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EXPLORING THE OPPORTUNITIES OF VIRTUAL FIELDWORK IN TEACHING GEOGRAPHY DURING COVID-19 PANDEMIC

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Abstract

The main purpose of this qualitative study was to explore the opportunities of virtual fieldwork in teaching geography during covid-19 pandemic. Educational institutions embarked on e-learning as a result of longer stay in lockdown which restricted face-to-face teaching. However, geography as a subject largely dwell in fieldwork methodologies to impart environmental skills appreciation to learners. Thus, this research based on finding opportunities used to explore virtual fieldwork to promote environmental appreciation skills. The research was guided by three main objectives which sought to explore virtual fieldwork approaches being used by teachers during covid-19, identifying inquiry-based and experiential skills imparted by virtual fieldwork and determining teacher's attitude towards virtual fieldwork in geography education. In answering these questions, the researcher used systematic sampling where 20 respondents were selected out of the population of 964 geography teachers. Interviews and questionnaires were the instruments used to gather data. The research established that geography teachers are using e-learning during this covid-19 pandemic. Videos, images and remote sensing tools are the major approaches used as method of integrating virtual fieldwork. The study finds that virtual fieldwork imparts research, analytical and generic skills in learners. Teachers' attitudes were found to be positive because of their technological pedagogical content knowledge. Negative attitude was associated with lack of resources, in which the researcher recommends that teachers should be trained and provided with resources to support virtual fieldwork in schools.

Keywords: Virtual Fieldwork, Covid-19, E-Learning, Distance Education, TPACK, Geography

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INTRODUCTION

The global pandemic of covid-19 has changed the way educational institutions apply their pedagogical methodologies. Series of covid-19 induced lockdown resulted in overutilisation of online and distance education in educational institutions. This substituted the traditional methodology of face-to-face interaction between the facilitator and learners. In almost every country and learning areas virtual classrooms have been introduced to continue with learning during the period of covid-19 pandemic. Virtual campuses have been launched, this eliminated the usage of physical campuses in every corner of the learning and educational institutions. Therefore, these total overhauls of educational institution and its curriculum has shifted the traditional approaches in teaching and learning of geography.

Geography as a subject of the environment, it was rooted and wholly anchored in traditional pedagogical approaches of fieldwork as an inquiry based learning (Firomumwe, 2019). The employability of fieldwork in geography at every level of learning is justifiable in terms of its direct exposure and development of learners' skills. The importance of fieldwork was justified in a study by Firomumwe (2019) that it develops learners' generic skills such as research, presentation and analytical skills. Again, geography as a subject of the environment entails that learning *for* and *about* the environment must be *through* the environment. This statement clearly signifies the relevance of fieldwork in facilitating the learning of geography in schools. Thus, during the covid-19 induced online learning, geographers should take up virtual fieldworks seriously. Failure to engage fieldwork in learning at any situation pose a greater risk of producing learned geographers without practical and pragmatic skills of solving geographic problems on our environment. In this scenario, schools and geography facilitators must foster technology advancement and innovation for the fulfilment of the needs of geography pedagogy during the virtual, online and distance learning. As geographers are initiated with fieldwork and outdoor learning for research, observation and discovery skill are developed. Online learning must be coupled with virtual reality and virtual field work to cement and concretise the knowledge gained from theoretical spheres of geography.

