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Pre-Service Science Teachers' Perceived Effect of Twitter Ban on Learning and Communication

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Abstract
This study investigated the perception of pre-service science teachers on the effect of the ban on Twitter- use in Nigeria in building learning communities, linkages, and accessing information. While the ban was predicated on allegations of hijack of the microblogging site for negative activities, there were outcries of its impact on learners who use the microblogging site to garner information and build professional learning communities. Multistage sampling technique was used to select 114 final year pre-service science education teachers from two Universities out of which only 84 were Twitter users. This number became the sample for the study. A 20-item modified Likert scale questionnaire tagged "Pre-service Science Teachers' Perception of Effect of the Twitter ban on their community building" constructed by the researchers was used to collect data. The reliability of the instrument was found by Combach's alpha reliability coefficient to be .75. Results show that eighty-four (73.7%) of pre-service science teachers utilize Twitter for learning while 76% express the view that the ban has an effect on building learning community but this perception was not gender-related. The subjects claim to have been disconnected from their professional communities and linkages due to the ban. Suggestions were made for a policy review.

Keywords Online learning · Pre-service teachers · Social media · Science Learning · Twitter ban

Introduction

The greatest revolution that changed the face of human interactions and communication is the invention of the Internet. The use of the internet in communication has diversified human interaction and opened up the learning space beyond walls and distances. An important advantage of virtual spaces in learning is their flexibility and customizability (Minachu and Reeves, 2010; Skold, 2012, Tours, 2017). This has been further enhanced by the massive increase in the number of individuals who use personal computers, palmtops, and internet-enabled cell phones. With the advent of microblogging and social media technologies, the development and design of pedagogy and learning content are now focusing more on the meaningful use of technology for instruction. Common among the social learning platforms in use by Nigerian learners for educational purposes is Twitter. The popularity of Twitter hashtags in locating specialized content and professional communities for learning has been well explored by research (Carpenter et al., 2020; Carpenter et al., 2018; Resenberg, Greenhalgh, Koehler, Hamilton, & Akcaoglu, 2016). The distinctive architecture of Twitter has not only made it easy for use by academics but also its organized structure for locating content, linking to professional communities, and an easy gateway for sharing information, ideas, questions, and their answers.

However, apart from its educational and professional community uses, Twitter has also been exploited in massive mobilization for other purposes. Government (for example in Nigeria) has accused Twitter of providing the structure for national mobilization for negative purposes. The resultant effect is the temporary ban of Twitter- use in Nigeria and the imposition of stringent conditions for the operation of social media in Nigeria since May 2021. Nigeria is not alone in this act. Other countries like China, Iran, Myanmar, North Korea, Russia, Turkmenistan, Uzbekistan, Turkey, Egypt,

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Saudi Arabia, and the United Arab Emirates had at one time or the other either suspended the operation of Twitter in their domains, blocked the microblogging site or imposed an outright ban. There have been diverse opinions about the effects of the ban on Nigerian society and particularly on pre-service science teachers (student teachers) learning in collaboration with the community of learners globally. While the views from political circles are strong that the subversive excesses of Twitter users negate national interests, there are also reports of the efficacy of Twitter and other social media platforms in governance (Ogunsola & Olojo, 2021). Opinions also abound that the ban cut Nigerian academics and professionals away from vital knowledge, skills, collaborations, and other academic benefits they derive from the microblogging sites. It thus becomes important to find out how pre-service teachers perceive the effect of the ban on their community building.

Research on gender disparity in Twitter use, perception, learning, and socialization are yet inconclusive. In the United States of America, there is a high differential in Twitter use along gender lines in the ratio of 38.4:61.6% in favor of males in 2021 (Statista Research Department, 2022). Globally, 43.6% of females use Twitter compared to males (56.4%) for the same period (Statista Research Department, 2022). Also, Zhu et al. (2019) documented higher online visibility of males than females due to social media use among professionals in academic medicine. There is thus a need for data from Nigeria considering her huge population in Africa and the extent to which the ban has affected each gender in the Nigerian society. This is one of the dimensions of this study. Information from this study might fill the knowledge gap about disparities in science community participation and visibility among the gender, thus enhancing scholarship through interaction and network building. It will also make available information that will assist decision-making about technology use in science teacher education as well as in policy-making at each level of governance in matters that concern education.

Literature Review

The advent of social media platforms has revolutionized how humans connect with groups. Apart from being a platform for socialization and interaction, Twitter and similar social media have become important tools for online learning. The default classroom setting is the physical, person-to-person, or in-person learning environment in which there is close physical proximity between social and professional community members (Lee et al., 2010; Megann, Ryan, Mcmahon & Hall, 2020). However, due to the need to overcome challenges associated with diversity, differences in location of community members, and the current importance attached to interdisciplinary and cross-disciplinary collaboration among researchers, there became the need to build an online community of professionals where interaction, information exchange, and linkage will be strengthened across borders.

One feature of Twitter and similar social networks is its simplicity in searching for content in different disciplines (Carpenter et al, 2020), discovering and locating individuals of similar interests, engaging in collaborative activities, and pool of knowledge (McGann et al., 2020). In addition to the above, online learning enables learners to adapt to new programmes and cultures, discover social activities, find and maintain relationships, seek knowledge on a variety of subjects, self-represent, recruit, share knowledge and academic purposes; adhere to specific agendas, increase learners' efficacy, self-esteem as well as reduce anxiety (Aydin, 2012; Raspopovic et al., 2017).

