.

Social tolerance became the prominent factor of psychological readiness for mathematics teachers in digital technology innovation. Communication skills on the other hand presented the best factor for mathematics teachers as presented in table two. However, all the factors score above 50% margin for both science and mathematics teachers This inferred that psychological readiness is of higher realm for both the science and mathematics teachers. This fact is substantiated by Botagoz, Zhanat, & Zhubakova, (2015) who saw it as a mental phenomenon by means of which the stability of activity of the person in poly-motivated space is explained in the form of his or her mindset.

The pedagogical content knowledge and skills of Science and Mathematics Teachers for Digital Technology Innovation in the areas of knowledge, teaching, technology, competence, rational understanding, and adaptive reasoning as presented in table revealed that mathematics teachers showed more understanding in all the skills except teaching where science teachers showed higher knowledge compared with mathematics teachers. For the ratio of support, training, and professional development of science and mathematics teacher to cope with 21st century pedagogy. All trend showed positive rating higher than the average mean ration of the group with professionalism leading and followed by intellectual while emotional readiness of science and mathematics teachers took the last seat.Some of researchers (Baydenko, 2004; Bosova, 2005; Vvedensky, 2003; Volodina, 2008; Zeer, 2005; Zimnaya, 2003; Markova, 1996; Mitina, 2002; Tatur, 2004) understand under the competence the set of qualities that reflect the flexibility and readiness to adapt to the professional environment. In an e-learning environment, teachers are more of mentor and guide and less of orators and lecturers while students are expected to conduct research on their own and come to the community experience (the classroom) ready for question, practice, or collaborate with fellow students (Asebiomo, 2014). In e-learning environment, the wall of the classroom becomes less physical and replaced with digital devices, the amount of knowledge a student can acquire is on the increase with the use of technology.

The school buildings serve as the major infrastructure needed followed by communication networks. Digital infrastructures such as hard and soft wares servers were least available for the teachers according to the findings.

Teacher took the lead of the most important stakeholder in the implementation of digital innovation among science and mathematics teachers, closely followed by head teacher/principal Non-Governmental Organization (NGO) coming a distance far.

From the two digital information sharing investigated of virtual and in-person communications, science teachers showed more knowledge of the former components of email, company wiki and google doc than the mathematics teachers. However, mathematics teachers took the lead in Instant Messages (IM). In-person communication, mathematics took the lead in all its three components of stand -up, teams and all-hands meetings than the science teachers. Hence, the findings showed importance of reviewing education policy and curriculum as a necessary exercise to making teaching and learning of science and mathematics digital compliant with the 21st century realities.

Conclusion

Psychological readiness and pedagogical content knowledge of science and mathematics teachers digital teaching and Learning are imperative to the transformation of knowledge in the new normal or in the post COVID-19 living.

Recommendations

The research however recommended the following for the psychological readiness and pedagogical

content knowledge of teachers in the normal or post COVID -19 teaching and learning:

1. Training and retraining of teachers in the better used of digital devices
2. Adequate and continuous orientation for teachers to see their roles in e-learning environment, as mentor and guide and less of orators and lecturers
3. More schools and infrastructure be provided for effective digital teaching and learning.
4. Use of effective digital information sharing that will bring about effective teaching and learning in the classroom.

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