Available sources with the researcher noted that in primary and secondary schools, virtual fieldwork and virtual reality seem to be a rare pedagogical instructional methodology. Therefore, it is important to give a background of what virtual fieldwork is. Virtual fieldwork is a modern methodology which offer opportunity for facilitators and learners to explore an area and environment without leaving the classroom. Virtual fieldwork encompass fieldwork simulations (virtual reality), where facilitators and learners outdo reality and simulate the real field work (Çaliskan, 2011). It also encompasses remote fieldwork where learners explore the environment through remote sensing (satellite imagery), videos and pictures from the environment. The classroom can be furnished with a 3D and 2D technological environments that discover the world and learners simulate and manipulate the earth in full. The main characteristics of a virtual fieldwork is that there is no physical visit of the area, but there is remote visit and manipulation of the environment through computers and its related software packages. Learners and facilitators can visit and see their areas of interest with their gadgets in the classroom through photos, videos and remote sensing satellite images (Evelpidou et al., 2021). In a recent study, it was revealed virtual fieldwork give learners the opportunities to visit inaccessible areas (Bacon & Peacock, 2021) in their virtual or physical classrooms. Virtual fieldwork in this covid-19 period is the only option where learners can experience and explore the environment remotely. This can be effectively achieved through the use and implementation of Geographic Information Systems and Remote Sensing techniques which brings the world in the classroom (Firomumwe, 2021). Learners use their gadgets and related software packages like Google Earth Pro, ARCGIS, Google Maps etc. to gather information of an environment remotely. Social and physical distance maintenance and barred intercity travel call for the mandatory usage of virtual fieldwork to produce and nurture primary and secondary geographers in the make.

LITERATURE REVIEW

The researcher reviewed a wide-range of literature sources on opportunities of virtual fieldwork in teaching geography in secondary schools during covid-19 pandemic period. A related study by İnce, Şahin & Yentür (2021) on 324 geography teacher's

perspective on distance education on covid 19 process revealed that inadequacy on students' participation in lesson and lack of technological opportunities is affecting the efficiency and effectiveness of the implementation of distance education. Therefore, teachers want to switch to face-face learning as it cannot be substituted with online and distance education. However, they recommended that improvement on internet capacity for teachers is crucial and videos need to be uploaded to develop geographic experiences. The study by Ince et al. (2021) concur with the study by Bagoly-Simó et al. (2020) that learning during covid-19 result in loss of geographic competence and identity at the same time their study noted that teachers in German formal education require guidance and support.

The review revealed that most recent studies on virtual fieldwork during covid-19 pandemic were carried out in higher educational institutions. In a related study by Shailey et al. (2018) it was noted that virtual reality is crucial in supporting fieldwork in educational institutions. The study emphasised that virtual reality trigger inquiry-based learning in students and support experiential learning, this was supported in a study by Çaliskan (2011) who pointed that virtual reality backs learner centred learning approach and deeper understanding of concepts in learning. The review finds that lack of resources and training was a barrier to the implementation in educational institutions. By the year 2007, virtual reality was very expensive to the extent that some educational centres were unable to get enough resources for virtual fieldwork. In a study by Sanchez (2009) it was testified that 80% of teachers express their willingness to use geospatial technologies and virtual globes such as google earth in geographical and geology teachings. The study pinpoints that virtual globes allow access to geological and geographic data. The study attested that 7.5% proven that geography teachers in France are using GIS and virtual globes in carrying out fieldwork. Studies from Granshaw & Duggan-Haas (2012) provided that virtual fieldwork develop teacher's technological skills in earth sciences education. The study predicted that technologies are increasing swiftly in educational arenas, this creates and facilitates virtual environments which are fast, less expensive and of higher resolution in accessing data in the field. This concurred with a study in 2007 that, projects are underway to develop virtual learning environment where lessons are specifically developed to realistically be carried in realistic simulations (Maskall et al., 2007). The study posits the benefit of virtual fieldwork is enormous in providing inaccessible sites in the classroom and schools with lack of resources to contact physical fieldtrip can resort to virtual fieldwork. A research study by Haris & Osman (2015) emphasised that virtual fieldwork offer a positive effect on learner's achievement as compared to traditional approaches. A positive achievement is achieved by an inquiry based and experiential learning as alleged by Çaliskan (2011); Granshaw & Duggan-Haas (2012); Shailey et al. (2017); Shailey et al. (2018).

Most recent studies in virtual fieldwork during the pandemic period was conducted in Higher Educational institutions like universities and colleges. However, the study was a bit different from the above literature. Recent studies concur with the efficiency of virtual fieldwork by arguing that it must not be substituted with real-physical fieldwork. Fieldwork provide a useful environment for alternative fieldwork in times of covid-19 lockdown, however, it must not substitute real fieldwork and can be used to prepare live fieldwork (Evelpidou et al., 2021). This was in tandem with the research by Fuller et al. (2021) who posit that virtual fieldwork must be seen as another methodology during covid-19 restriction period rather than substituting real fieldwork. However, a study by Bacon & Peacock (2021) emphasised that majority of respondents reveal that ecology field classes was affected by covid-19 lockdown, hence availability of digital technology and virtual fieldwork enhance learning experience.