Twitter is a microblogging site built by Americans, Evan Williams and Boz Stone in 2006 but which debuted in March 2007 in Austin, Texas. It allows users to send and receive messages in real-time either as a short message (SMS) or from mobile applications. The requirement to sign up for a Twitter account is just a valid email account to set up a personal profile (Tang & Hew, 2017). On its main page, Twitter invites users to share "what's happening?" with pictures or videos. Apart from large-scale public communication, private messaging is also available. Users can subscribe to others' posts by "following", "re-tweeting" received messages, or "liking" them. Twitter has gradually dominated the social media space since it is a free site for information dissemination and interaction. Because of its versatility, Twitter has been put to use in the academic sphere for finding and connecting to professionals of interest, locating and linking to content, strategies, and sharing of information, ideas, and research reports. It thus became an easy and effective tool for learning and pedagogy all over the world.

As a microblogging site, Twitter allows individuals (students, teachers, professionals, etc.) to make short posts ("tweets"), of not more than 280 characters about different subjects.

Such tweets often also contain links to other websites where users can get further information on their area of interest. A Twitter user may own an account that enables them to post and receive posts in their timeline; follow other Twitter users who either belong to their area of interest or with similar related professional and academic fields. The aim is to share content, methodologies, strategies, and academic resources common to the discipline. It also facilitates easy sharing of information through "retweets" of other users' tweets in very short whiles.

As a web 2.0 technology, Twitter has gained acceptance as a microblogging networking site useful for professional development and academics in Nigeria (Ogunsola & Olojo, 2021). Wickramanayake and Jika (2018) in a study with 242

Nigerian student teachers from Gombe state-reported Twitter as one of the most popularly used social media for education, entertainment, and communication. Twitter users were also reported to acquire different types of skills known to facilitate learning. However, on 5th May 2021, the government of Nigeria put a temporary ban on the use of Twitter in Nigeria. This elicited a myriad of opinions on the possible effects of the ban on the nation. From 4th June to 11th June 2021 a total of about 2.6 million posts connected to the ban were made. The opinions cover the perceived effect the ban will have on security, governance, mobilization, economy, and technological development, (Blankenship & Golubski, 2021). Blankenship & Golubski, (2021) also predicted huge losses to small and medium-scale businesses that use the microblogging site to promote awareness of their brands and businesses. In the field of teacher education in Nigeria, Wickramanayake and Jika (2018) reported high use of Twitter and other social media for learning, communication, and skill acquisition while Musa (2015) reported that 37.8% of Nigeria's Tertiary students of Mass communication make use of social media for their learning hence the outcry and claims about disenfranchisement from learning communities by the ban.

While Government presents the techno-skepticism view about citizens' use of Twitter for negative purposes, the opposing Techno- determinism views present arguments that inform this study. This study is to determine the perception of pre-service science teachers about the effect of the ban on Twitter- use in Nigeria on their building of learning communities.

The Theoretical Underpinning of Social Media Use

Practical pedagogy focuses on three issues about virtual learning (Skold, 2012). These are

1. That use of virtual space in education has created the need for theoretical and practical online pedagogy. Thus, pedagogic principles designed for physical or in-person education should not be wholesomely adapted for virtual spaces (Sheehy, 2010; Skold, 2012).
2. Every learning space is distinct from others by the unique learning task, the design, and the benefits targeted.
3. There is a social constructivist dimension to virtual learning environment design, especially in the area of the high premium placed on learner participation, interaction, active negotiation, and communication.

The social constructivist theories as exemplified by the work of Lev Vygotsky (1962) explain that individuals learn from each other through interaction and communication. Vygotsky also explicated the influence of social environment on the learning process and suggested that teachers build learning environments that support the interaction of students with their peers, teachers, and experts through discussions, collaborations, and feedback. With the prevalence of social media and the global dispersion of people in space and time, Vygotsky's social- constructivism began to make more sense since teachers and their students can now learn in their own spaces and time even when separated by distance. Its relevance can also be more appreciated in the virtual space as there is ample room for learners to source information both synchronously and asynchronously. Its implication for online/ community building and social networking is also appreciated in the ease of sharing ideas, chats, messages, video, video conferences, photographs, documents, illustrations/ diagrams, teaching and learning notes, meeting new friends, and discovering new things on daily basis.

In the area of behavior patterns of online platform users, Moore (1989) discussing 'transactional distance' considered the idea of separation in time and space in learning in virtual communities as an important factor in patterns of behavior of online platform users. Transaction in this sense is the interaction between individuals in a two-way exchange pattern involving the trading of ideas, opinions, and thoughts which are often the case in virtual worlds but not in physical learning environments. Deriving from Dewey and Bentley (1960)'s explanation, the transaction is an interplay of patterns of behavior that are contextual thus behaviors akin to online environments are at variance with those expected in face-to-face contexts. The import of this transactional distance is a possible high degree of misunderstanding between communicating parties (teacher and student, student and student, student and expert, student and other professionals, etc.) thus bringing to the fore the necessity of interaction, engagement, and reflection (Moore-Russo et al., 2015). This theoretical stance is a major aspect of learning from social networks because of the volume of connections and linkages involved. Pre-service science teachers exploit these opportunities for learning while not immune to the challenges associated with the context.

Science Teacher Education and Learning from Twitter

Since virtual/online spaces became visible in education (Kern et al., 2008; Skold, 2012), their influence has been pervasive and dominant, ranging from distance education facilitation to the provision of diverse communicative modes, collaborative spaces between teachers and students and among students, multimodal communicative patterns, easy customizability to fit learning pedagogy and specialized activities. In the field of science education, virtual spaces provided by social media such as Twitter have been found useful in demonstrating concepts in medicine, health education, and abstract science

concepts where demonstration and practical activities are easily simulated (Osborne & Hennessy, 2003, Skold, 2012). There are reports of the advantageous properties of virtual spaces such as lighting, color, and acoustics on learning. For example, Higgins et al. (2005) reported the positive effect of lighting on mood, long-term memory, and problem-solving ability of learners in virtual space over physical learning environments. Other physical variables which Higgins et al. (2005) indicated as benefits of virtual over physical spaces are air and class arrangements.

