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Walailak Journal of Science and Technology: A Potential Black Swan Event is Born

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Abstract

In early 2017, a manuscript was submitted to a special issue of Walailak Journal of Science and Technology (WJST), a free (platinum) open access (OA) journal published in Thailand. Prior to submission, WJST was checked for most obvious signs of predatory OA publishers and being covered by SCOPUS and listed at Directory of Open Access Journals (DOAJ), it was determined to be a non-predatory OA journal. An editor-created account that entered incorrect data and without the implicit permission of the corresponding author raised an immediate red flag. WJST immediately corrected that error. After submission, the article was peer-reviewed, and the steps between editorial revision and final proof processing and publication were fairly quick, and professionally handled. No DOI was assigned. An unrelated article published in WJST with an apparent error in a figure was discovered. The authors of that paper were contacted about the query, and the journal and editors were copied. After a week of silence, the editor contacted the corresponding author (CA). After one more week, and with the threat of retraction by the editor-in-chief if no suitable explanation was provided, the CA responded. No explanation was provided for the figure irregularities, and it was discovered that the CA had submitted the paper without the knowledge of at least one of the authors, with whom he had not been in contact since 2004. In clear breach of the ethical and submission policies of the journal, WJST decided to swiftly retract the paper, the first-ever such retraction for WJST. WJST was caught by surprise and was very apologetic for editorial oversight. This case represents a rarely documented and witnessed birth of a potential black swan event – a highly unlikely or improbable event – in an OA journal. Future perspectives and cautious advice are provided.

Keywords: Editorial Responsibility, Open Access, Peer Review, Predatory, Quality Control, Thailand.

1. Introduction

The open-access movement is in turmoil

Traditional print journals are being gradually phased out. The trend in increasing open access journals (OAJs) began in the early 2000s and has reached fever pitch levels in the past decade with literally hundreds, if not thousands, of OAJs emerging annually, some academically valid, some not. A watchdog and US-based librarian, Jeffrey Beall, began a blog in 2008 that began to document, and blacklist, what he felt were academically suspect OAJs, the "predatory" OAJs,

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or POAJs. However, soon Beall became emboldened with and by his lists, encouraged by an empathetic global audience of concerned and irritated academics who wanted a blacklist of POAJs that infringed upon basic academic responsibilities and that were simply trying to draw profit for publishing papers instantly, without peer review. In the 3-4 years preceding the closure of his blog, Beall's influence increased, and he began to call for journal and institutional policy to be implemented based on his blacklists. However, not only were those blacklists imperfect, inaccurate, and biased (Teixeira da Silva, 2017a, 2017b, 2018a), entries on them could rarely be challenged. This led to an increase in the number of enemies, both within the OA movement and within traditional publishing, and a rift among academics as to the ethics of his often culture-shaming and potentially discriminative blacklists (Kimotho, 2019). Beall's blacklists suddenly disappeared on January 15, 2017, leaving POAJ supporters with a massive vacuum in the OA watchdog movement, and throwing the OA movement into some disarray, only because many in academia and the industry had relied heavily on Beall's blacklists as a "safe" and "accurate" source of information. Despite Beall's explanation and lamentation (Beall, 2017), the negative consequences of those blacklists remain, more than four years after their closure (Teixeira da Silva, 2020b).

In the past few years, in some ways to counter the ills caused by POAJs, the OA movement has also seen a cementing of three other important movements, open data, open science, and open peer review, which have the apparent objective of making the publishing process more open and transparent, increasing reproducibility (Wallach et al., 2018), and perhaps fixing some of OA and traditional publishing's ills. Many projects are being experimented on, and many experimental systems have been launched, some useful and successful, others not (Tennant et al., 2019). Academics have become veritable guinea pigs and experimental rats of the publishing industry, as all these experimental models are being widely applied to global academia. Not all is well with the OA movement, and even black OA or guerrilla OA seems to have become more successful, at least academically, than the green and gold OA models (Green, 2017), while the OA movement has become increasingly politicized and excessively commercialized (The Conversation).

In some ways, academics are on their own, left to their own devices to find suitable publishing outlets to better distinguish what is a true academic OAJ, and what is a POAJ, or the widening grey zone in between (Teixeira da Silva, 2020a, 2021a). Either that or they are fed a constant flow of "follow us" or "use our platform" marketing ploys. Given the increasing lack of definition as to what a POAJ is (Grudniewicz et al., 2019), academics have to have a greater sense of the risks in publishing, become more publishing-wise, and seek publishing venues and suitable journals that suit their needs, while calculating the risks (personal and professional) and assessing the benefits, including, very importantly, the safety of the journal, its academic validity and the costs of publication, all very real and important aspects that have to be taken into consideration before a target journal is selected (Teixeira da Silva, 2021b).

2. Results

The choice of Walailak Journal of Science and Technology as a target OAJ

While searching for a suitable journal, a few years ago, my co-authors and I (Teixeira da Silva et al., 2017b) wanted a choice that was free (most important aspect), since none of us receive research funding for this academic work, and if possible, OA, since the topic we wanted to discuss, namely predatory congresses, would be of importance, and value, to a global audience. Having experience with several mainstream publishers and journals that focus on publishing-, library-and information-related topics, and aware that peer review in some of these cases, including the submission-to-publication process, can take a year or more to complete, some thematically suitable journals were automatically excluded because of their famed tardy publication process. Indexing was important, and indexing on Scopus or Directory of Open Access Journals (DOAJ) were attractive features. Eventually, we identified one Thailand-based OAJ, the Walailak Journal of Science and Technology (WJST), which is both listed on DOAJ (Figure 1A), even after its POAJ purges in 2014 (DOAJ, 2014), and also on Scopus, carrying a CiteScore (Figure 1B), an Elsevier/Scopus-owned metric that might be useful and competitive against the Clarivate Analytics' Journal Impact Factor (Teixeira da Silva, 2020c).

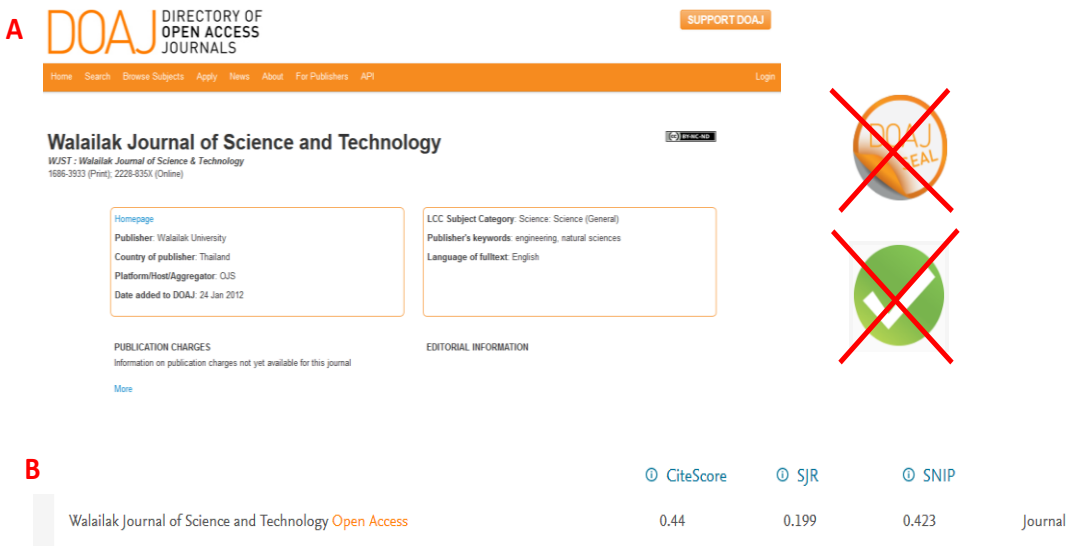

Fig. 1. The Walailak Journal of Science and Technology (WJST) is listed in DOAJ (A) and in Elsevier's Scopus (B)
Notes: In (A), WJST does not carry either of the two DOAJ symbols of "quality", the DOAJ seal, or the green tick. Sources: https://doaj.org/toc/2228-835X (A); https://www.scopus.com/ (B; listed under "W"). Screenshots of any proprietary material used under academic fair-use (Teixeira da Silva, 2015d).

Even though fairly local, WJST had several of the aspects that we were looking for: no OA fees or article processing charges (i.e., platinum OA), publication in English, local but reaching a global audience through OA and its indexing. This decision was made, despite knowing the possible risks associated with the DOAJ (Teixeira da Silva et al., 2018). Moreover, the timing of our submission was perfect, for a special issue on "Communication and Information Technology". After completing a provisional screening of the WJST website for any possible glaring signs of predatory behavior, such as the lack of ethical guidelines, unclear instructions for authors, the lack of an editorial board or unclear location or contacts, and several other predatory behaviors or signs (Teixeira da Silva, 2013), we felt that this was a "safe" publishing venue. We also determined that even though WJST was considerably local, in terms of editorial responsibility, that it did not present any glaring predatory behavior. The Editor-in-Chief (EIC), Dr. Chitnarong Sirisathitkul of the Walailak University School of Science in Thailand was contacted with a presubmission query to ascertain if the topic that we wished to cover, namely predatory congresses and symposia, and ways to quantify that predation, would be of interest to the WJST editors and readership. The EIC was very receptive, kind, and helpful, responding within 24 hours, and offering to assist with the submission process, if necessary.

Editor-created submission account: First bump in the road for WJST

Perhaps too enthusiastically, the WJST EIC immediately created an online submission account on my behalf, without asking me first, and only informing me after the account had been created, indicating my user name and password, which WJST had set. This raised an immediate red flag because, if this was standard policy, then it might constitute predatory behavior (Teixeira da Silva, 2016a), and one of the concerning aspects of the "fake" movement that is increasingly plaguing academic publishing (Teixeira da Silva, 2017c), raising concerns about our choice of journal. I discovered that factually incorrect and inaccurate information had been used to create that online submission account, namely, an incorrect name, only one of the three authors had been registered, and an undesired role was selected (Figure 2A). Clearly displeased that an inaccurate account had been created on my behalf, without my explicit permission, I issued a complaint by email to the EIC. Within 24 hours, the account had been wiped clean and removed (Figure 2B). I then created my account, with the correct meta-data for me, my co-authors, and the manuscript, all within 1 day (Figure 2C). Peer review was initiated immediately, and accompanied by a sincere and profound apology by the EIC. We felt that despite this technical hiccup and editorial faux pas,

equivalent to a small bump hit on the submission road, our submission was in honest hands.

WJST: Submission to publication a smooth process

Peer review, editorial feedback, reviews, and proof processing were completed quickly, and efficiently, all within approximately one month. The journal even accommodated our request to change the position of the table from within the text to the end of the text, given its size, showing fair and rational editorial policies that could take into account, to a limited extent, authors' requests. The accepted and published paper (Teixeira da Silva et al., 2017b) was only published online once two additional rounds of proofs had been approved by all authors, solidifying the notion that editorial oversight and responsibility in WJST was solid. This editorial handling, as well as transparency regarding all submission-related steps, including editorial mistakes, led us to believe that we were not dealing with a POAJ.

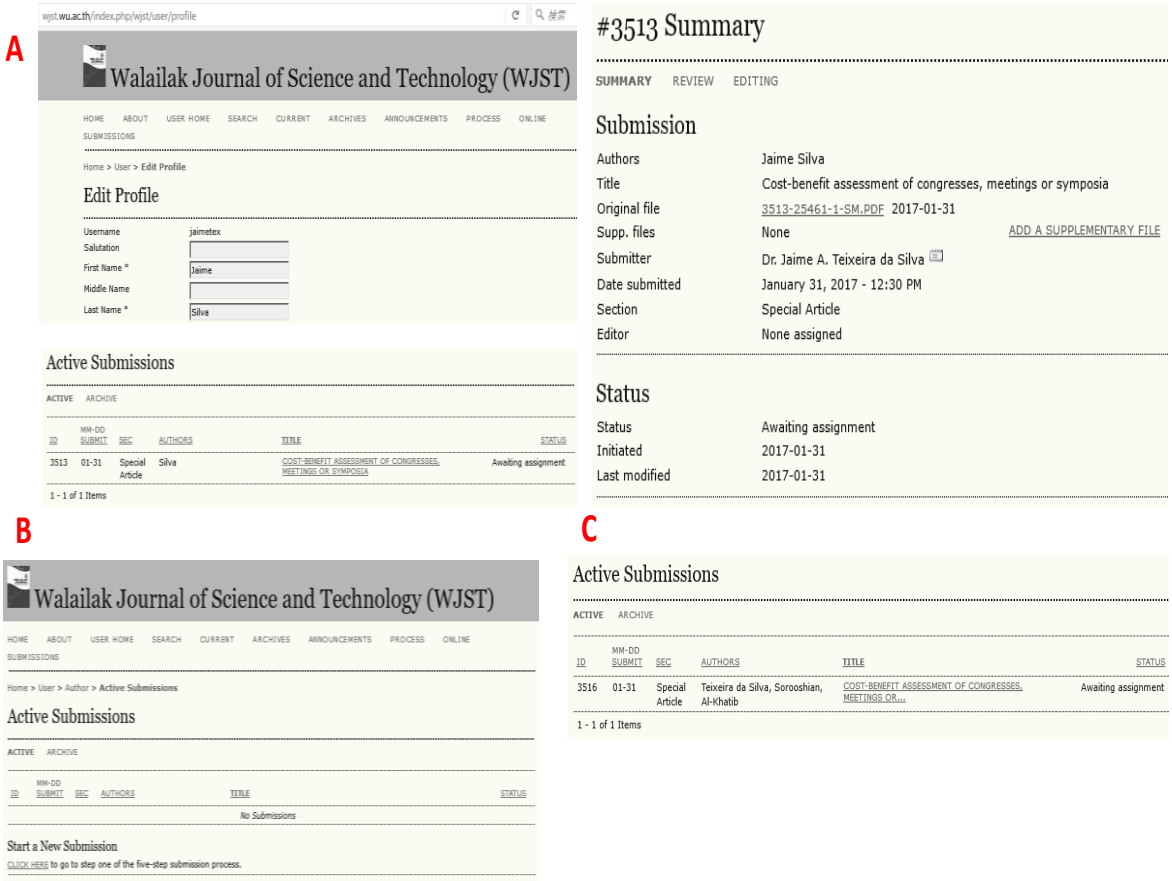

Fig. 2. Unethical Actions by the Editor-in-Chief of The Walailak Journal of Science and Technology
Notes: The Walailak Journal of Science and Technology (WJST) (http://wjst.wu.ac.th/index.php/wjst) Editor-in-Chief created an online submission account without permission, and included incorrect information (name) and incomplete information (only one of three authors listed) (A), submitting my paper for me as #3513, making the creation of this account and submission ethically suspect. The account was created by WJST on January 31, 2017. Within 24 hours, the submission had been erased (B). On the same day, February 1, 2017, I changed the account details and resubmitted the manuscript, which was assigned a new number #3516 (C). Screenshots of any proprietary material used under academic fair use (Teixeira da Silva, 2015d).