Conceptual Framework

The research paper was reinforced by the Technological Pedagogical Content Knowledge (TPACK) proposed by Mishra & Koehler (2006). The theory can be traced back to 1986 where Shulman (1986) explained the Pedagogical content knowledge (PCK) of a teacher. It was modified by (Mishra & Koehler, 2006) to include technological knowledge of teachers (Trigueros Gómez, 2018). The TPACK model is premised on three main constructs which are; Technological Knowledge (TK), Pedagogical Knowledge (PK) and Content Knowledge (CK). For a teacher to effectively teach, there is a need for these three types of knowledge especially during this covid-19 pandemic period, TK is of great value. The prelate source of TPACK is on

how to enhance the teaching and learning with technology for better understanding of the concepts. The ability of teachers to use virtual fieldwork in fostering learning in geography is based on teacher's understanding of the technology constructs. The acceptance of virtual fieldwork is entirely based on teacher's knowledge, understanding and ease of use during instruction. Thus, for teachers to implement virtual fieldwork during e-learning on this covid-19 induced lockdown there is a need for teacher's deeper understanding of TPACK. Without three types of knowledge it is difficult for them to implement curriculum objectives (Yildirim & Ünlü, 2021; Mishra & Koehler, 2006).

Objectives of the Study

The study was fortified and guided by the following objectives in gathering information on exploring the opportunities of fieldwork in teaching geography during covid-19 pandemic period.

- Exploring virtual fieldwork methodologies being used by teachers during Covid-19 lockdown.
- Identifying inquiry based and experiential skills imparted by virtual fieldwork in learners.
- Determining teacher's attitude towards virtual fieldwork in Geography education.

METHODOLOGY

The research paper underpinned a phenomenological qualitative research study in gathering information on secondary geography teachers in exploring the opportunities of virtual fieldwork in teaching of geography during covid-19 pandemic. In this method the researcher gathered views and experiences of Geography teachers on opportunities of virtual fieldwork in Geography teaching. Participants provided descriptions of what they perceived and understood on virtual fieldwork. The researcher interpreted participants' view with their consent, coded their views and merged them into themes.

In achieving the desired objectives, the researcher used systematic sampling on 964 e-learning geography teachers in Zimbabwe. The population was drawn from five major Geography teachers WhatsApp groups and the sample was systematically drawn from these groups. The researcher with the consent of group members laid out numbers in ascending order and chose the 48th number to represent the population. Thus, a sample of 20 respondents was drawn from a population of 964 e-learning geography teachers in Zimbabwe. Teachers who participated in this research study were given codes to identify them and protect their identity. Codes T1, T2, T3, T4, T5, T6, T7, T8, T9, T10, T11, T11, T12, T13, T14, T15, T16, T17, T18, T19 and T20 were assigned to respondents. The sample was characterised by a heterogenous group made up of 35% female and 65% male gender wise. In terms of age, the respondents' age ranges from 20-65 and majority of respondents have 11 – 15 years of professional experience in the field of teaching. Majority of sample are from public schools as shown in table 1 which shows biographical information of respondents. Questionnaires were sent over WhatsApp messaging chat to respondents in .docx format. Interviews were conducted on all objectives to cross-validate data from questionnaires. Interviews were conducted using a WhatsApp call platform to respondents. The researcher asked respondents' free time where they were to be conducted for the interview without interruption. Respondents were informed earlier about the approximate length of interview. The interview lasted for an average of 45 minutes per respondent and respondents were conducted on different days. Due to limited capacity of WhatsApp call platform to record voices of respondents, their views were written down on paper by the researcher with their knowledge (consent) as interview progresses. With the agreement from respondents, their views were analysed and merged into themes according to similarity of their views as per phenomenological qualitative study. In this case, data with the same meaning was merged to form the same point called theme. The response rate was 100% for both questionnaire and interviews.