The influence of social interaction in science learning as expressed within the constructivist views of social learning (Vygotsky, 1987) has been variously explored in physical and virtual spaces (Raspopovic et al., 2017). Vygotsky's (1987) idea that learners learn better in social environments because while interacting with others, they construct meaning which enables them to solve more difficult tasks independently, is instructive. Essential to science learning is the formation and membership of professional learning communities. Science learning thrives in science communities since scientific knowledge is group and community negotiated and approval of what is 'right' and 'acceptable' as authentic knowledge is negotiated by a community of science practitioners. Also, certain aspects of science pedagogic practices are tacit and acquired from professional colleagues through academic apprenticeship within the social networking space. Twitter has been acclaimed as one of the social media platforms for professional community building and educators all over the world particularly in science communities have harnessed its unique features for promoting professionalism (Macia & Garcia, 2016; Gao & Li, 2017; Carpenter et al., 2020).

Among Nigerian pre-service science teachers, the popularity of Twitter has been reported (Sokoya, Onifade & Alabi, 2012; Anyanwu et al., 2013). A more current study has reported that pre-service teachers in Nigeria utilize the benefit of Twitter for learning how to teach and form learning communities (Wickramanayake and Jika, 2018), as such the ban of the microblogging site may portend great hindrance to their learning and professional development. The focus of this study is to determine pre-service science teachers' views about the use of Twitter for professional development and community formation by the different gender and the effect of the ban on their professional community building in Nigeria.

Online Platforms and Student Learning Effectiveness

Studies have focused on the efficiency of online networking sites and platforms on students' learning. The unique features of these sites and the high interest of learners in the use of social learning platforms have triggered a wide range of research on its potential benefits for students' learning. Apart from its use in creating online interaction and discussion, it has been reported to have a positive effect on students' team-building spirit, supportive relationships, greater psychological wellbeing, social competence, communication skills, self-esteem as well as higher achievement and greater productivity in learning outcomes (Ezeani and Igwesi, 2012). Several studies (Ntibi & Ibok, 2020; Park, 2016), have reported a positive effect of online learning environments on learners' attitude towards learning, performance, stimulation of interest, academic emotion, and promotion of learning. Its efficacy in providing an emotional scaffold, interaction with mentors, access to course content customization, and building students' communities have been reported (Greenhow, 2011a, 2011b; Ansari and Khan, 2020). Also in Nigeria, Mohammed (2018) and Olutola (2018) in different instances (Plateau and the Katsina States) conducted ex-post-facto studies on Physics pre-service teachers (student teachers) utilization of social networks such as Twitter and the influence on their academic achievement. The study reported a significant influence of Twitter- use on students' level of utilization on their academic performance. In the area of collaborative learning, relationship formation between students and their lecturers, idea sharing and resource reflection, studies (Blair, 2013; Rockinson-Szapkiw & Rockinson-Szapkiw, 2011) have reported a significant role of Twitter in the development of critical thinking.

Studies reviewed are rich in the influence of Twitter and other social networks in diverse areas of student learning including network community building, academic performance, and academic visibility, particularly in science disciplines. Studies have also shown that Pre-service science teachers benefit from Twitter- use in their learning and academic socialization. The ban on Twitter, therefore, may have been a critical phase in these pre-service science teachers' learning. It is thus of importance to investigate the perception of these pre-service science teachers about the ban and its effect on their community building and to understand if these views are gender determined. This is the focus of this study.

Gender Disparity in Social Media Use

Researchers interested in understanding social factors and the social dynamics in learning and professionalism have in recent times started focusing on social media presence, visibility, language use, and even tagging as indices of professionalism and community acceptance. In a study of gender differences in Twitter- use and influence among health policy and health service researchers, Zhu et al. (2019) reported that men tend to have more followers than women, and as such women have less influence on Twitter compared to males. This study is of significance since career development, visibility, networking, and professional development are closely related to community building and participation

and may explain some previous gender studies' discrepant reports. Women's entry into science professional disciplines, retention, and growth are issues that have dominated gender studies over the years. Understanding their perspective on the use of Twitter and the implication for their visibility and development may be insightful.

Methodology

This section explains the questions asked, the hypothesis stated, and the method of obtaining answers to the questions raised in this study.

Research Questions

The following research questions guided the study:

1. What percentage of pre-service science teachers use Twitter for building learning communities in Nigeria?
2. To what extent do Pre-service science teachers use Twitter for accessing information?
3. What is the perception of pre-service science teachers on the effect of the ban on Twitter- use in Nigeria in building learning communities?
4. What is the effect of pre-service science teachers' gender on the perception of the ban on Twitter- use in building learning communities?

Research Hypotheses

The following hypotheses guided the study.

1. There is no significant difference in male and female pre-service science teachers' use of Twitter in building learning communities and accessing information.
2. There is no significant difference in pre-service male and female science teachers' perception of the effect of the ban on Twitter on building learning communities and access to information.