A suspect paper detected in WJST: Birth of a potential black swan event

The special issue on plant sciences published just prior to the special issue in which our paper appeared caught my attention. While browsing the articles, I came across one paper by Velu et al. (2017). Three possible red flags with that paper caught my eye: a) the vast majority of references

were old, with only three references out of a total of 24 being newer than 2010, and none from 2014-2017; b) the name of the middle author (of three), Wolfgang Reuter, was unfamiliar, even though he was listed at a premier German research institute, the Max-Planck Institute for Biochemistry; c) there was an apparent error or possible manipulation of Figure 1B vs Figure 1C in the Velu et al. paper (Figure 3). These were red flags for the following reasons: a) an old data set may reflect a recycled data set; b) no author by that name could be found at the institutional website (Max Planck Institute of Biochemistry), raising concerns of possible guest or ghost authorship (Teixeira da Silva, Dobránszki, 2016), or possibly even false authorship (Teixeira da Silva, 2017c); c) it was important to access the original data of the purportedly manipulated figure to see if the figure had been manipulated, or if the two photos were truly different figures. Since the paper was recent at that time (2017), the authors would surely have the data to support their claims and counter the challenge.

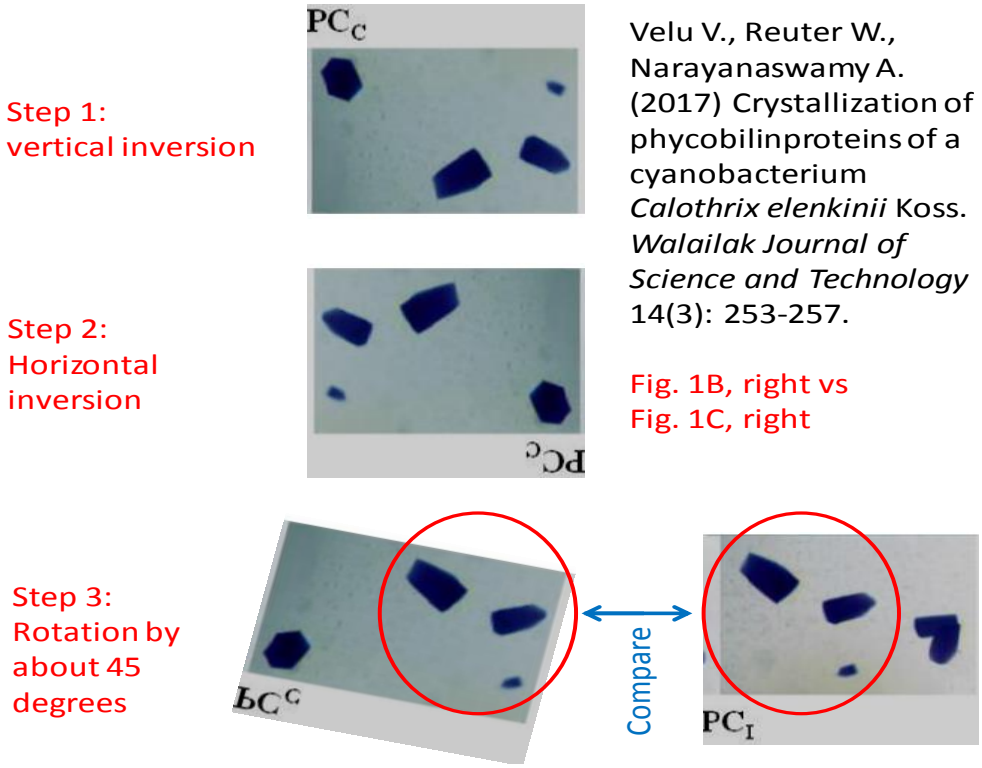

Fig. 3. Analysis of Fig. 1B vs 1C from Velu et al. (2017), showing possible figure duplication and manipulation to represent different treatments
Notes: Screenshots of any proprietary material used under academic fair use (Teixeira da Silva, 2015d). The copyright or open access licensing policies at WJST are not specified.

These concerns could not be posted anonymously to a whistle-blower website PubPeer (The PubPeer database) since WJST papers do not carry a digital object identifier (DOI), and because WJST is not indexed on PubMed, so papers do not have a PMID, which allows for linking to PubPeer. Consequently, the paper could also not be discussed on PubMed Commons, another post-publication peer review platform (Teixeira da Silva et al., 2017a) that was shuttered (Teixeira da Silva, 2018b; Dolgin, 2018). So, the only available option possible was to contact the authors, and copy the editor, to express these concerns. The email of the last author was found, but no email was found for the German author, Wolfgang Reuter. The corresponding author, Dr. Velu, was contacted on February 22, 2017. Three days later, the EIC sent the following request to the authors: "*Please response to the inquiry. It will let the journal to determine whether the errata or retraction is needed.*" After one more reminder from the EIC, the first author responded, as follows, on March 2, 2017 (verbatim, errors uncorrected):

"1. *Regarding my publication in Plant science (Velu et al., 2017).*

2. This work is my Ph.d work which i did in max plank institute Germany Munich.

3. About Wolfgang Reuter he has retired from his work during 2004 itself, he guided my work. No contact with him now, since now Iam in India.

4. If you give your quire in detail about this matter, if possible ill give explanation for you."

The EIC, clearly caught off-guard with this situation, and also clearly unclear of how to deal with such a situation, stated (verbatim, errors uncorrected), in an email to me: "*From the author's reply, it mean that the paper is submitted and published without a consent of one listed author. This sloppiness is directly my fault since I ran the background check the validity of persons and institutions myself. From now on the journal impose the email acknowledgement from all authors. If you have any suggestion how to deal with this particular paper, please do so.*" This indicated that the journal had no prior experience with this type of situation.

On March 3, 2017, I indicated to the EIC that the paper should be retracted, because I felt that it had violated several key WJST ethical requirements or clauses for authors (Editorial Policies), as follows:

a) violation of "*all co-authors have seen and approved the final version of the paper and have agreed to its submission for publication.*"

b) violation of "*Authors are asked to provide the raw data in connection with a paper for editorial review, and should be prepared to provide public access if practicable, and should in any event be prepared to retain such data for a reasonable time after publication.*"

c) Author 3 did not respond.

d) The corresponding author failed to offer any plausible explanation for what appeared to be a figure duplication and manipulation to represent two completely different treatments (Figure 3).

On March 5, 2017, the EIC wrote to the author, with a decision to retract the paper: "Dear Dr Vijaya Velu, Your reply means that the paper is submitted and revised without the consent of one listed author. Moreover, the figure in question is not clarified. As an editor-in-chief of Walailak J Sci & Tech, I decide that tour paper will be retracted. C Sirisathitkul, Walailak Journal of Science and Technology."

This was the first-ever recorded retraction for WJST, a highly unexpected event – the black swan event (Taleb, 2010) in publishing (Teixeira da Silva, 2015a) – in what had been perceived as a perfectly flawless OAJ with an impeccable publishing record.

WJST black swan event: Lessons learned, and the way forward

The discovery of a highly improbable event in an otherwise to-date impeccable publishing record of the WJST, which started to publish as an OAJ in 2004, indicates that not all might be well with the editorial process at WJST, as was even expressed by the EIC himself. The WJST does not have a DOAJ green tick or a seal of quality (DOAJ Seal…), most likely because it does not assign DOIs to articles, and possibly for other reasons (see red cross over DOAJ "quality" symbols in Fig. 1A).

So, within the space of a single submission, two main aspects of concern were discovered:

1) Editor-created online submission accounts exist, or are created, without informing authors, or without seeking their approval prior to the creation of those accounts;

2) Peer review is fallible and, in just a sample size of one paper, authorship and figure integrity issues were discovered, leading to a retraction, which is a sign of failure, by the journal, the editors, and the authors (Teixeira da Silva, 2016b). The notion that traditional peer review is imperfect is now a well-established fact (Teixeira da Silva, Dobránszki, 2015).

However, also within the space of this submission, several positive aspects were discovered:

1) The EIC was highly communicative, responsive, and responsible, not only correcting errors that had been pointed out within the space of hours or days, but admitting openly to his errors, but correcting them. This is highly courageous and commended academic behavior, which shows that the journal's leadership is in good hands. It also shows commendable editorial transparency (Teixeira da Silva and Dobránszki, 2018).

2) The EIC was willing to soil the journal's impeccable publishing record by publishing a retraction, based on credible evidence of ethical misconduct, but also recognizing the journal's failures, thus marking a black swan event for WJST.

3) In the highly volatile world of OA publishing, especially now that there are a much higher number of competing positive and negative forces and competition than 5 or 10 years ago,

all things considered, the actions of the WJST and its editorial leadership constitute a positive development. These actions would bode well for a positive future of WJST if it remains on this path of honest, but painful, reform, that must now involve a deep level of post-publication peer review (Teixeira da Silva, 2015b) that analyzes the website for predatory aspects, and that examines, in detail, the published literature, for flawed academic papers, errors, or fraud. Initially, the response may be extremely negative, as occurred with the *Archives of Biological Sciences*, a Serbian OAJ that was caught with a highly fraudulent editorial leadership that was subsequently sacked *en masse*, replaced by an entirely new editorial board, including a new EIC, followed by an intense post-publication peer review period that is still incomplete, but leading to at least 20 retractions and errata within the space of just a few months (Teixeira da Silva, 2015c).

Velu et al. (2017) was retracted from WJST on May 8, 2017 (Walailak Journal of Science and Technology), just over two months after the decision by the EIC to retract the paper. The retracted paper was watermarked with a red "RETRACTED" across every page, the retraction notice was clear, explanatory, and apologetic. The EIC further indicated that a post-publication peer review had been conducted, stating: "The journal is more thorough with the e-mail addressess [sic] of co-authors and suggested reviewers. We also inspect the materials already publish before in the back issues." WJST needs to specify its copyright or licensing policies, as the website and each PDF file do not indicate the license clearly, e.g., is use of OA papers under a CC-BY-4.0 license?

The DOAJ is increasingly being viewed as an OA "whitelist", and even though it is an OASPA member (OASPA), several entries in the DOAJ list have been discovered with questionable publishing practices, calling into question the validity of the DOAJ lists (Does the DOAJ…, 2017; Teixeira da Silva et al., 2018).

3. Conclusion

Other potential black swan events: Concluding remarks

The discovery of literature in a journal that is erroneous is not necessarily a negative aspect. The publishing status quo generally associates a good academic journal with an error-free academic journal. However, since perfection is impossible to achieve, even among the most highly ranked journals, a perfect, error-free journal is also a myth. The realization that errors need to be corrected, and that some of those errors are "fatal", leading to retractions, for a multitude of reasons, is simply a maturing aspect of the publishing process that authors, journals, editors, and publishers must learn to accept and live with. In that sense, WJST is not a unique black swan event, or maybe not even a unique event any longer, as retractions rise. Two prominent journals, *Annals of Mathematics* (Retraction Watch) and *Nature Chemistry* (Retraction Watch), also experienced their first retractions, in essence denting their perfect publishing records, fortifying the notion that the literature is indeed imperfect. It is still unclear if the middle author of the Velu et al. (2017) paper, Wolfgang Reuter, is retired, or deceased, but such an unclear status of authors leaves them and their co-authors with a very challenging situation if their status is deceased (Teixeira da Silva, Dobránszki, 2015b), especially since there has been a spike in the militancy of the entire publication process (Teixeira da Silva, 2016c).