Table 1: Characteristics of Respondents in Terms of Their Age, Professional Experience, Gender and Type of School They Represent

Biographical Information	Number of Participants	Percentage of Participants (%)
Age		
20 – 29	3	15
30 – 39	5	25
40 – 49	10	50
50 – 59	1	5
60 – 65	1	5
Count	20	100
Professional Experience		
0 – 5	3	15
6 – 10	4	20
11 – 15	7	35
16 – 20	1	5
21 – 25	3	15
26+	2	10
Count	20	100
Gender		
Female	7	35
Male	13	65
Count	20	100
Types of School		
Private	3	15
Public	17	85
Count	20	100

RESULTS AND DISCUSSION

The results below were presented in guidance from the research objectives above. The results are the views of geography teachers in Zimbabwe and were presented per research objective.

Exploring Virtual Fieldwork Methodology Being Used By Teachers During Covid-19 Induced Lockdown

In answering this research question, the researcher divided the results in sub-questions presented below;

What Methodological Approaches Are You Using to Teach Geography During Covid-19 Induced Lockdown

The study established two themes from this research sub-questions, which are e-learning and face-to-face interaction. The study revealed that 80% of respondents reasoned that they are using e-learning in contacting lessons during covid-19 lockdown. Methods of e-learning used by teachers during lockdown emerged as online WhatsApp, Facebook, and distance education through virtual classrooms. Teachers noted that WhatsApp and Facebook are the main online platforms they use to create Personal Learning Network (PLN). In these platforms, they emphasised that teachers post learning materials (question papers and notes) on their time and learners read and ask questions on their own. This was supported by the following excerpts from respondent T15 and T19;

“During this lockdown we are conducting holiday and extra-lessons using WhatsApp and Facebook groups for learning... the use of these groups is important as it creates flexible learning time for learners and teachers... teachers only send notes and questions, and learners respond on their free time even at midnight” (T15)

“I use WhatsApp to conduct geography lessons, I just prepare short notes and send to the group. In case where learners do not understand I will explain using text and audios to simplify the concepts to learners” (T19)

The study reveals that on 80% of teachers who testify the use of e-learning, 25% of them indicate that they use Virtual Geography Rooms (VGR) such as zoom and skype to contact lesson and send notes and questions through WhatsApp. The following excerpt attest the use of geography virtual rooms during e-learning.

“...from the first lockdown of 2019 up to now I was fully engaged in online virtual learning on zoom with my students...” (T17)

This shows that online learning is the most common techniques geography teachers are using to instruct learners during lockdown. This necessitates the ability of teachers to cover syllabus and impart geographical skills during a longtime break created by covid-19 learning restrictions.

The study come up with the second theme which is the use of face-to-face interaction during this lockdown. The study established that teachers are using face-to-face in this covid-19 lockdown. Teachers revealed that they are unable to use technology and they are still going traditional but with focus on one-on-one to teach geography learners. This theme was supported by the following excerpt;

“Learners have endured a long time without learning; therefore, I devised a strategy of minimising number of learners to five or one when I contact face-to-face in home lessons... I use this method because is easy for me” (T11)

Which Fieldwork Approaches Are You Using To Stimulate Learning In The Environment?

The research established that fieldwork was barred since lockdown was introduced. This calls for innovation in stimulating learner’s minds through virtual fieldwork. Teachers revealed that they are using videos and pictures to substitute fieldwork. This was supported by the following excerpt

“There are some difficult concepts which require videos and image to represent theory... practical activity is now anchored through videos and images especially when teaching concepts like volcanoes, floods etc. it is crucial to use videos and images since real fieldwork was restricted.” (T9, T4)