Method of the Study

The descriptive survey design was employed for the study. This is to enable the sample of a range of opinions on the subject under investigation from a cross-section of pre-service science teachers. A simple random sampling technique was employed to select two states out of the six in the South-south zone of Nigeria. Only state-owned and funded Universities in the sampled states were selected because of similarities in their science education programs, admission policies, and geo-ethnic background. A total of 114 pre-service science teachers studying for the Bachelor of Science Education (B.Sc (Ed) degrees in Biology, Chemistry, Physics, Computer Science, and Integrated Science in the Faculties of Education in the two Universities were selected by stratified random sampling technique. Stratification helped ensure that pre-service teachers from all the five science education disciplines were included in the sample.

The instrument for data collection was a 20-items 4-points modified Likert scale questionnaire tagged "Pre-service Science Teachers' Perception of Impact of the Twitter ban on their community building". The questionnaire is a modified Likert scale because the neutral opinion was omitted from the original Likert format. All the 20 items are closed items and respondents were asked to indicate their level of agreement with the statements by marking a tick ($\surd$) to indicate their level of agreement or disagreement with items on the scale. The instrument, though noncategorical, covered items on Twitter usage, benefits of Twitter use, and the perceived effect of the ban of Twitter on community building. The instrument was face and content validated by one curriculum evaluator and one science educator and certified suitable for the study. The reliability of the instrument was determined from data collected from 20 final-year science education pre-service teachers of a university of the same status in a different state in the same geo-ethnic zone. Crombach alpha inter-rater discriminatory reliability yielded a reliability coefficient of 0.75. Permission to collect data from the student was sought from the Deans of the faculties and the course lecturers of undergraduate General Educational Technology (EDU 311) in the two Universities. The instrument was then administered to the sample during the class by the researchers with the assistance of two research assistants and the course lecturers on two separate days in each of the Universities. The subjects responded to the items in the questionnaire during the lesson period and the questionnaires were retrieved on the spot. However, preliminary analysis showed that only 84 students in the sample owned a hashtag and use Twitter for information sourcing and building of learning communities while the remaining 30 neither owned a hashtag nor use Twitter. Thus, the 84 subjects became the sample for the study. Data generated from the 84 pre-service science teachers were subjected to simple descriptive analysis using percentages, and inferential statistics (Wisconsin non-parametric test and t-test of independent samples).

Results

Data collected were subjected to descriptive analysis using frequency count and percentages of the 114 respondents sampled, 84 representing 73.7% and consisting of 42 males and 42 females had Twitter accounts and have been using the micro-blogging site for academic purposes before the ban while 30 respondents, representing 26.3% of the sample do not have a Twitter account and had never used Twitter for academic purposes. Among the non-users, 13 (43.3%) are

females while 17 (56.75) are males. This result showed that a good percentage of pre-service teachers were using Twitter for academic purposes before the ban (Tables 1 and 2).

The above table shows a high agreement that the ban on Twitter affected the learning and community building of Pre-service science teachers in the sample. Only a few (17) representing 20.3% in item 16 made a quick switch over to other social media during the ban.

Perception of Pre-Service Science Teachers on the Effect of the Ban of Twitter- Use in Nigeria on Professional Community Building

Only nine items relating to the perception of respondents on the ban of Twitter were used in analyzing this research question in Table 3 below.

Table 1 Frequency and percentage of Twitter users in the sample

	Frequency	Percent	Cumulative Percent
Non-User	30	26.3	26.3
User	84	73.7	73.7
Total	114	100.0	100

Table 3 above shows the perception of pre-service teachers on the impact of the ban on Twitter- use on their learning communities. While 67 (79.7%) of the respondents have switched to other online learning platforms, the responses to another item except for item six shows between 76.2% to 83.3% agreement that the ban had some effect on their learning. This value is above the 50% benchmark set for the study. On the other hand, item six in Table 3 revealed that the ban had an impact on the learning of pre-service science teachers who were using the microblogging site for learning and building their professional communities before the ban.

The Difference in Male and Female Pre-Service Science Teachers' Perceptions About the Effect of the Ban on Twitter- Use on Their Learning Communities

There is no appreciable difference in the mean and standard deviation of the perception of males (Mean = 3.2778, SD = 0.45927)) and females (3.2302, D = 0.50867) in the sample when the extent of use of Twitter was considered. There seems to be no difference due to gender. This is

Table 2 Perception of Pre-service Science Teachers on the extent of use of Twitter for building learning communities

ITEMS	SA		A		D		SD	
	X	%	X	%	X	%	X	%
The use of social media in education/learning is of immense importance to me	65	77.4	16	19	3	3.6	0	0
Most students use Twitter for collaboration and academic interaction	30	35.7	51	60.7	3	3.6	0	0
Using Twitter and other online platforms Advances my learning	45	53.6	34	40.5	4	4.8	1	1.2
Twitter and other social media distract my focus	3	3.6	9	10.7	44	52.4	28	33.3
Using Twitter enhances the quality of my learning	37	44.0	36	42.9	9	10.7	2	2.4
I use Twitter to ask pertinent questions and receive answers from mentors and colleagues prior to the ban	24	28.6	46	58.3	9	10.7	2	2.4
I sparingly used Twitter for learning	3	3.6	11	13.1	33	39.3	37	44.0
The presence of spam mail makes Twitter distractive for learning	31	36.9	35	41.7	12	14.3	6	7.2
I use Twitter but it is not useful to my learning	8	9.5	13	15.5	27	32.1	36	42.9
The ban on Twitter has negatively impacted on my networking	33	39.3	34	40.5	11	13.1	6	7.2
Because of the ban on Twitter, I now find it difficult to connect with my distant professional colleagues	35	41.7	33	39.3	11	13.1	5	5.0
I am now completely disenfranchised from my professional community due to the ban	36	42.9	33	39.3	9	10.7	6	7.1
My hashtag helped to increase my professional visibility before the ban	26	31.0	41	48.8	13	15.5	4	4.8
Because of the ban on Twitter, I am no more able to access rich content from my professional colleagues	31	36.9	33	39.3	13	15.5	7	8.2
The ban on Twitter does not affect on how I learn	0 6	7.1	11	13.1	31	36.9	36	42.9
I have switched over to other online learning platforms	29	34.5	38	45.2	14	16.7	3	3.6
Connecting through my hashtag had numerous benefits for my learning before the ban	30	35.7	40	47.6	10	11.9	4	4.8
I miss my Twitter handle	30	35.7	38	45.2	12	14.3	4	4.8
I like Twitter as an online learning site because it integrates learning with fun	22	26.5	47	56.5	11	13.3	3	3.6
The ease with which contents are organized by topics makes Twitter very useful in learning	24	28.9	44	53.0	9	10.8	6	7.2