4. Limitations

This paper describes, in some detail, the trials and tribulations encountered by a not-so-well-known OA journal that indexed on perceived safe-to-publish-in whitelists like the DOAJ, but that, despite more than 12 years of publishing experience, still managed to make fundamental editorial flaws during manuscript processing, emphasizing that experience does not imply flawlessness. The single case (WJST) may be the tip of the iceberg of the discovery of flaws and fraud within indexed and traditionally whitelisted (e.g., in DOAJ, Scopus, Web of Science, PubMed, etc.) OA and non-OA journals. Since a black swan event is usually described as a highly improbable event (Taleb, 2010), but "first retractions" are on the rise, they may no longer be considered as such. Only a meta-analysis of "first retractions", and the timing of those retractions would be able to offer greater insight into the black swan status of such events.

5. Conflicts of interest

The author has commented on and has been profiled on, PubPeer and Retraction Watch, which were mentioned in this paper. The author was involved in exposing editorial fraud at the *Archives of Biological Sciences*. The author declares no additional conflicts of interest.

References

Beall, 2017 – *Beall, J.* (2017). What I learned from predatory publishers. *Biochemia Medica*. 27(2): 273-279. DOI: https://doi.org/10.11613/BM.2017.029

Directory of Open Access Journals, 2014 – Directory of Open Access Journals. (2014). DOAJ publishes lists of journals removed and added. [Electronic resource]. URL: https://doajournals.wordpress.com/2014/05/22/doaj-publishes-lists-of-journals-removed-and-added/ (date of access: May 9, 2021)

DOAJ Seal – DOAJ Seal is now live on the site. [Electronic resource]. URL: https://blog.doaj.org/2015/06/11/doaj-seal-is-now-live-on-the-site/

Does the DOAJ..., 2017 – Does the DOAJ list include problematic open access journals? [Electronic resource]. URL: https://www.researchgate.net/post/Does_the_DOAJ_list_include_problematic_open_access_journals

Dolgin, 2018 – *Dolgin, E.* (2018). PubMed Commons closes its doors to comments. [Electronic resource]. URL: https://www.nature.com/articles/d41586-018-01591-4

Editorial Policies – Editorial Policies. [Electronic resource]. URL: https://wjst.wu.ac.th/index.php/wjst/about/editorialPolicies#custom-3

Green, 2017 – *Green, T.* (2017). We've failed: Pirate black open access is trumping green and gold and we must change our approach. *Learned Publishing*. 30(4): 325-329. DOI: https://doi.org/10.1002/leap.1116

Grudniewicz et al., 2019 – *Grudniewicz, A., Moher, D., Cobey, K.D., Bryson, G.L., Cukier, S., Allen, K., ... Lalu, M.M.* (2019). Predatory journals: no definition, no defence. *Nature*. 576(7786): 210-212. DOI: https://doi.org/10.1038/d41586-019-03759-y

Kimotho, 2019 – *Kimotho, S.G.* (2019). The storm around Beall's list: a review of issues raised by Beall's critics over his criteria of identifying predatory journals and publishers. *African Research Review*. 13(2): 1-11. DOI: https://doi.org/10.4314/afrrev.v13i2.1

Max Planck Institute of Biochemistry – Max Planck Institute of Biochemistry. [Electronic resource]. URL: https://www.mpg.de/biochem-en

OASPA – Open Access Scholarly Publishing Association (OASPA). [Electronic resource]. URL: https://oaspa.org/membership/members/

Retraction Watch – Retraction Watch. [Electronic resource]. URL: https://retractionwatch.com/2017/07/12/author-shocked-top-math-journal-retracts-paper/ URL: https://retractionwatch.com/2017/07/13/nature-chemistry-issues-first-retraction/

Taleb, 2010 – *Taleb, N.N.* (2010). The Black Swan: The impact of the highly improbable (2nd ed.). London: Penguin. 366 pp.

Teixeira da Silva et al., 2017a – *Teixeira da Silva, J.A., Dobránszki, J., Al-Khatib, A.* (2017). Fortifying the corrective nature of post-publication peer review: Identifying weakness, use of journal clubs, and rewarding conscientious behavior. *Science and Engineering Ethics*. 23(4): 1213-1226. DOI: https://doi.org/10.1007/s11948-016-9854-2

Teixeira da Silva et al., 2017b – *Teixeira da Silva, J.A., Sorooshian, S., Al-Khatib, A.* (2017). Cost-benefit assessment of congresses, meetings or symposia, and selection criteria to determine if they are predatory. *Walailak Journal of Science and Technology*. 14(4): 259-265.

Teixeira da Silva et al., 2018 – *Teixeira da Silva, J.A., Dobránszki, J., Al-Khatib, A., Tsigaris, P.* (2018). Challenges facing the DOAJ (Directory of Open Access Journals) as a reliable source of open access publishing venues. *Journal of Educational Media & Library Sciences*. 55(3): 349-358. DOI: https://doi.org/10.6120/JoEMLS.201811_55(3).e001.BC.BE

Teixeira da Silva, 2013 – *Teixeira da Silva, J.A.* (2013). Predatory publishing: A quantitative assessment, the Predatory Score. *The Asian and Australasian Journal of Plant Science and Biotechnology*. 7(Special Issue 1): 21-34.

Teixeira da Silva, 2015a – *Teixeira da Silva, J.A.* (2015). The "black swan" phenomenon in science publishing. *Journal of Educational and Social Research*. 5(3): 11-12. DOI:

https://doi.org/10.5901/jesr.2015.v5n3p11

Teixeira da Silva, 2015b – *Teixeira da Silva, J.A.* (2015). Debunking post-publication peer review. *International Journal of Education and Information Technology (Public Science Framework)*. 1(2): 34-37.

Teixeira da Silva, 2015c – *Teixeira da Silva, J.A.* (2015). Archives of Biological Sciences: from falling star to glimmer of hope. *Self-published* 8 pages. [Electronic resource]. URL: https://www.researchgate.net/publication/282366831

Teixeira da Silva, 2015d – *Teixeira da Silva, J.A.* (2015). Fair use in post-publication peer review. *Journal of Educational and Social Research*. 5(3): 13. DOI: https://doi.org/10.5901/jesr.2015.v5n3p13

Teixeira da Silva, 2016a – *Teixeira da Silva, J.A.* (2016). On the abuse of online submission systems, fake peer reviews and editor-created accounts. *Persona y Bioética*. 20(2): 151-158. DOI: https://doi.org/10.5294/PEBI.2016.20.2.3

Teixeira da Silva, 2016b – *Teixeira da Silva, J.A.* (2016). Retractions represent failure. *Journal of Educational and Social Research*. 6(3): 11-12. DOI: https://doi.org/10.5901/jesr.2016.v6n3p11

Teixeira da Silva, 2016c – *Teixeira da Silva, J.A.* (2016). The militarization of science, and subsequent criminalization of scientists. *Journal of Interdisciplinary Medicine*. 1(2): 214-215. DOI: https://doi.org/10.1515/jim-2016-0031

Teixeira da Silva, 2017a – Teixeira da Silva, J.A. (2017a). Caution with the continued use of Jeffrey Beall's "predatory" open access publishing lists. *AME Medical Journal*. *2*: 97. URL: https://doi.org/10.21037/amj.2017.06.14

Teixeira da Silva, 2017b – *Teixeira da Silva, J.A.* (2017b. Jeffrey Beall's "predatory" lists must not be used: They are biased, flawed, opaque and inaccurate. *Bibliothecae.it*. *6*(1): 425-436. DOI: https://doi.org/10.6092/issn.2283-9364/7044

Teixeira da Silva, 2017c – *Teixeira da Silva, J.A.* (2017). Fake peer reviews, fake identities, fake accounts, fake data: Beware! *AME Medical Journal*. 2: 28. DOI: https://doi.org/10.21037/amj.2017.02.10

Teixeira da Silva, 2018a – *Teixeira da Silva, J.A.* (2018). The illicit and illegitimate continued use of Jeffrey Beall's "predatory" open access black lists. *Journal of Radical Librarianship*. 4: 1-5.

Teixeira da Silva, 2018b – *Teixeira da Silva, J.A.* (2018). PubMed Commons closure: a step back in post-publication peer review. *AME Medical Journal*. *3*: 30. DOI: https://doi.org/10.21037/amj.2018.02.07

Teixeira da Silva, 2020a – *Teixeira da Silva, J.A.* (2020). Is there a clear division between predatory and low-quality journals and publishers? *Journal of the Royal College of Physicians of Edinburgh*. 50(4): 458-459. DOI: https://doi.org/10.4997/JRCPE.2020.303

Teixeira da Silva, 2020b – *Teixeira da Silva, J.A.* (2020). The ethical and academic implications of the Jeffrey Beall (www.scholarlyoa.com) blog shutdown. *Science and Engineering Ethics*. 26(6): 3465-3467. DOI: https://doi.org/10.1007/s11948-017-9905-3

Teixeira da Silva, 2020c – *Teixeira da Silva, J.A.* (2020). CiteScore: advances, evolution, applications, and limitations. *Publishing Research Quarterly*. 36(3): 459-468. DOI: https://doi.org/10.1007/s12109-020-09736-y

Teixeira da Silva, 2021a – *Teixeira da Silva, J.A.* (2021). What is a legitimate, low-quality, or predatory surgery journal? *Indian Journal of Surgery* (in press).

Teixeira da Silva, 2021b - *Teixeira da Silva, J.A.* (2021b). COVID-19 research and publishing: Advance ambitiously, but cautiously, in 2021. *Indian Journal of Science and Technology*. *14*(10): 892-896. https://doi.org/10.17485/IJST/v14i10.92

Teixeira da Silva, Dobránszki, 2015a - *Teixeira da Silva, J.A., Dobránszki, J.* (2015a). Problems with traditional science publishing and finding a wider niche for post-publication peer review. *Accountability in Research: Policies and Quality Assurance*. *22*(1): 22-40. URL: https://doi.org/10.1080/08989621.2014.899909

Teixeira da Silva, Dobránszki, 2015b - *Teixeira da Silva, J.A., Dobránszki, J.* (2015b). The authorship of deceased scientists and their posthumous responsibilities. *Science Editor*. *(CSE)*. *38*(3/4): 98-100.

Teixeira da Silva, Dobránszki, 2016 - *Teixeira da Silva, J.A., Dobránszki, J.* (2016). Multiple authorship in scientific manuscripts: ethical challenges, ghost and guest/gift authorship, and the

cultural/disciplinary perspective. *Science and Engineering Ethics*. *22*(5): 1457-1472. URL: https://doi.org/10.1007/s11948-015-9716-3

Teixeira da Silva, Dobránszki, 2018 – *Teixeira da Silva, J.A., Dobránszki, J.* (2018). Editors moving forward: stick to academic basics, maximize transparency and respect, and enforce the rules. *Recenti Progressi in Medicina*. 109(5): 263-266. DOI: https://doi.org/10.1701/2902.29244

Tennant et al., 2019 – *Tennant, J.P., Crane, H., Crick, T., Davila, J., Enkhbayar, A., Havemann, J., … Vanholsbeeck, M.* (2019). Ten hot topics around scholarly publishing. *Publications*. 7(2): 34. DOI: https://doi.org/10.3390/publications7020034

The Conversation – The Conversation. [Electronic resource]. URL: https://theconversation.com/increasing-open-access-publications-serves-publishers-commercial-interests-116328

The PubPeer database – The PubPeer database. [Electronic resource]. URL: https://pubpeer.com

Velu et al., 2017 – *Velu, V., Reuter W., Narayanaswamy A.* (2017). Crystallization of phycobilinproteins of a cyanobacterium *Calothrix elenkinii* Koss. *Walailak Journal of Science and Technology*. 14(3): 253-257; Retraction: 14(6): 547.

Walailak Journal of Science and Technology – Walailak Journal of Science and Technology [Electronic resource]. URL: https://wjst.wu.ac.th/index.php/wjst/article/view/3898

Wallach et al., 2018 – *Wallach, J.D., Boyack, K.W., Ioannidis, J.P.A.* (2018). Reproducible research practices, transparency, and open access data in the biomedical literature, 2015–2017. *PLoS Biology*. 16(11): e2006930. DOI: https://doi.org/10.1371/journal.pbio.2006930

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Exploring the Critical Determinants of Market Orientation of Cocoa Farmers in Ghana

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Abstract

Despite the impressive strides made in the cocoa sector, it is still faced with decent deficits. The study was therefore aimed at determining the factors that influence the market orientation of cocoa farmers in Ghana. The factors considered in this study were entrepreneurial proclivity, innovation factors, socio-economic factors and farm characteristics. With a descriptive survey design, 370 cocoa farmers were selected. Data collected was analysed using inferential statistics (ordinal logistic regression model). The results found that entrepreneurial proclivity, the innovation characteristics of the farmer business school, farmer characteristics (gender, age, tribe, religion) and farm characteristics (farm size, yield, source of labour and training of workers) were the factors that influenced the market orientation of cocoa farmers. A revision of the farmer business school is essential for growth in the cocoa sector. The study provides empirical information for considering the various factors that influence the market orientation of cocoa farmers in Ghana. These factors are critical in ensuring that the Farmer business school which was introduced in Ghana can be sustainable.