The study finds that 25% of respondents revealed that teachers are using GIS and Remote Sensing to explore the field during online learning. Teachers use applications like google earth pro, google maps and maps to discover the environment. Teachers reasoned that teaching must be within the environment in order to cultivate geographic knowledge. Therefore, remote sensing tools are used in the virtual classroom to explore the environment. The most common tools being used include google maps and Google Earth Pro. This application was endorsed by majority of teachers as it offers 3D which is close to real life scenario. Teachers noted that they are using images downloaded from Google Earth Pro to show learners as a way of doing field work. Some of the teachers reveal that they are using videos from YouTube to visualise geological and environmental phenomenon during online lessons. Geography teachers testify that learners are also given websites and links where they can click and see videos on their own. Teachers take their own photos and videos from the field and send them through WhatsApp and Facebook to their PLN chat groups. This concurred with study of (Bos et al., 2021; Çaliskan, 2011; Evelpidou et al., 2021; Fuller et al., 2021; Haris & Osman, 2015; Ruan et al., 2021; Sanchez, 2009; Thorndycraft et al., 2009) who reasoned that images, photographs and other applications like google earth and google maps are tools used to foster virtual reality in geography and ecology (Bacon & Peacock, 2021) instructions.

Which Gadgets are There to Support Virtual Fieldwork?

The study documented that majority of teachers mentioned computers especially laptops, smartphones, Global Positioning System gadgets, projectors and interactive smart boards as the most common gadgets used by teachers during online

learning. In a large group study by Ince et al. (2021) it was noted that majority of teachers are using tools such as Laptops (78.09%) smartphones (45.37%) with smart TV contributing less (2.16%) to implement distance learning during covid-19. It was revealed that teachers established that these gadgets need a fully functional Wi-Fi for internet connectivity to download data from remote sensed sites, pictures from Google Earth Pro and other sites. Visualising videos from YouTube require internet connectivity, and even to conduct an online learning there is a need for internet connectivity. Teachers attested that they are using Bring Your Own Device (BYOD) approach to support virtual fieldwork. It was revealed that teachers are using their own devices such as smartphones, i-pads and laptops to connect to internet and visualise required image or video. I-pads, smartphones, computers were cited by many scholars as a tool to support digital fieldwork in educational institutions (Maskall et al., 2007; Ruan et al., 2021; Welsh et al., 2015). Thus, results of this study was in tandem with the majority of the studies in the notion that Geography teachers are embracing technology in instruction during covid-19 period.

To Identify Inquiry-Based and Experiential Skills Imparted by Virtual Fieldwork in Learners

To answer this objective, the researcher tried to answer the following sub-questions with the answers from the respondents.

How Effectiveness are Virtual Fieldwork Approaches in Teaching and Learning

Majority of teachers affirmed that virtual fieldwork is an effective methodology in dealing with the situation of Covid-19 at hand. The study revealed that some of the teachers who implement GIS and Remote sensing in teaching agreed that virtual fieldwork is a real substitution of real fieldwork. The growth of GIS and remote sensing field is cultivating the digital approach in dealing with the earth and its environment. Teachers confirmed that learners are able to use and interpret remote sensing data by their pseudocolour, which is a practical skill entailed in the syllabus. Teachers revealed that their experience with virtual field work give them the conclusion that learners do better in virtual set-up than real fieldwork.

“Virtual fieldwork is of great importance even in areas which are inaccessible... some of our students are from urban areas, who are not able to walk long distance, therefore, the safest method is virtual fieldwork” (T17)

Teachers reasoned that the ability of teachers to help learners to interpret images, videos and remote sensed data renders its effectiveness. One of the respondents nodded that she has a wide experience in GIS and Remote Sensing, therefore, her ability to coach learners to interpret images from remote sensed data is par standard. This rendered virtual field work more effective in geography e-learning. However, teachers who indicated that they are from rural areas specified that virtual fieldwork is much less effective in their geographic areas as internet connectivity is underperforming to them. Virtual fieldwork was seen as a successful tool in integrating practical to theory during this covid-19 period. Majority of students indicate that fieldwork is a very effective tool during this covid-19 period though it cannot substitute real or live fieldwork (Bacon & Peacock, 2021; Evelpidou et al., 2021; Ruan et al., 2021). Results from Bacon & Peacock (2021); Evelpidou et al. (2021); Ruan et al. (2021) differs with the results of this study that teachers are favouring virtual fieldwork than real fieldwork. Participants alluded that virtual fieldwork offer learners with an array of skills which makes them more effective and pronounced in contemplating geographic information even if they are not there physically.