Table 3 Frequency and percentage responses of pre-service science teachers on the effect of the ban on Twitter on building learning communities

	SA		A		D		SD	
	X	%	X	%	X	%	X	%
The ban on Twitter has negatively impacted on my networking	33	39.3	34	40.5	11	13.1	6	7.1
Because of the ban on Twitter. I now find it difficult to connect with my distant professional colleagues	35	41.7	33	39.3	11	13.1	5	6
I am now completely disenfranchised from my professional community due to the ban	36	42.9	33	39.3	9	10.7	6	21
My hashtag helped to increase my professional visibility before the ban	26	31	41	48.8	13	15.4	4	4.8
Because of the ban on Twitter, I am no more able to access rich content from my professional colleagues	31	36.9	33	39.3	13	15.4	7	8.2
The ban on Twitter does not affect how I learn	11	13.1	6	7.1	36	42.9	31	36.9
I have switched over to other online learning Platforms	29	34.5	38	45.2	14	16.7	3	3.6
Connecting through my hashtag had numerous benefit for my learning before the ban	30	35.7	40	47.6	10	11.9	4	4.8
I miss my Twitter handle	30	35.7	38	45.2	12	14.3	4	4.8

Table 4 Descriptive analysis of the perception of pre-service science teachers by gender on the effect of the ban on their learning

	GENDER	N	Mean	Std. Deviation	Std. Error Mean
USE	1	42	3.2778	0.45927	0.07087
	2	42	3.2302	0.50867	0.07849
IMPACT	1	42	3.1746	0.56062	0.08651
	2	42	3.1151	0.55885	0.08623

further explained by the independent t-test in Table 5 below. Table 4 also reveals a slight difference in means of males (Mean = 3.1746) and females (Mean = 3.1151) in terms of the impact of the ban on their learning communities. These results are further proved insignificant when subjected to a t-test of difference in Table 5 below.

There was no significant difference in the perception of males (Mean = 3.2778, SD = 0.45927) and females (Mean = 3.2302, SD = 0.50867), t(82), p = 0.654. the difference in the mean of each gender was too small to be significant at the 0.05 alpha level for this study but is significant at P = 0.654. The perceptions of males and females about the use of Twitter in building learning communities were similar and devoid of disparity due to the gender of respondents. The null hypothesis 1 stating no significant difference in the perception of males and females on the use of Twitter by Preservice science teachers in building learning communities was retained.

To determine if there is a significant difference in the means of the responses of the sample about the impact of the ban on Twitter on their learning communities as stated in hypothesis 2, the data were subjected to independent samples t-test.

Table 6 showed that the perception of males pre-service science teachers (Mean = 3.1746, SD = 0.56062), did not differ significantly from those of females (Mean = 3.1151, SD = 55,885), t(82), p = 0.487). Gender, therefore, did not determine the views of the sample about the effect of the ban on their learning communities. The effects were perceived similarly by both genders. Null hypothesis 2 was therefore retained. Pre-service science teachers' perception of the impact of the ban on Twitter on building learning communities was not significantly different along gender lines. Null hypothesis 2 was thus retained.

These results are further shown graphically in Figs. 1 and 2 below.

The violin plot above with a Wisconsin value of 6.62 ($P = 0.391$ at 95% interval shows that there is no appreciable difference in the views of both gender on the effect of the ban on their building of learning communities.

Table 5 T-test of the significance of the difference in perception of pre-service science teachers on the use of Twitter in building learning communities by gender

Gender	N	Mean	SD	Df	t- Value	Sig 2-tailed
Male	42	3.2778	0.45927	82	0.450	0.654
Female	42	3.2302	0.50867			

Discussion of Results

The result of this study showed that the ban on Twitter had some unpleasant effects on pre-service science teachers' learning communities. This impact had earlier been reported by Carpenter et al. (2020) and McGann et al. (2020), and Aydin (2012) who have noted the simplicity of searching for content and ease of discovering and engaging in collaborative activities among others as important attributes that make Twitter-use highly beneficial. As such denial of access to the microblogging site due to the ban would have posed a great challenge to users particularly the pre-service teachers in connecting to their communities. Blankenship and Golubski (2021) have also reported

Table 6 T-test of perception of pre-service science teachers on the effect of the ban of Twitter on their learning communities

Gender	N	Mean	SD	Df	t-value	Sig. 2-tailed
Male	42	3.1746	0.56062	82	0.487	0.627
Female	42	31,151	0.55885			