Keywords: Agricultural Extension, Cocoa Management, Farmer Business School, Innovation Development, Rural Development.

1. Introduction

Many scholars, practitioners and academics have recognised the role market orientation play in contemporary marketing and business activities. They see it as a way of enhancing competitive advantage and dominance for superior performance of organisations. This is enhanced by the tastes and preferences of consumers, advances in technological activities and the capacity for enhanced market opportunities (Achrol, Kotler, 1999). Organisations are expected to expect, regulate and provide customer fulfilment to their set markets, be up-to-date with emerging market trends, monitor the actions of their opponents and amend their products, services and administrative structures and operate efficient and effective resources than their competitors. This can only be achieved by the active engagement of market orientation (Kohli, Jaworski, 1990). Market-oriented firms are very much educated about their target markets and can utilize the information they have at their disposal to make an unrivalled incentive for their clients (Slater, Narver, 1995).

Kohli and Jaworski (1990) defined market orientation as the organisation-wide age of market insight relating to current and future client needs, the spread of the knowledge across divisions,

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and association-wide responsiveness to it. It is the degree of allocation of resources to the production of agricultural products that are meant for sale. According to Harris (2002) and Deshpande and Webster (1989), the general concept of market orientation is that it connects the organisation to its operational environment by gathering market information and spreading it inside the organisation with the sole purpose of creating superior value. According to Kotler (2003), organisations that operate according to the dictates of market orientation create maximum profits through their customer satisfaction strategies, competitive strategies and access to timely and superior information. This explains the reason some firms can achieve better performance outputs over those who compete with them (Van Raaij, Stoelhorst, 2008).

Market orientation has been the subject of many studies. Many have focussed on measuring the market orientation of manufacturing companies or corporate bodies and how it influences their performance and productivity (Agarwal et al., 2003). Very few have focussed on the determining factors of market orientation. This study belongs to the latter category which focuses on significant characteristics, or the factors associated with the market orientation of cocoa farmers. Such knowledge is important because it can be used to formulate specific policies and/or target specific groups of producers to promote this concept in the cocoa industry, especially in Ghana. There is no specific agreement in the literature as to what specific factors influence market orientation. However, four general categories of factors that influence the market orientation of cocoa farmers have been posited. These particularly fit the context of marketing of cocoa products in Ghana; the characteristics of the innovation (farmer business school) in question, the characteristics of the farmer, the farm characteristics and entrepreneurial proclivity.

The theory of adoption of innovation by Rogers (2003) visualizes the entry points for potential adopters and the diverse reactions of farmers vis-à-vis the innovation and it could be a way of explaining the issues that influence market orientation. This is because the cocoa farmers were introduced to a set of ideas within the Farmer business school module. Their use of the practices is expected to help them become more market-oriented. As such, the theory helps to clarify the fact that not all cocoa farmers can adopt the market orientation principles at the same time as well as not every cocoa farmer might even find the farmer business school programme worth adopting. Therefore, the factors that influence the market orientation of cocoa farmers are of great concern to all; cocoa farmers, extension organisations, policymakers, researchers etc.

The following objectives were set for the study;

1. To determine the extent to which entrepreneurial proclivity influences the market orientation of cocoa farmers in Ghana.
2. To determine the innovation factors that influence the market orientation of cocoa farmers in Ghana.
3. To determine the socio-economic factors that influence the market orientation of cocoa farmers in Ghana.
4. To determine the farm characteristics that influence the market orientation of cocoa farmers in Ghana.

2. Materials and methods

For this study, the area of interest was Ghana but with a specific focus on the six Cocoa Regions. The study population consisted of all cocoa farmers in the country. According to the report of the Ghana Statistical Service (2014), the number of cocoa farmers is estimated at 350,000. In total, 600 cocoa farmers were sampled from all the six Cocoa Regions in Ghana; Ashanti (100 respondents), Brong Ahafo (100 respondents), Central (100 respondents), Eastern (100 respondents), Volta (50 respondents) and Western (150 respondents). The multi-stage sampling technique was employed to select the cocoa farmers. The first stage involved the selection of Cocoa Districts. Two districts from each of the regions except for Western Region (3) and Volta Region (1) making a total of 10 districts were selected using the simple random sampling technique. Out of each district, three communities were selected through the simple random sampling technique. The final stage involved the simple random selection of the cocoa farmers to make up the sample size of 600 farmers. Questionnaires were the research instruments used for the collection of data. Data collected was analysed using inferential statistics (ordinal logistic regression model).

In this study, market orientation was operationalised as a function of six indicators; cocoa farmers' customer orientation, competitor orientation, inter-functional co-ordination (Narver, Slater, 1990; Slater, Narver 1994), intelligence generation, intelligence dissemination and market responsiveness (Jaworski, Kohli, 1993; Narver, Slater, 1990). Adopting the scales used by different authors such as Narver and Slater (1990), Slater and Narver (1994) and Jaworski and Kohli (1993), the following scales were used: 1=low; 2=moderate; 3=high to determine the level of market orientation of the cocoa farmers.

To determine the factors influencing the market orientation of cocoa farmers, the ordinal logistic regression model was used to describe and explain the relationship between the dependent nominal variable (level of market orientation - Y) and the continuous independent variables (innovation characteristics, entrepreneurial proclivity, farmer characteristics, farm characteristics- X_1, X_2, X_3, X_4).

The explicit form of the function is specified as follows;

$Y= \beta_0+ \beta_1X_1+\beta_2X_2+\beta_3X_3+\beta_4X_4+e$.

β = The coefficient of the parameters.

e = The error term.

Y= Dependent variable as defined (Likert scale=1-low, 2-moderate, 3-high.

Xi = A vector of explanatory variables (innovation characteristics) for participant cocoa farmer defined, X_i=Compatibility [1 (very low)-5 (very high)], X_{ii}=Complexity [1 (very low)-5 (very high)], X_{iii}= Observability [1 (very low)-5 (very high)], X_{iv}= Trialability [1 (very low)-5 (very high)], X_v= Relative Advantage [1 (very low)-5 (very high)].

X_2 = A vector of explanatory variables (entrepreneurial proclivity) for farmer, X_i=Innovativeness [1 (very low)-5 (very high)], X_{ii}= Risk taking [1 (very low)-5 (very high)], X_{iii}=Risk taking [1 (very low)-5 (very high)].

X_3 = A vector of explanatory variables (farm characteristics) for farmer defined, X_i= Training (Yes=1, No=0), X_{ii}= Farm Size (1=low, 2=medium, 3=high), X_{iii}= Age of Farm (1=0-7years, 2=8-30years, 3=>30years), X_{iv}= Farm Labour (Paid=1, Unpaid=0), X_v= Land Tenure (Outright purchase=1, Others=0), X_{vi}= Farm Registration (Yes=1, No=0), X_{vii}= Farm Credit (Yes=1, No=0).

X_4 = A vector of explanatory variables (farmer characteristics) for farmer as defined, X_i= Age (1= < 40 years, 2=50-60 years, 3= > 60 years), X_{ii}= Gender (Male=1, Female=0), X_{iii}= Farming Experience (1=1-10years, 2=11-20years, 3=21-30years, 4=31-40years, 5=Above 40years), X_{iv}= Educational Level of Farmers (1=Formal Education, 0=No Formal Education), X_v= Marital Status (1=Married, 0=Single), X_{vi}= Household Size (1=1-5, 2=6-10, 3=11-15, 4=16-20), X_{vii}= Off-farm Income of Farmers (Yes=1, No=0), X_{viii}= Ethnicity (Akan=1, Migrant=0), X_{xi}= Religion (Christian=1, Others=0), X_{xii}= Use of Mobile phone (Yes=1, No=0), X_{xiii}= Farmer Group (Yes=1, No=0), X_{xiv}= Leadership Position (Yes=1, No=0), X_{xv}= Status (Indigene=1, Migrant=0); X_{xvi}= Farm size (1=4.4ha, 2=4.4-8ha, 3=>8ha).

3. Results and discussion

Table 1 describes the ordinal logistic regression model that was used to test the factors that influence market orientation.

Table 1. Model Fitting Information

Model	-2 Log Likelihood	Chi-Square	df	Sig.
Intercept Only	2173.657			
Final	1945.812	227.85	110	0.00

Source: Field Data
Link function: Logit

In Table 1, an ordinal logistic regression was conducted to test for the factors that influence the market orientation of cocoa farmers. The results ($p < 0.05$) indicate that it is statistically significant. This means that there are factors that significantly influence the market orientation of cocoa farmers. Table 2 describes the parameter estimates of the ordinal logistic regression.

Table 2. Parameter Estimates

	Estimate	Std. Error	Wald	df	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Market Orientation=3	9.26	4.07	5.17	1	0.02	1.28	17.25
Entrepreneurial Proclivity=3	0.81	0.34	5.57	1	0.02	0.14	1.48
Innovation=2	-4.58	2.38	3.70	1	0.04	-9.25	0.09
Gender=Male	-0.54	0.24	4.96	1	0.03	-1.02	-0.07
Age=Adults	1.27	0.56	5.16	1	0.02	0.18	2.37
Tribe=Akans	-0.61	0.27	5.18	1	0.02	-1.13	-0.09
Religion=Christian	0.58	0.28	4.29	1	0.04	0.03	1.12
Farm Size=Low	-3.39	0.90	14.07	1	0.00	-5.16	-1.62
Farm Size=Mod	-3.01	0.97	9.57	1	0.00	-4.91	-1.10
Participation=1	0.43	0.27	5.82	1	0.01	0.25	1.32
Yield=1	1.47	0.70	4.46	1	0.04	0.11	2.85
Yield=2	1.54	0.61	6.41	1	0.01	0.35	2.73
Yield=3	2.54	0.60	17.94	1	0.00	1.37	3.72
Yield=4	2.29	0.59	15.02	1	0.00	1.13	3.44
Yield=5	1.59	0.63	6.27	1	0.01	0.34	2.83
Labour=1	0.70	0.26	7.26	1	0.01	0.19	1.21
Training=1	-1.86	0.31	35.37	1	0.00	-2.47	-1.25

Source: author's construct

Table 2 represents the statistic of the significant parameters used in the measurement. The results show that entrepreneurial proclivity, innovation characteristics, gender, age, tribe, religion, farm size, participation in the farmer business school, yield, source of labour and training of workers were statistically significant ($p < 0.05$). Thus, they are significant predictors of the market orientation of cocoa farmers.

Entrepreneurial Proclivity and Market Orientation

The results show that entrepreneurial proclivity was significant ($p < 0.05$) as a factor in influencing the market orientation of cocoa farmers. It was found that a moderate level [and beyond] of entrepreneurial proclivity influences the market orientation of cocoa farmers. This result is confirmed in a study by Acheampong (2012) who found a positive relationship between entrepreneurial proclivity and market orientation. An entrepreneurial cocoa farmer can display three major characteristics; innovativeness, pro-activeness and risk-taking. These characteristics help in taking long term decisions that can produce an effective market orientation design (Weerawardena, 2003).

This also means that the cocoa farmers have dynamic objectives whereby they merge inventive intuition to distinguish marketplace opportunities and needs and new open doors with the capacity to oversee, secure assets and adjust to the environment to accomplish desired

outcomes while accepting some segment of danger or risk for the activity. It makes them more proactive than competitors towards new market openings (Wiklund, Shepherd, 2003).

Innovation Characteristics and Market Orientation

The result also shows that the innovation characteristics were significant ($p < 0.05$) as a factor in influencing the market orientation of cocoa farmers. It was found that the farmer business school when perceived at a low level of relative advantage, compatibility, observability, complexity and trialability, is likely to influence the market orientation of the cocoa farmers. The implication is that the farmer business school module needs to be revised to make it fit the context of the country and fully tailored into the market orientation of the cocoa farmers.

On the off chance that market orientation as instructed at the farmer business school is considered as an innovation, the adoption of market orientation standards can be clarified by Rogers (1983). Rogers inferred that the pace of selection of innovation is an element of that innovation's attributes and that people differ notably in their probability of attempting new advancements. Rogers (2003) characterized relative advantage as how much an idea is seen as being better than the thought it supplants. He further showed that it is decidedly associated with the pace of selection of the innovation. Compatibility is how much innovation is seen as consistent with the current qualities and values, past encounters and needs of expected adopters. Consequently, the more noteworthy the similarity with the felt needs, the more prominent the dispersion or diffusion rate (Mndzebele, 2013).

Complexity characterizes the degree to which advancement can be considered generally hard to comprehend and utilize, for example, ease of use (Rogers, 2003). Pulendran et al. (2000) asserted that the absence of usability of innovation negatively affects the perception of the innovation which leads to a decrease in adoption. Rogers (2003) characterized observability as how much the consequences of advancement are visible to other people. As indicated by Rogers (2003), trialability is how much an innovation might be explored on a limited basis. It additionally portrays how effectively potential adopters can investigate an innovation. Potential cocoa farmers would need to perceive what the innovation can do and give it a try before focusing on it.