Skills Imparted by Virtual Fieldwork

Majority of respondents reasoned that virtual fieldwork is a double-edged sword to both teachers and learners. Virtual fieldwork imparts technological skills to both learners and teachers. Teachers attested that learner who are doing GIS and Remote Sensing benefit a lot from virtual fieldwork since practical and technological skills are being sharpened on daily basis. This was supported by one of the respondents who argue that the benefit of virtual field work is more pronounced in developing learner's skills in GIS and Remote Sensing. Image interpretational skills are being inculcated daily by the use of

virtual fieldwork. The study affirmed that teachers are of the view that virtual fieldwork develop inquiry-based learning which is of learners centred approach.

“When learners see images especially psuedocolour from remote sensing, they inquire and probe themselves what this colour is? Why it is of this shape? Why is it located there? In answering all these questions learners are inquiring themselves which develop their cognitive domain and sharpen other skills.” (T4)

The research established that generic skills are developed during virtual fieldwork. Teachers revealed that they have witnessed an increase in development of research skills such as data collection skills, recording skills, communication skills, team work skills and analytical skills which are being depicted by majority of students during virtual fieldwork.

In short, the study found that virtual fieldwork develop research, technological, practical, recording, interpretational skills, communicating, data collections, team work and inquiry-based skills in learners as indicated by majority of teachers. This concurred with Bos et al. (2021); Çaliskan (2011); Evelpidou et al. (2021); Sanchez (2009) who reasoned that virtual fieldwork instil inquiry based skills, analytical skills and experiential skills for real life in students. This means skill developed can be used in problem solving even after school, particularly those who want to pursue in the field of remote sensing.

Determining Teacher’s Attitude Towards Virtual Fieldwork In Geography Education

In presenting this question the researchers divided this question into two sub-questions

What Factors Enabled The Use Of Virtual Fieldwork By Teachers?

Two subthemes emerged on this objective; these are sufficient teacher’s Technological Pedagogical Content Knowledge (TPACK) and positive teacher attitude towards virtual fieldwork. The research established that teachers are of the view that teacher’s TPACK is one of the factors that enable teachers to conduct virtual fieldwork during e-learning times. Teachers noted that teacher’s sufficient knowledge about the subject, pedagogy and technology play a crucial role in its implementation. This was supported by the following excerpts;

“In order for you to conduct virtual fieldwork you need to be well conversant with the subject and pedagogical knowledge on what are you trying to achieve...otherwise you will end up surfing unnecessary information on the internet” (T6)

“Virtual fieldwork is all about technology, without computer skills and geospatial knowledge it will be difficult to implement it using online platform. I gained my geospatial skills from university; this inculcate my virtual fieldwork skills in geography.... I’m now practically implementing these methodologies with my classes” (T4)

“Topics such as GIS and Remote Sensing are important in implementation of virtual fieldwork. Without background from these topics, it will be a problematic to a teacher to use fieldwork... this gets worse if the teacher is inexperienced and lacks subject mastery” (T20)

Teachers were of the view that technological knowledge acquired through teacher training institutions is paramount in the implementation of virtual fieldwork. Participants shown that in order to implement virtual fieldwork teachers must have enough knowledge which ranges from technology, pedagogy to content. Interpretation of the syllabus, subject mastery knowledge and technology integration in teaching and learning are crucial knowledge centres to execute meaningful virtual fieldwork for learners. On a simple note, implementation of virtual fieldwork requires interconnectedness of three centres of knowledge. Lack of one of the TPACK constructs renders virtual fieldwork ineffective because implementation is based on three knowledges. This is worth taking that at this point, Technological Content knowledge (TCK) is of higher value in achieving the geographic skills from virtual fieldwork as reiterated by Trigueros Gómez (2018). This was also in tandem with the study by (Welsh et al., 2015) who testify that virtual fieldwork methodology (pedagogic and content knowledge) is sharpened by technological skills. Therefore, if teachers embrace the technology with passion they can learn and develop

their pedagogical content knowledge (Ruan et al., 2021). A better hybridity of TPACK in implementing virtual fieldwork yield interesting results if clear pedagogical knowledge tally well with technological knowledge in possession with teachers (Bacon & Peacock, 2021).