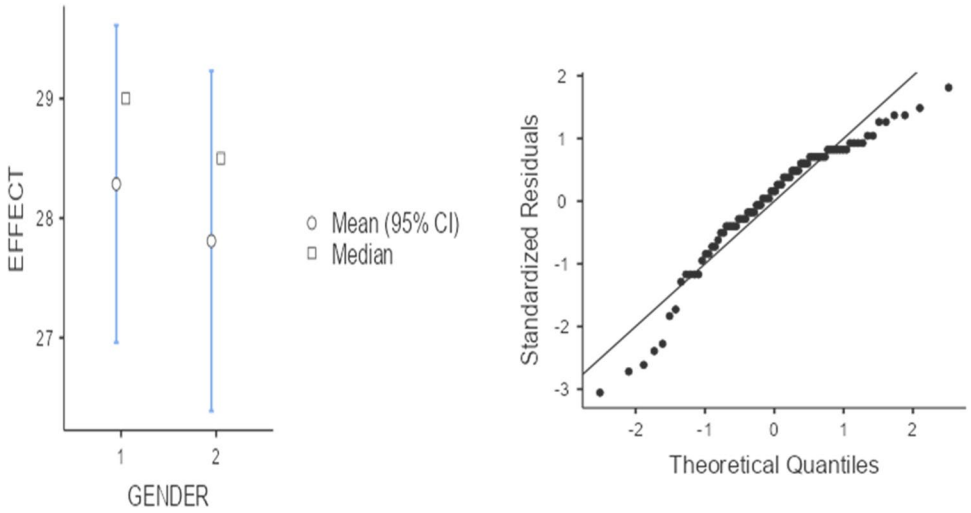

Fig. 1 Graphical representation of the relationship in means of the sample by gender

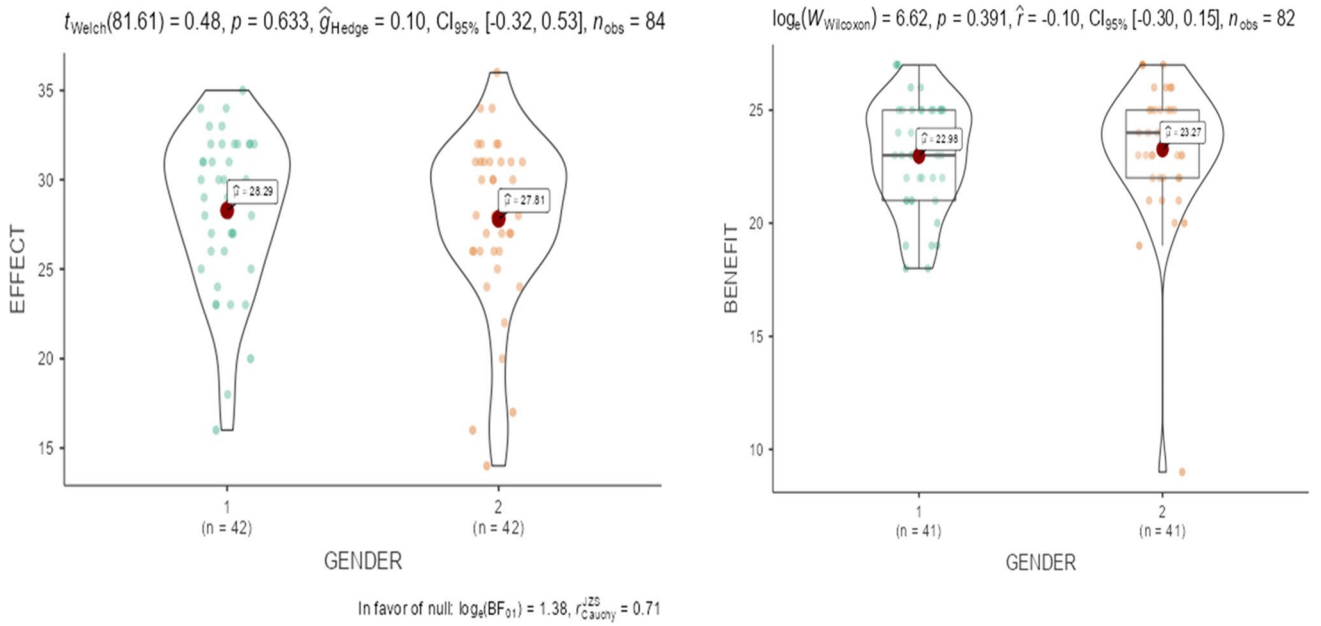

Fig. 2 Violin plot of the difference in the perception of the sample by gender

huge losses to small and medium-scale businesses that use the site though mention was not made of its impact on learning and academics. It thus can be inferred that since learning is a product of multi-faceted interaction between people, materials, and media, the impact on one segment has a ripple effect on other related but different segments. In the domain of science teacher education, membership in professional communities is essential to learning as knowledge is group negotiated within communities of practitioners. Any disenfranchisement through a ban of this type must have negative consequences on learning. It is important to note that the ban on Twitter is a recent issue and no study in the domain is yet known to the researchers either in science education or elsewhere.

There are no clear studies on the implication of the ban on the different gender but this study reports no differentials in the views of pre-service teachers along gender lines. Also, there are no differentials in the extent of use of the microblogging site among Nigerian pre-service science teachers used for this study. This result contradicts the reported male dominance in the United States of America and even the world as recorded by Statista Research Department (2022) and Zhu et al. (2019) who reported higher male dominance and influence on Twitter. There appears to be no difference in views due to gender. It is possible to state that issues on gender visibility, access, and retention in science domains are not accentuated by the degree of social media use in the Nigerian context.

Conclusion

There exist a large number of pre-service teachers who use Twitter for their learning. While these pre-service teachers are not questioning the Government's prerogative of control and preserving national peace and integrity, their perception is that the ban of the portal has some effects on users, especially in their linking with their learning communities. Though some of them have switched to the use of other social media platforms, a good number still feel that there is a certain service of Twitter that they miss. The free and easy accessibility of information and connection of the portal is of economic and academic value to pre-service science teachers.