Farmer Characteristics and Market Orientation

It is generally agreed that the personal characteristics of farmers can influence their decision to make use of an innovation as the best course of action available or the decision that individuals make each time they consider taking up an innovation (Chand et al., 2011). Therefore, an understanding of personal characteristics that influence innovation adoption and integration is relevant.

Gender was found as a significant ($p < 0.05$) factor in influencing the market orientation of cocoa farmers. It was found that the male cocoa farmers were likely to be more market-oriented as compared to their female counterparts. Female cocoa farmers can be targeted in programmes aimed at improving the market orientation of cocoa farmers. Using financial knowledge as a proxy for market orientation, Akoto (2015) found that male cocoa farmers were more likely to be knowledgeable than female farmers. Mandell (2008) and Cole and Fernando (2008) also confirmed this assertion. The reason is that men mainly make the household's economic decisions. They are more interested in the issues of finance, personal investment and marketing and so they tend to seek more information about these topics than their female counterparts. This makes the women less financially literate than the men.

The study also found that age was significant ($p < 0.05$) as a factor in influencing the market orientation of cocoa farmers. It was found that the adult cocoa farmers as compared to the youth and the aged were more likely to be more market-oriented. Cole and Fernando (2008) also established a non-linear effect on the financial literacy of farmers. These were peaked at age 40 in India and age 45 in Pakistan. In Akoto (2015), the age of cocoa farmers was also explored as an important factor in predicting the likelihood of farmers' literacy. These results contradict the work of Worthinton (2004) who found that among the Australians, those aged between 50 to 60 years are less likely to be financially literate.

The results show that tribe was significant ($p < 0.05$) as a factor in influencing the market orientation of cocoa farmers. It was found that the Akans who formed the majority of the respondents were found to be more likely to be market-oriented than those from the other tribes.

Lusardi and Mitchell (2006) also argued that a person's race or tribe is an influential factor in their level of market orientation.

Also, religion was significant ($p < 0.05$) as a factor in influencing the market orientation of cocoa farmers. It was found that the Christians who also formed the majority of the population were more likely to be market-oriented than those from other religions. Since religion has a way of forming the values and behaviours of people, it is expected that individuals who are more attached to their religious persuasions usually have higher motivation to adopt technologies than their counterparts who are not. They tend to be independent in their thoughts and actions. Therefore, there is the possibility of a relationship between religiosity and the innovativeness of an individual. There is a positive relationship for the sample of Jews, Catholics and Protestants selected for a study. However, in Asian countries and especially among Muslim consumers, a negative relationship was found since they were significantly different in terms of ideology and religious philosophy (Sari, 2015). Participation in the Farmer business school was significant ($p < 0.05$) as a factor in influencing the market orientation of cocoa farmers.

Farm Characteristics and Market Orientation

The results show that farm size was significant ($p < 0.05$) as a factor in influencing the market orientation of cocoa farmers. It was found that the cocoa farmers with farm sizes less than 21 acres were more likely to be market-oriented. This means that the cocoa farmers with small farm sizes were more likely to be highly market-oriented. It is rather expected that cocoa farmers with very large sizes of the farm were to be more market-oriented because they worked purposely for business reasons. This is confirmed by Akoto (2015) who indicated that cocoa farmers with farm sizes that are more than 40 acres were more knowledgeable than farmers who had farm sizes of less than 40 acres. However, the reason for subsistent cocoa farmers to be more market-oriented may be that their main concern was to feed their families with the income from their sales, hence, they will be aggressive in searching for ways to improve their productions.

The results show that yield was significant ($p < 0.05$) as a factor in influencing the market orientation of cocoa farmers. It was found that all the levels of yield were significant in influencing the market orientation of the cocoa farmers. With positive estimates, it implies that the higher the yield, the higher the likelihood of the farmers' level of market orientation. The results show that the source of labour was significant ($p < 0.05$) as a factor in influencing the market orientation of cocoa farmers. It was found that the cocoa farmers that paid for labour were more likely to be more market-oriented. Aneani et al. (2012) found that hired labour was significant and had a positive coefficient of 0.023 because it became a tool for intensifying the adoption of cocoa innovations. This was also confirmed by Ben-Houassa (2011) who observed that farms with a larger supply of labour are more likely to also introduce innovations. This is done so far as farmers can allocate sufficient time to implement new technologies and management practices. In addition, there is a greater level of labour specialisation on larger farms, including labour allocated to long-term business development and technological change. Here, labour was measured as the total weeks worked by family and non-family labour (Schneider, 2016).

The training was found to be significant ($p < 0.05$) as a factor in influencing the market orientation of cocoa farmers. It was found that the cocoa farmers that engaged in training activities are more likely to be market-oriented. This goes to emphasize the fact that those who participated in the farmer business school were more likely to be more market-oriented than those who did not. Adult learners usually have little time to learn because they have specific objectives. In their training sessions, they expect huge benefits from such activities, else, they feel they have wasted their time (Talukder, 2012). The difference that training makes is that given two groups of people exposed to the same innovation, the group that has been trained in the usage of the innovation are more likely to adopt than those who were not trained (Kundu, Roy, 2010). This point is reemphasised by Talukder (2012) who asserts that attendance to training programmes promotes greater knowledge and understanding, a favourable attitude and better skills in the use of multiple innovations.

4. Conclusion

Entrepreneurial proclivity, innovation characteristics, gender, age, tribe, religion, farm size, yield, source of labour and training of workers were found to be the factors that influence the

market orientation of cocoa farmers. The study recommends that activities that will enhance the entrepreneurial proclivity and boost the innovative capacity of the cocoa farmers must be promoted by extension agents through the Ghana COCOBOD.

References

Acheampong, 2012 – *Acheampong, L.* (2012). Marketing and consumer behaviour group, how does the environment shape an individual's the market orientation and entrepreneurial proclivity? Master's Thesis. Wageningen, Wageningen University and Research Centre.

Achrol, Kotler, 1999 – *Achrol, R.S., Kotler, P.* (1999). Marketing in the network economy. *Journal of Marketing*. 63(2): 146-163.

Agarwal et al., 2003 – *Agarwal, S., Erramilli, M.K., Dev, C.S.* (2003). Market orientation and performance in service firms: Role of innovation. *Journal of Services Marketing*. 17(1): 68-82.

Akoto, 2015 – *Akoto, G.O.* (2015). An analysis of personal financial literacy among cocoa farmers in Ghana. Master's Thesis. Kwame Nkrumah University of Science and Technology, Kumasi, Ghana.

Aneani et al., 2012 – *Aneani, F., Anchirinah, V.M., Owusu-Ansah, F., Asamoah, M.* (2012). Adoption of some cocoa production technologies by cocoa farmers in Ghana. *Sustainable Agriculture Research*. 1(1): 103.

Ben-Houassa, 2011 – *Ben-Houassa, K.* (2011). Adoption and levels of demand of fertilizer in cocoa farming in Côte d'Ivoire: Does risk aversion matters. CSAE conference, economic development in Africa. Presentation Paper, St Catherine's College, Oxford.

Chand et al., 2011 – *Chand, M., Sharma, D.D., Gupta, R.* (2011). Enhancing the adoption of farm technology – A conceptual model. *Journal of Farm Sciences*. 1(1): 89-95.

Cole, Fernando, 2008 – *Cole, S., Fernando, N.* (2008). Assessing the importance of financial literacy. *ADB Finance for the Poor*. 9(2): 1-6.

Deshpande, Webster, 1989 – *Deshpande, R., Webster, F.E.* (1989). Organizational Culture and Marketing: Defining the Research Agenda, *Journal of Marketing*. 53(1): 3-15.

Harris, 2002 – *Harris, L.C.* (2002). Measuring market orientation: Exploring a market oriented approach. *Journal of Market-Focus Management*. 5: 239-270.

Jaworski, Kohli, 1993 – *Jaworski, B.J., Kohli, A.K.* (1993). Market orientation: Antecedents and consequences. *Journal of Marketing*. 57(3): 53-70.

Kohli, Jaworski, 1990 – *Kohli, A.K., Jaworski, B.J.* (1990). Market orientation: The construct, research propositions, and managerial implications. *Journal of Marketing*. 54: 1-18.

Kundu, Roy, 2010 – *Kundu, A., Roy, D.D.* (2010). A People – Centric approach in adoption of innovation: A review and directions for future research. *Asian Journal of Management Research*. 49-58.

Lusardi, Mitchell, 2006 – *Lusardi, A., Mitchell, O.S.* (2006). Financial Literacy and Planning: Implications for Retirement Wellbeing. MRRC Working Paper, No. 2006-144.

Mandell, 2008 – *Mandell, L.* (2008). Financial education in high school. In A. Lusardi (Ed.)., Overcoming the saving slump: How to Increase the effectiveness of financial education and saving programs (pp. 257-279). Chicago: University of Chicago.

Matsuno, Mentzer, 2000 – *Matsuno, K., Mentzer, J.T.* (2000). The effects of strategy type on the market orientation-performance relationship. *Journal of Marketing*. 64(10): 1-16.

Mndzebele, 2013 – *Mndzebele, N.M.* (2013). Electronic commerce adoption in the hotel industry in South Africa. Presented at the Conference on Applied and Theoretical Information Systems Research, Taipei, Taiwan.

Narver, Slater, 1990 – *Narver, J.C., Slater, S.F.* (1990). The effect of a market orientation on business profitability. *Journal of Marketing*. 54(4): 20-35.

Pulendran et al., 2000 – *Pulendran, S., Speed, R., Widing, R. E.* (2000). The antecedents and consequences of market orientation in Australia. *Australian Journal of Management*. 25(2): 119-144.

Rogers, 2003 – *Rogers, M.E.* (2003). Diffusion of innovations. New York: Free Press.

Sari, 2015 – *Sari, D.K.* (2015). Investigating the reasons Moslems boycott foreign brands. Doctoral Thesis. The University of Western Australia, Australia.

Schneider, 2016 – *Schneider, C.* (2016). Why farmers may, or may not, adopt nitrogen-efficient technologies. Soil Science Society of America.

Slater, Narver, 1994 – *Slater, S.F., Narver, J.C.* (1994). Does Competitive Environment Moderate the Market Orientation-Performance Relationship? *Journal of Marketing*. 58(1): 46-55.

Talukder, 2012 – *Talukder, M.* (2012). Factors affecting the adoption of technological innovation by individual employees: An Australian study. *Procedia-Social and Behavioral Sciences*. 40: 52-57.

Weerawardena, 2003 – *Weerawardena, J.* (2003). Exploring the role of market learning capability in competitive strategy. *European Journal of Marketing*. 37(3/4): 407-429.

Wiklund, Shepherd, 2003 – *Wiklund, J., Shepherd, D.* (2003). Knowledge-based resources, entrepreneurial orientation, and the performance of small and medium-sized businesses. *Strategic Management Journal*. 24(13): 1307-1314.

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Rural Settlement in Gnjili Potok Until the Immigration of Slavs: Geo-Historical Observations

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Abstract

Studies on rural settlements are useful for tourism, research, historical, and educative purposes. Notwithstanding the indisputable global need for studies in the area of rural settlements, little works have been conducted so far. Since Montenegro lags behind most European and even neighboring countries in this respect, we explored rural settlement in Gnjili Potok until the immigration of Slavs using a geographical (spatial) method. Our findings show that the main relics in the field of social life in the considered geo-space were and are still indicative of tribal-brotherhood and family relations. Furthermore, the history rural settlement of Gnjili Potok is not fully explored, so its history, as well as the history of many other rural settlements in Montenegro, cannot be reliably traced until 1744. It is almost certain that the ancient peoples (Illyrians, Celts, Romans) lived in the area of the rural settlement of Gnjilog Potoka and that they were engaged in agriculture and cattle breeding. Therefore, our study contributes to the study of the rural settlement of Gnjili Potok from the aspect of the evolution of the settlement to the immigration of Slavs.

Keywords: Ancient Peoples, Geographical (Spatial) Method, Gnjili Potok, Research, Rural Settlement.

1. Introduction

Homelands occupy an important place in the life of every individual. It is therefore not surprising that the concept of homeland is a very common topic of many debates and public discussions (Botić, 2009). At the same time, knowledge about the homeland is usually reduced to a very narrow thematic circle. Typically, this results in a very low level of awareness and care of one's homeland either through an individual's living space or preserving homeland heritage and tradition. Raising the level of awareness about one's own space also raises awareness about the inclusion of native content. These contents require an interdisciplinary approach in order to gain a complete insight into the native issues in homeland studies as emphasized by Botić (2009).

The rural settlement of Gnjila Potok can be viewed through several different aspects. We look at this work from the geographical – historical aspect of the evolution of settlements to the immigration of Slavs. We define the new rural history as the systematic study of human behavior over time in the rural environment. Historians and geographers of rural life must study these distinguishing marks of rurality because rural Montenegro is characterized by social processes as

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much as by geographical dwelling (Bulatović, Rajović, 2020b). Eugen Weber, professor of history at the University of California at Los Angeles and a leading historian of rural life emphasizes: "the history I thought and taught and wrote about went on chiefly in cities; the countryside and little towns were a mere appendage of that history, following, echoing, or simply standing by to watch what was going on, but scarcely relevant on their own account" (see Swierenga, 1981).