The other theme that emerged on factors that enables teacher's use of virtual fieldwork approach is their positive attitude towards virtual fieldwork. Teacher's adequate Technological Pedagogical Content enhance their understanding and confidence of the subject matter. Confidence from technological knowledge and content as well as pedagogical knowledge stimulate their confidence in virtual fieldwork implementation. The following excerpts clarify this

"I have no challenge in incorporating virtual fieldwork in my daily instruction because I have technological and technical skills from GIS and Remote Sensing courses from college" (T4)

"My passion in technology and geography positions me better in implementing virtual fieldwork through conferencing videos with learners and I show them links of video on YouTube and images on Google Maps ...during this lockdown I do not have to worry, always I have data and passion with technology." (T17)

Majority of teachers sanctify that they would not encounter challenges in implementing virtual fieldwork in teaching secondary level geography because they got technological skill from GIS and Remote sensing topics. Professional development courses organised at District, Provincial and National level through Geographic Association bestow teacher's confidence in cooperating virtual fieldwork in teaching and learning even when the training was of short duration. The study reveal that restrictions imposed by National Health on covid-19 boost teacher's confidence in using virtual fieldwork in learning. This was in tandem with the study by Bacon & Peacock (2021); Evelpidou et al. (2021); Fuller et al. (2021) who attested that learners are seeing opportunities of virtual fieldwork during this covid-19 restriction period. Therefore, teachers are viewing this period as a period to show their wits in exploring geography knowledge through technology and virtual fieldwork.

What Factors Constrain The Implementation Of Virtual Fieldwork In Geography Teaching Lessons

From this research sub-question, two themes emerged as shown in Table 2 below; inadequate training and lack of resources. Inadequate training was cited by less than half of the participants. It is widely accepted that lack of teacher's content knowledge reduce the implementation of virtual fieldwork and negatively affect attitudes of teachers as noted in Mishra & Koehler (2006); Shulman (1986). Teachers posits that lack of training in ICT and digital technology is affecting their ability and efficiency to use technology in fully exploring virtual fieldwork in learning. This was mirrored in the following excerpts;

"I have so many years in this service, but I have never been exposed to ICT training. I just see these computers but they are difficult for me to integrate them in teaching...there is e need for new blood to operate and explore these new teaching methods" (T11)

"Most of geography teachers in Zimbabwe have basic ICT knowledge, therefore, these technical core topics like GIS and RS received little attention and training from the government. This means it is difficult for us to use remote sensing and GIS for virtual fieldwork application we can use only video on YouTube and images from internet to substitute virtual learning." (T3, T19)

Table 2: Themes and Coded Responses from Participants on Constraints Affecting Implementation of Virtual Fieldwork

Theme	Category	Code	Participant	Number of participants
Lack of Resources	Human Resources	There is a total lack of professional Development for in-service Geography teachers	T3, T10, T14, T20	4
		Geography is my second subject major; I need professional development workshops to sharpen my content knowledge	T15, T18	2
	Technological and Financial Resources	We are using our resources and own devices for virtual fieldwork and lessons	T4, T9, T10	3
		Gadgets are using 3G network which is less effective is of low speed on internet to stream video from YouTube	T4, T9	2
		Due to lack of finance schools are buying gadgets of low memory and storage capacity and can store only little information for virtual fieldwork	T6, T7, T15, T20	4
		Rural areas are lacking internet connectivity for virtual fieldwork implementation	T8, T1	2
		Desktops are embedded in laboratory which is shared and cannot be used during virtual fieldwork in lockdown period	T7, T10, T13, T16, T19	5
		Schools are unable to buy laptops for Geography teachers and secure effective internet connections	T2, T13, 18	3
Theme	Code		Participant	Number of Participants
Inadequate Training	Government has never exposed to ICT training as Geography Teachers		T5, T11	2
	Ministry of Education must train geography teachers on the technical usage of Remote Sensing and GIS gadgets for better integration of virtual learning in geography		T6, T19	2
	Very few teachers were trained to on ICT and Technology integration for only 3 days, this reduced our ability to integrate virtual fieldwork in lessons		T3	1

Inadequate training in education is taking back teacher’s attitude towards teaching of geography through virtual fieldwork in this covid-19 period. This resonate with a study by (Firomumwe, 2021) that majority of teachers pinpoint lack of training as a major drawback in implementing technology and GIS in schools. This claim was also backed in a study by (Bacon & Peacock, 2021) who stated that some lecturers and students are lacking skills to utilise virtual fieldwork.