On the perception of males and females about the effect of the ban of Twitter on their learning and community building, the study found no significant difference along gender lines as such any difference in science performance, visibility and influence are not due to social media but may be due to other social, psychological and cultural issues. The study has revealed that though there were hues and cries about the ban, there are students who do not use the portal (26.3% of the original sample) and are nonchalant about the ban with a feeling that it has no consequences for their learning. This perception is not encouraging in the present technologic age in which learners must avail themselves of all available sources of information for their growth. However, a large number of pre-service students utilize the platform for building their learning communities and believe that the ban has limited their avenues for information gathering, interaction, and linkage.

The world is in an age where all technological resources are of value for education and national development. It is of importance to note that national integrity and interest are uppermost in maintaining sovereignty. It is thus a challenge to indigenous technologies, web designers, and instructional designers to work towards maintaining harmony in the online space in the interest of continuous academic growth and professionalism.

Implication for policy

The evidence in the literature that over 36 million Nigerians are Twitter users is corroborated by this study since at least 76.7% of the study sample use the network. This population perceives the ban on Twitter as uncalled for since in their perception, the benefits of the use of the microblogging platform are numerous to education and nation-building and any differences in operation could be subjected to dialogue between the parties. This feeling of disenfranchisement from the learning resource should be addressed by the policy. This population is too huge to be ignored. It is the view of the researchers that public orientation and information on the danger of posting damaging tweets and other information by way of user education could perform the magic instead of an outright ban. Such an outright ban has implications for other sectors of the national economy including education.

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Declarations

We the authors hereby declare that all funds for this study were provided by the authors. No external, institutional, or organizational funding was received for this study. There is therefore no financial conflict with any person, persons, organization, or government agency as it concerns this study as no grants or funding was received.

Ethical Approval for the Study The study respondents from whom data was collected are 400-Level pre-service science teachers of the faculty of Education of two universities in South-South Nigeria. Permission to administer the instrument to the students was sought and granted by the Dean, Faculty of Education in the institutions along with their Faculty Board Academic Matters Committees.

In addition, only pre-service teachers interested in the study and who willfully desired to participate in the study were used. Respondents were neither forced nor coerced to participate in the study.

Conflict of Interest This study was conducted in late 2021 while the ban on Twitter uses placed by the Nigerian Government on 5th May 2021 was in force. This ban was however lifted on 13th January 2022. The study aimed to find the effect of the ban on learning by pre-service teachers. It is purely academic without any political, cultural, sectorial, or ethnic bias. The results are also a reflection of the perception of the subjects during the period of the ban.

References

Ansari, J.A.N & Khan, N.A. (2020). Exploring the role of social media in collaborative learning the new domain of learning. *Smart Learning Environment 7*(1), 1–16.

Anyanwu, E. U., Ossai-Onah, V. O., & Iroeze, P. (2013). Use of social media Tools among Nigerian undergraduates in three selected Tertiary institutions in Imo State, Nigeria. *Journal of Information and Management, 4*(2), 46–52.

Aydin, S. (2012) *A review of research on Facebook as an educational technology research and development, 60*(6); 1093–1106.https://doi.org/10.1007/s11423-012-9260-7.https://esrc.ujri.org.twitter. Accesed June 2022

Blair, A. (2013). Democratizing the learning process: The use of Twitter in the teaching of politics and international relations. *Politics, 33*(2), 135–145.

Blankenship, M. & Golubski, C. (2021). Nigeria's Twitter ban is a misplaced priority. *Africa in focus,* Wednesday, August 11, 2021, Brooking. edu-del.

Carpenter, J. P., Staudtwillet, K. B., Koehler, M. J., & Greenhalgh, S. P. (2020). Spam and Educators. Twitter uses Methodological challenges and considerations. *Tech Trends, 64*(3), 460–469.

Carpenter, J., Tani, T, Morrison, S & Keane, J. (2018). Exploring the Education Twitter Hashtag landscape. In E. Langram & J Borup (Eds), *Proceedings of Society for Information Technology & Teacher Education (SITE) international conference* (pp2230–2235) Washington, D. C., United States: Association for the Advancement of computing in education (AACE).

Dewey, J., & Bentley, A. F. (1960). *Knowing and the Known 111*. Beacon Press.

Ezeani, C. N. and Igwesi, U. (2012). Using social media for dynamic library services delivery: The Nigeria experience. Library Philosophy and Practice (e-journal). Available @ http://digitalcommons.unl/.edu/libphilprac/814. Retrieved August 2013.

Gao, F., & Li, I. (2017). Examining a one-hour synchronous chat in a micro blogging-based professional development community. *British Journal of Educational Technology, 48*, 332–347.

Greenhow, C. (2011a). Online Social Networks and Learning. *On the Horizon, 19*(1), 4–12.

Greenhow, C. (2011b). Youth Learning and Social Media. *Journal of Educational Computing Research, 45*(2), 139–146. https://doi.org/10.2190/EC.45.2.a

Higgins, S. Hall, E., Wall, K., Wolner, P., McCaughen (2005). The Impact of School environments: A literature review at http://www.designcouncil.org.uk/Document accessed.

Kern, R., Ware, P., Warschaver, M. (2008). Network-based language teaching. Ink King and Hornberger (Eds) *Encyclopedia of language and Education second Edition*. Springer, pp 1374–1385.