2. Methodology

The core of the methodological procedure used in this research is the geographical (spatial) method and it included geo-space Gnjilog Potoka and environment. The method of observation was supposed to provide insight into the social environment, through direct observation with participation, as well as the creation or use of the following sources: oral, written, and biographical (see Simms, 2004; Rigg, 2013; Campbell, 2018; Markuszewska, 2019; Bulatović, Rajović, 2020a, 2020b, 2020c).

3. Results and Discussion

Early Development of Man

As is well known, prehistory lasted from the appearance of the first man on Earth (about two million years ago) to the appearance of the first letter and state (about 3500 BC). People first lived in the open, under the open sky (Wenming, 1997). In the Old Stone Age, they settled in caves when it was very cold since these dwellings were most suitable for living in that period. However, they did not stay in one place; they were nomads. That is, they constantly changed their place of residence (Rehatsek, 1885). The main activity of the man at that time was collecting food: hunting, fishing, and collecting fruits in forests and meadows. From the earliest times, people have gradually improved the living conditions of their environments. They improved their tools and weapons, such as hunting spears, which they made of stone, animal bones, and wood. People learned to light fire, as well as to store surplus food for bad weather.

Gradually, they figured out how to make various types of houses for a living such as huts and dugouts. People in the Stone Age also lived in wide communities (hordes). As the climate gradually warmed up, these dwellers gradually switched from a nomadic to a sedentary lifestyle. They started growing plants and producing food. The first wild animal that man domesticated was the wolf, from whose descendants domestic dogs were born. Then man domesticated sheep, pigs, goats, cattle, cats, chickens, and horses. Along with the knowledge of agriculture, man at the early stages of human development discovered that tools can be made of metal. That is how new professions in crafts and trade appeared.

History of the Territory of Montenegro

We explored the history of the territory of Montenegro from the time of the first human communities, through the period of formation and prosperity of the Illyrians (the oldest historically known inhabitants of this part of the Balkans) to the end of the Roman domination till the arrival of Slavs in the western part of the Peninsula. Our findings are informed by two types of sources: archaeological, i.e. objects of material culture obtained from systematic excavations, and written data on this territory from ancient Greek and Roman authors, as well as data drawn from inscriptions discovered and preserved in the field (Garašanin, n.d.). It should be immediately pointed out that these data are still quite scarce: archaeological research in Montenegro began to develop more intensively only after the Second World War. As for written sources, the data of ancient writers directly related to Montenegro are quite small and rare, and epigraphic monuments' inscriptions do not cover all aspects of life and historical development but only shed light on certain problems. Hence, the image that we can create today about the oldest history of Montenegro will certainly, with new research, have to be significantly supplemented and expanded (Garašanin, n.d.).

Although it has not been established historically, the Celts probably penetrated the considered geo-area of the settlement before the arrival of the Romans in the IV century BC and suppressed the Illyrians in the wider areas. It is quite certain that the Gnjili Potok area, "like other parts of today's Montenegro was part of the Roman province of Dalmatia from the Second Century BC, or, later, the province of Prevalis. Furthermore, the specific population of the Slavic tribes that immigrated there in the 7th century AD is not completely clear, nonetheless, it is reasonably believed

that they were already Romanized Illyrians (Blagojević, 1979). According to Djordjevic (1912), in studying the historical component of a population, one should start with the evolution of the population's settlement. In terms of time, the evolution of the rural settlement of Gnjili Potok took place over two hundred and seventy-seven years (Bulatović et al., 2019; Bulatović, Rajović, 2020a; Rajović, 2009; Rajović, Bulatović, 2012; Rajović, Bulatović, 2014; Rajović, Bulatović, 2015; Rajović, Bulatović, 2016; Rajović, Bulatović, 2017; Rajović, Bulatović, 2018; Rajović, Bulatović, 2018).

The first mention of the settlement, under the name Gnjili Potok, is found in 1744 (Rajović, Rajović, 2010). Folk tradition says that formerly the studied area was almost uninhabited (Rajović, Bulatović, 2017). In fact, until the mentioned year – there are few or almost no documents at all about the population of the rural settlement of Gnjili Potok. However, based on the data in the literature, it can be stated that the considered geo-space from the earliest times, was inhabited by people who later disappeared due to migration or wars.

Fig. 1. Locality Njive (Fields) Đinovića
Note: Did the ancient peoples live here? In the close vicinity is the Rajova (Rajović) River – rich in brown trout.

According to Rajović (1995) and Rajović and Rajović (2010), the oldest known population of Gnjilog Potoka was probably the Illyrians. Fundamentally, historical traces of the Illyrians could be seen in the names of individual localities: Banjišor, Bulac, Gropa, Gvozda, Macurski put (Macurski road), Dukovka, Pridor, Tatarka, Krkline, Zaoglina, Latinski krš (Latinski karst), Rutinka, Perinka, and Njive Đinovića (see Figure 1). According to the same authors, it is almost certain that the people who lived in the rural settlement of Gnjili Potok engaged in agriculture and cattle breeding, but due to the great cold and huge snow moved to the parish areas. As proof, Rajović (1995) supports this claim with the presence of ancient peoples' alleges that they left their graves at "Latin Karst", a present site. At an existing location in Orničice, there exist two graves covered by weeds and a tangle of beech veins near an asphalt road. Other graves were covered with an embankment of the road, which cut the site and remained deep in the ground. The name "Latin Karst" says that it is a Latin cemetery, probably Romanized Illyrians, and perhaps the ancient Greeks.

Noting the oral tradition about Gnjilog Potoka, Rajović (1995) points out that the earliest persons in this area are called the "Ancient people", "Latins", "Macure", and "Bukumire" living near Berane are the remnants of that people. Rajović (1995) states the presence of piles of stones at an altitude greater than 1100 m above sea level is accumulated stone evidence with a diameter of 4m or more (it is smaller and smaller) as evidence of their habitations. Some piles of stones are almost overgrown, and many are covered with forest. They mainly occur from the following localities:

Latinsko cemetery, across Krklina, Radmilice, Rudog Brijega, Pridora, Korita, Katuništa to Radmilice, Ornice, and Njive Đinovića (Rajović, Rajović, 2010). Consequently, Rajović and Rajović (2010) also point to the perception that the three plateaus were created artificially, and not naturally.

The first according to Rajović (1995) is located above Kagina Ornica (plateau in a circular shape called Korita). The second and third plateaus are called Rajkova Ravnina and Perinka (private property of Dragoja Krstova Rajović – located between Kraj Novović and Dola Novović). It is interesting to point out that the last two plateaus have a circular shape and spring water at their ends. According to Rajović (1995), the mentioned locations were the habitats of "some or all of the livestock settlements that existed in the ancient times (Illyrians, Celts, Romans).

Fig. 2. Lomovi Locality
Note: Even today, it is rich in wild fruits and many wild animals have found their peace in its area. In the immediate vicinity is the Trešnjevačka Smail River.

Rajović and Rajović (2010) indicate that the aforementioned localities, dotted with meadows and pastures provided excellent opportunities to get food like nettles, hawthorn, walnuts, acorns, dogwood, wild cherries, wild pears, wild apples, hazelnuts, mushrooms, wild strawberries, raspberries, and blueberries. Forest spaces in Lise, Pelinovice, Trešnjevika, and Čukačke Kose provided game habitats for wild rabbits, wild ducks, wild pigs, deer, pheasants, martens, and badgers. This is how these ancient dwellers obtained their meat, skin, and fur using trap hunting. Their main source of fish catch was from the Rajova (Rajović) River where fishes were caught near large pools near the settlement.

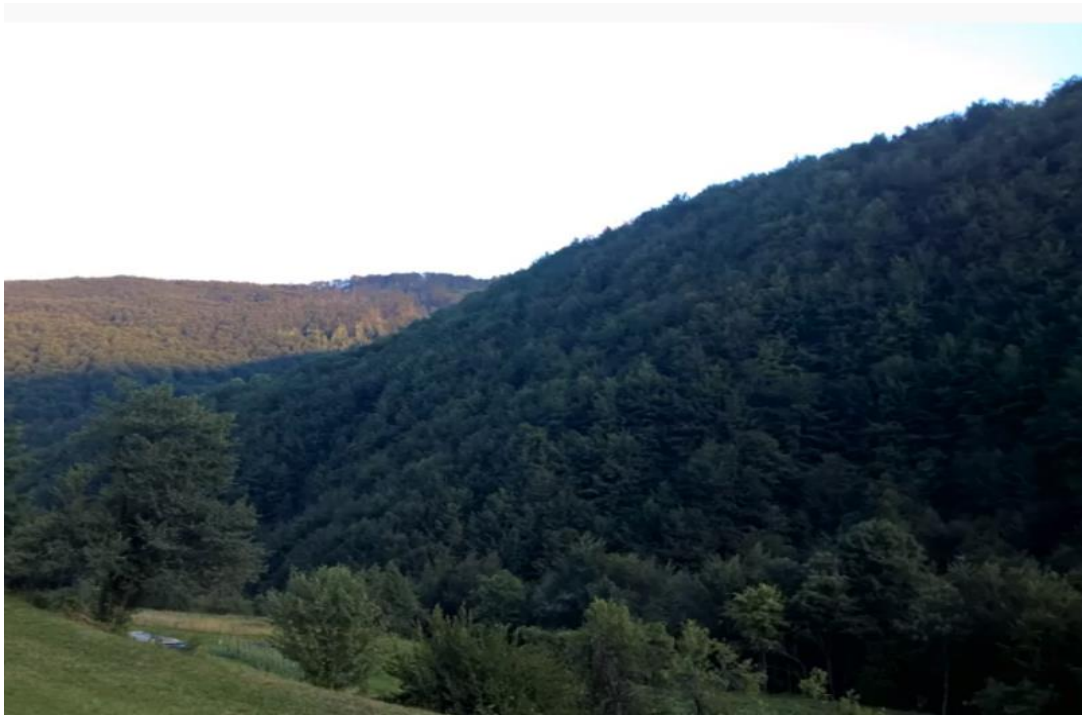

Fig. 3. Southwestern part of the settlement (forest complex as a fox habitat)
Note: Did ancient people know it as today's hunters?

Rajović (1995) rightly concludes that the ancient peoples lived in the considered geo-space and the legends "About the stone fox on Lisa", as well as about "Buried gold and gold horsetail at the site Radmilica" point to his position. Also, Rajović (1995) also bases his claims on the localities that are situated near the rural settlement of Gnjili Potok that have been determined to have been the abodes of ancient peoples like the Zanoga Lisačka, Bačko Brdo, and Miravčine (see Vešović, 1935; Dašić, 1986). It was Vešović (1935) and Dašić (1986) who provided amply information about the neighboring rural settlement of Kralje (the motherland of today's fraternities – the rural settlement of Gnjili Potok) that it served as a pasture for cattle breeders from Kralje. According to Rajović and Rajović (2010), it was the ancestor of Rajović-Rajo with his brother Vuk in 1744, who formed a new abode (settlement) in the considered geo-space. Subsequently, the ancestor of Labović-Labo moved to the settlement after five years in 1749 (see Rajović, 1995; Rajović, 1999; Rajović, Rajović,2010).

4. Conclusion

Per the set task of the study, our research records highlighted several evident observations:

- Geographically, the rural settlement of Gnjili Potok is located in the southeastern part of the municipality of Andrijevica. They extend in the belt 42 º 44 ′ 43 "north latitude and 19 º 43 ′ 04" east longitude. It covers an area of 8.83 km² and according to the survey data of the authors of this text for 2018, a total of 58 permanent residents live in this area.
- The main relics in the field of social life in the considered geo-space were and still are tribal - brotherhood and family relations. The tradition is so strong in this respect, that almost every inhabitant of Gnjili Potok knows their ancestry from families and fraternities they are related to by blood. Relationships within the same fraternity are traditionally so close that kinship, friendship, and godparenthood are respected and respected to an incredible extent. Within the family, relationships are still based on authority and maximum parental respect.
- On the oldest history of the rural settlement Gnjili Potok, from the time of the first human communities, through the period of formation of the Illyrians as the oldest historically known inhabitants of this part of Montenegro, it should be pointed out that data are still quite scarce. Hence, the image that we can create today about Montenegro, and thus the considered geo-space, with new research will have to be significantly supplemented and expanded. Thus, the historical

evidence of the current rural settlement of Gnjili Potok is not fully elucidated, so its history, as well as the history of many other rural settlements in Montenegro, cannot be reliably traced until 1744. (as is the case with the said settlement). Just in the mentioned years, they settled from Kralj in the rural settlement of Gnjili Potok - Rajo and Vuka (sons of Savić), and five years later (in 1749) – and Labo (ancestors of today's inhabitants - fraternities in Gnjili Potok).