Lack of resources is the last theme that arose during the analysis of results. As highlighted in table 2 above, majority of teachers noted that resources are the main stumbling block for the implementation of virtual fieldwork during covid-19 lockdown. It is prudent to say the integration of virtual fieldwork require both human, technological and financial resources. However, participants reasoned that teacher are using their gadgets during e-learning. These gadgets are sometimes less effective in connecting to internet or its memory capacity to process large sums of data. Internet remains the major barrier in exploring the opportunities of virtual fieldwork especially in rural areas. This resonate with the findings of Ince et al. (2021) that lack of technological opportunities and internet connectivity is reducing teacher’s motivation in participating in online learning. The study established that schools are financially and technologically weak to sustain virtual fieldwork during lockdown. Schools with computers are mainly desktops which are embedded in computer lab and makes it difficult for geography teachers to use at home for online learning. Participants reasoned that those financial resources are weak to the extend that teachers are unable to get financial support for professional development courses on ICT and virtual fieldwork. These weaknesses were largely identified by teachers from public schools. Teachers from private institutions reserved that they have enough ICT gadgets and financially prepared to take up virtual fieldwork during this lockdown. On human resources, fewer participants noted that they lack proper training, since they are teaching Geography as a second subject. Therefore, their TPACK knowledge and integration of virtual fieldwork is poor. Lack of resources was cited by many scholars as the main reason for the poor implementation of virtual fieldwork in geography lessons Bacon & Peacock (2021); Bos et al. (2021); Çaliskan (2011); Shailey et al. (2017); Welsh et al. (2015). Hence lack of resources is affecting virtual fieldwork in all spheres of education.

CONCLUSION AND RECOMMENDATION

The study established that majority of teachers are using e-learning platforms during covid-19 lockdown, minority of teachers are using face-to-face interaction with students. Majority of those teachers are using videos, images, Google Maps, Google Earth Pro and other remote sensing tools and gadgets to integrate virtual fieldwork in teaching online Geography in schools. Digital technology gadgets such as computers, i-pads, smartphones and projectors were cited by majority of participants as tools they integrate to implement virtual fieldwork in geography instructions. The study revealed that virtual fieldwork is very effective in this covid-19 period. It was supported by majority of participants and other cited literatures in the discussion that research skills, problem solving, analytical skills and other generic skills are developed and sharpened during virtual fieldwork. On attitude of teachers towards virtual fieldwork, the study confirmed that teacher's knowledge with particular emphasis on TPACK is crucial in fostering virtual fieldwork. Teachers with all three centres of knowledge namely Technological Knowledge, Pedagogical Knowledge and Content Knowledge exhibited a positive attitude in integration of virtual fieldwork in teaching of geography. However, their attitude towards integration of virtual fieldwork is taken back by lack resources such as human, financial and technological resources. Shortage of resources were cited by majority of participants from public schools. Inadequate training and professional development courses are reducing teacher's positive attitude in implementing virtual fieldwork.

In response to the findings of the study, the researcher recommends that teachers must be trained to improve their TPACK knowledge. Resources must be provided to all schools and technological gadgets must be provided to teachers so that they sharpen their technological skills and tactfully embark on virtual fieldwork. Internet should be improved and provided to teachers so that they can effectively integrate virtual fieldwork and e-learning. Public schools and rural areas should be provided and supported with adequate resources to counter internet shortages and resource shortages at all level, thereby minimising discrepancies between rural and urban schools in implementation of virtual fieldwork. In light of this a research can be undertaken to compare the effectiveness of virtual fieldwork between rural and urban schools during Covid-19 pandemic period.

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