Lee, K., Brownstein, J. S., Mills, R. G., & Kohain, I. S. (2010). Does collocation inform the impact of collaboration? *Plus One, 5*(12), e14279. https://doi.org/10.1371/journal.pone.0014279

Macia, M., & Garcia, I. (2016). Informal online communities and networks as a source of teacher professional development: A review. *Teaching and Teacher Education, 55*, 291–307. https://doi.org/10.1016/j.tate2016.01.02

McGann, M., Ryan, M., McMahon, J., & Hall, T. (2020). T-REX: The teachers' research exchange. *Overcoming the research-practice gap in education. TechTrends, 64*(3), 470–483.

Minachu, S., & Reeves, S. (2010). "Design of learning spaces in 3D virtual worlds: An empirical investigation of Second Life" Learning. *Media and Technology, 35*(2), 111–137. https://doi.org/10.1080/17439884.2010.494419

Mohammed, A. (2018). Examination of Social networking Utilization and Students' Academic Achievement in Physics in Jos, Plateau State. Unpublished M.Ed Thesis, University of Jos.

Moore, M. G. (1989). Editorial: Three types of Interaction. *The American Journal of Distance Education, 3*(2), 1–6.

Moore-Russo, D., Wilsey, J., Grabowski, J., & Bampton, T. (2015). Perceptions of online learning spaces and their incorporation in mathematics teacher education. *Contemporary issues in technology and teacher education,* 15 93). https://citejournal.org/volume-15/issue-3-15/mathematics/perception-of-online-learning-spaces-and-their-incorporation-in-mathematics-teacher-education

Musa, A. S. (2015). Social Media in the learning process of Nigerian Students of Mass Communication. *New Media and Mass Communication. 44*, 25–30. https://core.ac.uk. Accessed 8/12/2022

Ntibi, J. E., Ibok, E. E. (2020). Students' Facebook and Twitter Usage as predictors of their Academic Achievement in Physics in Ogoja Education Zone of Cross River State, Nigeria. European Journal of Social Sciences 60(1)39–46. http://www.eurpeanjournalofsocialsciences.com. Accessed August 2022

Ogunsola, K. and Olojo, T.P (2021). Towards connected Governance: citizens' use of web 2.0 in Nigeria. *Web 2.0 and cloud Technologies for implementing connected government*. https://doi.org/10.4018/978-1-7998.4570.6ch004

Olutola, I. (2018). Assessment of Social networking utilization and Students' Academic achievement of Tertiary institutions in Katsina State. *Ghana Library Journal, 20*(1), 1–14.

Osborne, J., Hennessy, S. (2003). Literature review in science education and the role of ICT: Promise, problems and future directions". *Future lab series* at http://archive.Futurelab.org.ule/resources

Park, S. (2016). virtual Avatar as an Emotional scaffolding strategy to promote interest in the online learning environment. http://sciencedirect.com/topic/comuters-science/online-learningenvironment

Raspopovic, M., Cvetanovic, S., Medan, I., Ljubojevic, D. (2017). The effect of integrating social learning environment with online learning. *The International Review of Research in Open and Distributed Learning 18*(1).

Rockinson-Szapkiw, A. J., Rockinson-Szapkiw, M. (2011). Engaging higher education students using Twitter. Proceedings of Global Learn Asia Pacific, 360–364. http://works.bepass.com/amanda_rockinson_szapkiw/31/

Rosenberg, J. M., Greenhalgh, S. P., Koehler, M. J., Hamilton, E. R., & Akcaoglu, M. (2016). An investigation of state educational Twitter hashtags (SETHs) as affinity spaces. *E-learning and Digital Media, 13*(1-2), 24–44.

Sheehy, K. (2010). Virtual environments: Issues and opportunities for researching inclusive educational practice. In A. Peachey, J. Gillen, D. Livingstone, & S. Smith-Robbins (Eds.), *Researching learning in virtual worlds* (pp. 1–15). Springer.

Skold, O. (2012). The effect of virtual space on learning: A literature review. *First Monday Peer-Reviewed Journal on the Internet 17* (1–2). https://doi.org/10.5210/fmv17./.3496

Statista Research Department. (2022). Twitter user distribution by gender in US 2021. https://www.statista.com.statistics. Accesed 12/6/ 2022

Sokoya, A. A., Onifade, F. N., & Alabi, A. O. (2012). „Connections and Networking: The Role of Social Media in Agricultural Research in Nigeria" Session: 205-Social Networking for Agricultural Research. Education, and Extension Service: *An International Perspective-Agricultural Libraries Special Interest Group*, 23-28.

Tang, Y., Hew, K.E. (2017). Computer in Education. https://doi.org/10.1016/j.compedu.201612.004

Tours, E. (2017). Teachers' self-initiated professional learning through personal learning networks. *Technology, Pedagogy, and Education, 26*, 179–192. https://doi.org/10.1080/1475939X.2016.1196236

Vygotsky, L. (1962). *Thought and Language*. MT Press.

Vygotsky, L. (1987). Thinking and Speech. In R. W Rieber & A. S Carton (Eds)., The collected works of L. S Vygotsky. Vol 1. Problems of General Psychology 39–285. New York: Plenum.

Wickramanayake, L., & Jika, S. M. (2018). Social media use by undergraduate students of education in Nigeria: A survey. *The Electronic Library, 36*(1), 21–37. https://doi.org/10.1108/EL-01-2017-0023

Zhu, J. M., Pelullo, A. P., Hassan, S., Siderowf, L., & Marchant, R. M. (2019). Gender differences in Twitter use and influence among Health policy and Health Services Researchers. *JAMA Intern Med, 179*(2), 1726–1729. https://doi.org/10.1001/jamainternmed.2019.4027