- It is almost certain that the ancient peoples (Illyrians, Celts, Romans) lived in the area of the rural settlement of Gnjilog Potoka and that they were engaged in agriculture and cattle breeding. Comparatively, traces of historical evidence were maintained especially in the names of individual localities: Banjišor, Bulac, Gropa, Gvozda, Macurski put, Dukovka, Pridor, Tatarka, Krkline, Zaoglina, Latinski krš, Rutinka, Perinka, and Njive Đinovića.
- The considered geo-area interspersed with meadows and pastures provided the old peoples with excellent opportunities to easily access food: nettles, hawthorns, walnuts, acorns, dogwood, wild cherries, wild pears, wild apples, hazelnuts, mushrooms. Forest spaces: Lise, Pelinovice, Trešnjevika, and Čukačke Kose served as game habitats for wild rabbits, wild ducks, wild pigs, deer, pheasants, martens, and badgers. This is how meat, skin, and fur were obtained.
- The path from an idea to the realization in this research although clear is burdened with many aggravating circumstances. We hope that the results of this research will be a contribution to the study of rural settlements in our country. We hope that this research will be useful to all those who want to get to know the rural settlement of Gnjili Potok in more detail.

References

Blagojević, 1979 – *Blagojević, O.* (1979). Bačko Dobro Polje – gorštaci u ravnici (stari zavičaji u knjizi), Etnografski institut Srpske akademije nauka i umetnosti, Book, 18, Beograd, pp. 49-55.

Botić, 2009 – *Botić, J.* (2009). Rijeka Krka i Nacionalni park Krka u funkciji zavičajne nastave. *Godišnjak Titius: godišnjak za interdisciplinarna istraživanja porječja Krke*. 2(2): 239-251.

Bulatović, Rajović, 2019 – *Bulatović, J., Rajović, G.* (2019). Analysis of the population survey in the basin of Rajova (Rajović River): Problems and prospects of development with a focus on ecological awareness. *Larhyss Journal*. 39: 109-141.

Bulatović, Rajović, 2020a – *Bulatović, J., Rajović, G.* (2020). Trešnjevička Smail River and Enviroment – Mountain Beauty: A Geographical Review, *European Geographical Studies*. 7(1): 31-36.

Bulatović, Rajović, 2020b – *Bulatović, J., Rajović, G.* (2020). Population of Montenegro (2020 and Historical) and Montenegro Population Forecast (2020–2050). *Population Processes*. 5(1): 32-37.

Bulatović, Rajović, 2020c – *Bulatović, J., Rajović, G.* (2020). Some aspects geographical - historically thinking in the context of the time: Review of Literature. *Revisita Geografica Academica*. 14(2): 52-72.

Campbell, 2018 – *Campbell, C.J.* (2018). Space, place and scale: Human geography and spatial history in past and present. *Past and Present*. 239(1): 23-45.

Dašić, 1986 – *Dašić, M.* (1986). Vasojevići od pomena do 1860., Narodna knjiga, Belgrade.

Đorđević, 1912 – *Đorđević, P.T.* (1912). Ekonomija i evolucija naselja, Beograd: Glasnik Srpskog Geogradskog Društva, pp. 27-30.

Garašanin, n.d. – *Garašanin, M.* (n.d.). Crna Gora do doseljivanja Slovena, Kulturna kapija Crne Gore. Portal Montenegrina.

Jaćimović,1985 – *Jaćimović, B.* (1985). Razvitak, pravci i metode poljoprivredne geografije, *Iz Posebnih izdanja Odseka za geografiju i prostorno planiranje*, Book, 3, Belgrade, p. 111.

Markuszewska, 2019 – *Markuszewska, I.* (2019). Sentimentality versus transformation of the historical traditional rural landscape (a case study: the landscape of Dutch law settlement in Poland). *Quaestiones Geographicae*. *38*(1): 53-70.

Rajović, Bulatović, 2014 – *Rajović, G., Bulatović, J.* (2014). Geographical starting points the analysis of current rural problems in Montenegro*:* A case study of the rural settlement of Gnjili Potok. *International Letters of Social and Humanistic Sciences*. 9: 81-99.

Rajović, Bulatović, 2015 – *Rajović, G., Bulatović, J.* (2015). Historical-Geographical View of Rural Village Gnjili Potok – Which Road to Renewal and Development. *International Letters of Social and Humanistic Sciences*. 1(1): 41-54.

Rajović, Bulatović, 2016 – *Rajović, G., Bulatović, J.* (2016). Quality of life in rural villages of Montenegro - Gnjili Potok and Vranještica: Case study. *Scientific Electronic Archives*. 9(2): 23-35.

Rajović, Bulatović, 2017 – *Rajović, G., Bulatović, J.* (2017). Recreational Fishing: Case Rajova River (Issues Regarding the Development of Recreational Fisheries: Case of the Rajova River). Scholars' Press, Saarbrucken, Germany.

Rajović, 1995 – *Rajović, V.* (1995). Gnjili Potok i Trešnjevik. "Stupovi-Vasojevići", Andrijevica.

Rajović, 1999 – *Rajović, V.* (1999). Vrijeme i ljudi. Andrijevica: "Stupovi – Vasojevići.

Rajović, 2009 – *Rajović, G.* (2009). Rural settlement Gnjili Potok as a reflection of the socio-economic conditions. *Istraživanje i razvoj*. *15*(32-33): 75-77.

Rajović, Bulatović, 2012 – *Rajović, G., Bulatović, J.* (2012). Tourist Potential on Example of Rural Settlement Gnjili Potok (Montenegro). *Anuario Turismo y Sociedad*. 13: 171-184.

Rajović, Bulatović, 2018 – *Rajović, G., Bulatović, J.* (2018). Montenegrin village Gnjili Potok at the beginning of the 21 st ceuntry, *Revisita Geografica Academica*. 12(1): 93-128.

Rajović, Bulatović, 2018 – *Rajović, G., Bulatović, J.* (2018). Rural settlement Gnjili Potok (Montenegro): Attachment to the study demographic discharge of geo-space. *World Scientific News*. 91: 12-30.

Rajović, Rajović, 2010 – *Rajović, G., Rajović, D.* (2010). Natural and socio economic characteristics of rural settlements Gnjili Potok. Agency PC system, Belgrade.

Rehatsek, 1885 – *Rehatsek, E.* (1885). Art. I. – The pre-historic man of caves and lake-dwellings. *Calcutta Review*. 81(161): 1-18.

Rigg, 2013 – *Rigg, J.* (2013). From rural to urban: A geography of boundary crossing in Southeast Asia. *TRaNS: Trans-Regional and-National Studies of Southeast Asia*. 1(1): 5-26.

Simms, 2004 – *Simms, A.* (2004). Historical landscape studies in Ireland. With an appendix on the future of the Irish countryside. *Belgeo. Revue belge de géographie*. (2-3): 301-320.

Swierenga, 1981 – *Swierenga, R.P.* (1981). The New Rural History: Defining the Parameters. *Great Plains Quarterly*, 211-223.

Vešović, 1935 – *Vešović, J.R.* (1935). Pleme Vasojevića, Državna štamparija, Sarajevo.

Wenming, 1997 – *Wenming, Y.* (1997). The settlement archaeology and research of prehistory. *Cultural Relics*. 6: 29-37.

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Blended Learning and Pre-service Teachers' Achievement on "Classroom Testing" Course during COVID-19 Pandemic

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Abstract

The COVID-19 pandemic ravaging most cities of the world has forced many countries to go into partial or total lockdown thus suspending face-to-face learning. The difficulties created by the lockdown that arose to mitigate the spread of the COVID-19 pandemic forced educational institutions to adopt blended learning which became crucial to fostering undisrupted teaching and learning. This study, therefore, investigated the effect of blended learning on a compulsory course, Classroom Testing, in the Nigerian Teacher Education Curriculum. The post-test randomised control group quasi-experimental design was adopted using two groups (experimental, n = 232 and control, n = 214). The experimental group was taught using blended learning while the control group was taught using the lecture method. The classroom Testing Achievement Test was used to collect data while descriptive and inferential statistics were used to analyse the data collected. Findings from this investigation revealed that pre-service teachers who taught classroom testing using blended learning achieved better than their counterparts who taught the same content using the conventional lecture method. This study concludes that blended learning can guarantee undisrupted learning and also increase pre-service teachers' achievement in the course classroom testing.

Keywords: Blended Learning, Classroom Testing, Covid-19, Lecture Method, Undisrupted Learning.

1. Introduction

Growing concern around the world is the effect that the COVID-19 pandemic has on many nations especially in the health sector. The suspension of face-to-face learning thus disrupting teaching and learning at all levels of education (primary, secondary, tertiary) is a confirmation of the effect of the pandemic on education. Coronavirus known as "COVID-19" was declared a pandemic by the World Health Organization (WHO) and its index case was confirmed in Nigeria on 27th February 2020 (Nigeria Education in Emergencies Working Group, 2020). This confirmation led the government of the nation to declare lockdown and embark on school closure as a step in preventing the further spread of the virus. This singular act led to the closing of schools leaving thousands of children and youths out of school (Federal Ministry of Education, 2020). The closing of schools brought about the need to begin to look for other ways to avoid disruption in learning.

An investigation into learning disruption shows that it militates against students and pre-service teachers' achievement in schools. This assertion was confirmed by Nyamupanpedengu (2017) who found out that disruption to teaching and learning in the form of protest against

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unaffordable fees hikes and lack of transformation affected student's performance in South Africa. The study carried out by Huntington-Klein and Gill, (2020) in the United States of America also identified high course load and unavailability of necessary hardware and software requirements for synchronous and asynchronous online instruction as some of the factors impeding the performance of students in their courses. This suggests that students' performance is being inhibited by disruptions to teaching and learning.

In Nigeria, the conventional instructional method also known as the traditional lecture method is more popularly used for instruction (Akinbobola, 2006; Ogunleye, Babajide, 2011; Olaniyan et al., 2015). This method requires that the teacher stands in front of the students to deliver his lecture while the students are required to listen and take down notes. This method is referred to as a teacher-centered method because the teacher is active thus controlling the class while the students remain passive almost throughout the teaching-learning process (Akpan, Aminikpo, 2017). This method has been found not to take into consideration the different characteristics of the students because students differ in terms of intelligent ideas, perception, and learning rate (Umoh, Akpan, 2014). Again, the lecture method becomes a disadvantage especially during educational disruption such as it is being currently experienced with the COVID-19 pandemic. Students and pre-service teachers could not attend schools hence the possibility of it affecting their achievement in the identified course. The findings of Nyamupanpedengu (2017) and Huntington-Klein and Gill (2020) already confirmed that disruptions in learning affected students' performance.

Blended learning is a strategy that has been discovered to have the capacity of alleviating the challenges caused by disruption to learning in schools. It is a strategy that relies on students learning some content online combined with the face-to-face lecture method. Scholars investigated the effects of blended learning on student achievement in secondary schools and found a significant effect of its use on student achievement (Abdulkareem, 2016; Alsalhu et al., 2019; Khader, 2016). Also, other scholars conducted studies on the effect of blended learning on student's achievements in tertiary institution courses and modules and found out that the use of blended learning has a positive effect on student's achievement (Gambari et al., 2017; Kiviniemi, 2014; Onyenma, Abraham; 2020; Onyenma, Olele, 2020).

Graham (2013) describes blended learning as an approach that combines computer-mediated instruction with face-to-face lecture methods. This requires that the teacher brings in some online mediated approach with lecture method to achieve teaching-learning objectives. This assertion was supported by Norm (2012) who opines that blended learning is a formal education program in which students learn at least in part through the teaching of content and instruction using digital and online media with students having control over some elements such as time, path and place.

In the study carried out by Kiviniemi (2014) on the effect of blended learning approach on students' outcomes in a graduate-level public health course, he adopted a quasi-experimental, non-equivalent control group design which involved 66 graduate students (Experimental group, n = 38, Control group, n = 28). The experimental group was taught the content of the public health course using blended learning (online and face to face) while the control group was taught the same content using the traditional method. The data used in this study was obtained using the examination questions while inferential statistics (Analysis of Covariance) was used to analyse the data collected. Kiviniemi (2014) found out that student's taught the content using blended learning performed better than their counterparts taught using the traditional method.

In the research completed in 2016 by Abdulkareem, he investigated the effects of blended learning on senior secondary school student's performance and retention in the English Language in Kaduna State, Nigeria. The researcher adopted the pre-test post-test control group quasi-experimental design which involved 172 students (Experimental group, n = 110, Control group, n = 62). The experimental group was taught English Language using blended learning (blended learning package) while the control group was taught the same concept using the traditional lecture method. English Language Achievement Test (ELAT) was used to obtain data for this study and the data obtained was analysed using descriptive and inferential statistics. Abdulkareem (2016) discovered that there was a significant difference between the mean achievement score of students taught English Language using blended learning package and those taught the same content using traditional teaching method in favour of those taught using blended learning.

Khader (2016) studied the effectiveness of blended learning (online and face to face) in improving third-grade student's achievement in science. His study adopted a quasi-experimental

design that involved 108 students (Experimental group n = 54, Control group n = 54) randomly selected from two schools in Bani Kenana. The experimental group was taught science using blended learning while the control group was taught the same content using the traditional lecture method. A researcher-prepared achievement test was used to obtain data for this study. The data obtained were analysed using the two-way Analysis of Covariance. Khader's (2016) investigation revealed a statistically significant difference in the achievement of students taught using blended learning and those taught using traditional lecture methods in favour of those students taught using online and face-to-face methods.

The investigations carried out in 2017 by Akpan and Aminikpo on the effect of blended learning on student's performance in social studies in River State, Nigeria revealed that blended learning has a significant effect on student's performance when compared to those students taught using the lecture method. The study adopted the quasi-experimental research design and it involved 80 students (Experimental group n = 40, Control group n =40). The researchers taught the experimental group social studies using blended learning (Station Rotation) while the control group was taught using the conventional teaching method. Social Studies Achievement Test (SAT) was used to gather data for this study and the data obtained was analysed using inferential statistics (Analysis of Variance).

Gambari et al. (2017) in their study investigated the effectiveness of blended learning (internet and face to face) and e-learning modes of instruction on the performance of undergraduate students from three universities in Kwara State in the educational technology concept. Their study adopted the pre-test post-test control group quasi-experimental design which involved 85 participants (Experimental group 1, n = 30, Experimental group 2, n = 30, Control group, n = 25). Experimental group 1 was exposed to blended learning, experimental group 2 was exposed to e-learning while the control group was taught using the traditional method. Educational materials and methods performance test was used to obtain data for the study and the data obtained was analysed using inferential statistics (Analysis of Covariance). Gambari et al (2017) study revealed that there was a significant difference in the performance of students taught using blended learning, e-learning and traditional method in favour of those students taught using blended learning followed by those taught using e-learning.

Suleiman et al. (2017) investigated the effects of computer-based blended learning strategy on secondary school chemistry student's retention in individualised and collaborative learning in Minna, Niger State. The study adopted the pre-test post-test and delayed post-test quasi-experimental design which involved 120 students (Experimental group 1, n = 40, Experimental group 2, n = 40, Control group, n =40), The researchers taught the experimental group 1 the concept of a mole using computer-based blended learning individualize settings, while experimental group 2 was taught the same content using computer-based blended learning collaborative settings. The control group was only limited to the traditional lecture method. Suleiman et al. (2017) used Chemistry Achievement Test to collect data for this study and analysis of covariance was used to test the hypothesis. They found out a significant difference in the retention scores of students taught moles concept using computer-based blended learning individualise settings, computer-based blended learning collaborative settings and the control group in favour of those students taught using computer-based blended learning individualise settings, computer-based blended learning collaborative settings.

Also in 2018, Utami investigated the effect of the blended learning model on senior high school student's achievement on an information and communication technology course. The study adopted the pre-test post-test randomized control group experimental design involving 62 (Experimental group, n = 31, Control group, n =31) students offering an information and communication technology course. The experimental group was taught using blended learning (online and face to face) while the control group was taught using the traditional teaching model. An objective test was used to collect data for the study and a t-test was used to analyse the data obtained. Finding from his study revealed that the experimental group taught using blended learning had higher levels of learning achievement than their counterparts taught using the traditional method.

Alsalhi et al. (2019) conducted a study on the effect of blended learning on the achievement of ninth-grade students in science and their attitudes towards its use. The study adopted the quasi-experimental approach involving 112 students (Experimental group n = 61, Control group n =51).

The experimental group was taught science using blended learning while the control group was taught using the traditional method. An achievement test was used to collect data for this study and a t-test was used to test the hypothesis. Finding from this study revealed that blended learning has a positive impact on student's performance in science when used.

In a more recent study by Onyenma and Abraham (2020), the effect of blended learning (flipped classroom) on the academic performance of students in Physics was investigated. The study adopted the non-equivalent control group quasi-experimental design and it involved 81 students selected from two federal colleges in southeast Nigeria. The experimental group was taught electromagnetic theory using blended learning while the control group was taught the same content using the face-to-face lecture method. Researcher-made Electromagnetic Theory Achievement Test (RMETAT) was used to obtain data and analysis of covariance was used to analyse the data obtained. Finding from Onyenma and Abraham's (2020) study showed that blended learning has a significant effect on the performance of students in physics.

Again, Onyenma and Olele (2020) investigated the effect of blended learning (Flipped Classroom) on student's retention of Physics. The study adopted the non-equivalent control group quasi-experimental design which involved 81 Federal College of Education students in Southeast Nigeria. The experimental group was taught electromagnetic theory using blended learning while the control group was taught the same content using face to face method. Researcher-made Electromagnetic Theory Achievement Test (RMETAT) was used to obtain data for this study. The data obtained were analysed using descriptive and inferential statistics. Finding from this study showed that blended learning has a significant effect on student's retention of physics.

A review of the extensive literature on blended learning revealed that there are different blends of blended learning. Friesen (2014) identified five different models of blended learning to include the station rotation model, laboratory rotation model, flex model, self-blend model, and the flipped classroom model. Most of the previous investigations of the effect of blended learning on students achievement were limited to the use of station rotation, laboratory rotation, flex, and self blend model with only a few of these studies using the flipped classroom model (Akpan, Aminikpo, 2017; Abdulkareem, 2016; Gambari et al, 2017; Kiviniemi, 2014; Onyenma, Abraham, 2020; Onyenma, Olele, 2020). This assertion was again stressed by Tandoh et al. (2014) who discovered that the combination of web-based techniques and instructional tools with face-to-face instruction is the most common approach to blended education. Since Jonathan (2014) already argued that blended learning has various event-based activities mixed, there might be the need to try other blends of the concept.

In this present study, the flipped classroom model of blended learning with self-paced learning was adopted. Onyenma and Olele (2020) opined that self-pace learning refers to the e-learning activities learners engage in and which can be completed at learner's leisure thus encouraging students to learn at their own pace. A good example of this is the WhatsApp and Telegram platforms which allow students to learn remotely at their pace, thus, giving the learner power over their learning.

The justification for using WhatsApp and Telegram is because there is little or no evidence in the literature that its blend has being used in blended education. Not only is there relatively scare literature of its usage, WhatsApp and Telegram was the most available and accessible platform readily available to avoid disruption in learning at the instance of the abrupt emergence of the COVID-19 pandemic. This is because, despite the hardship experience and the relatively low scientific development in the country of this study, students can still afford and also have access to its use. The use of WhatsApp and telegram might seem ancient to the world over, but to the area of this study, the proliferation of its use is just in vogue. Students, especially pre-service teachers taking the course classroom testing during the 2019/2020 harmattan semester in the selected college of education, have access to its use on their mobile phones hence its adoption in other to avoid disruption to learning.

Classroom testing is a compulsory course taking by all 400 level pre-service teachers in the Nigerian teacher education curriculum. The course is a 2 unit course for all science-related disciplines in the college of education. The content of classroom testing includes the learning of concepts and the application of these concepts through mathematical calculations. The adoption of the course in this investigation was also considered novel because literature has little or no evidence of the effectiveness of blended learning on pre-service teacher's achievement. In light of

this, the objective of this study is to investigate the effect of blended learning on pre-service teacher's achievement in classroom testing. The only null hypothesis "there is no significant difference in the achievement of pre-service teachers taught classroom testing using blended learning and those taught using lecture method" will be tested for acceptance or otherwise at a significant level of 0.05 while the corresponding research question- "Is there any significant effect of blended learning on pre-service teachers' achievement in classroom testing" will be answered. The investigation is arranged as follows; methods, results, and discussion.

2. Methods

Research Design

This investigation adopted the quasi-experimental post-test control group design. This involves one level of experimental (Blended Learning) and control groups. The independent variable in this study is the teaching method (Blended Learning and Lecture Method). The dependent variable is the post-test achievement of students in the two groups.

Participants

The population for this study comprised all the undergraduates in the College of Education in Ondo State, Nigeria. The target population was all the 400 level students studying science-related programmes and offering the course classroom testing (EDU 403). The total population of students offering the course classroom testing during the 2019/2020 Harmattan semester was 854 covering six departments (Agricultural Science, Biology, Chemistry, Home Economics, Mathematics, Physics). Out of this number, four intact classes were randomly selected for this study. Two of these classes were used as the experimental group while the other two classes were used as the control group. A total number of 446 students took part in this study. Table 1 shows the distribution of participants used in this study.

Table 1. Sample Distribution of Participants

Gender	Experimental Group		Control Group	
	Frequency	Percent (%)	Frequency	Percent (%)
Male	105	45	102	48
Female	127	55	112	52
Total	232	100	214	100

Research Instrument

The researchers employed two instruments to collect data for this study

1. Course Content/ Material: The researchers adopted the course material for the course as documented in the Nigerian Teacher Education Curriculum. The course material used for the experimental group was given to the students using blended learning while that of the control group was given to the students using face to face lecture method only. The instrument covered all the course content on classroom testing (SEC 403). A breakdown of the course content and the modes of instruction is shown in Table 2.

Table 2. Break Down of the Course Content and Modes of Instruction for Experimental and Control Group

S/N	Course Content	Mode of Instruction	
1	(a) The need for evaluation in education	W/T and LM	LM
	(b) Basis attitudes to a good test	W/T and LM	LM
2	Types of Test	W/T	LM
3	Planning for the assessment of learning	W/T	LM
4	Test Construction	W/T and LM	LM
5	Test Administration	W/T	LM
6	Test Scoring and Reporting	W/T and LM	LM
7	Test Scores Interpretation	W/T and LM	LM

8	Continuous Assessment	W/T	LM
9	Examiners' Report	W/T	LM

Notes: W/T = WhatsApp and Telegram Platform; LM = Lecture Method.

2. Test Instrument: The researcher designed an instrument titled Classroom Testing Achievement Test (CTAT) was used to collect data for this study. CTAT in its initial form comprised of 50 multiple choices and was developed from the course content of classroom testing. Each item on the instrument has five options (A-E) with one correct answer and four distractors. CTAT has two sections. Section A contains information on the bio-data of participants (Department, Level) while section B consists of 50 multiple choices objective tests on the content classroom testing. The instrument was given to 3 experts in Science Education and 2 experts from tests and Measurement, to check for its validity. Based on the expert's recommendation, the researchers added, removed, and modified some items on the instrument. The final draft of CTAT consisted of 45 multiple choice objective items on classroom testing. The reliability of the test was determined using Kuder Richardson 21 and a coefficient value of 0.86 was obtained which is considered reliable enough to be used for this study.

Procedure

This study began shortly after the first COVID-19 pandemic lockdown was lifted in Nigeria. It was the beginning of the 2019/2020 Harmattan semester. Classroom Testing (SEC 403) is one of the compulsory courses talking by 400 level science-related disciplines. The researchers taught the experimental group classroom testing using blended learning while the control group was taught the same content using the lecture method at different times. Concrete efforts were made by the researchers to avoid interaction between the two groups especially as it involves the teaching of the course.

Blended learning in the context of this study involved students studying part of the content online and the remaining part of the content using the lecture method. Lecture notes and teachings were uploaded on WhatsApp and Telegram platforms with all the participants as members of the group. Wednesdays of every week during the investigation period were agreed by the lecturers and the students to be online for the questions and answer section. Only students who made 80 % attendance on the platform (WhatsApp and Telegram) and 80 % attendance during lecture method were used in this study. The control group was taught the same content using the lecture method only. Online teaching for the experimental group took place twice a week for an hour with its face-to-face lecture method component holding once in two weeks. The control group was taught twice a week with a 2 hours duration for the period of the investigation. CTAT was administered to the two groups after completing the teaching of the course. This study lasted for 9 weeks and it was carried out under 3 stages.

Stage 1: (1 week). The researchers prepared the lesson notes and content for classroom testing. The researchers also used this period to create the group for the course on WhatsApp and Telegram platforms. Students also registered on the online platform in preparation for teaching.

Stage 2: (7 weeks). The teaching of the two groups took place. The experimental group was taught classroom testing using blended learning while the control group was taught the same content using the lecture method by the researchers at different times.

Stage 3: (1 week) Post-test administration of CTAT was carried out on the two groups. The test was duly graded and recorded.

Data Analysis

The data collected from the test was analysed using descriptive (mean, standard deviation) and inferential (t-test) statistics. The only research question was answered using mean and standard deviation while the null hypothesis was tested for acceptance or otherwise using t-test analysis.

3. Results

Research Question: What is the effect of blended learning on students' achievement in classroom testing?

Table 3. Effect of Blended Learning on Pre-service Teachers' Achievement in Classroom Testing

Group	N	Mean	Standard Deviation	Mean Difference
Experimental	232	33.22	4.91	4.75
Control	214	28.47	4.70	

Table 3 shows the achievement of pre-service teachers' that participated in the classroom testing achievement test (CTAT) when taught using blended learning and lecture method. The mean score of pre-service teachers' taught classroom testing using blended learning was 33.22 while that of those pre-service teachers' taught using lecture method was 28.47. Table 3 reveals that the mean score of pre-service teachers' taught classroom testing using blended learning is 4.75 greater than those pre-service teachers' taught classroom testing using the lecture method.

Research Hypothesis: There is no significant difference in the achievement of pre-service teachers' taught classroom testing using blended learning and those pre-service teachers' taught using lecture method.

Table 4. t-test Analysis of the Effect of Blended Learning on Pre-service Teachers' Achievement

Group	N	Mean	Standard Deviation	*df*	*t*	*ρ*
Experimental	232	33.22	4.91	444	10.42	0.00
Control	214	28.47	4.70			

Table 4 reveals the independent sample t-test of the achievement scores of pre-service teachers' taught classroom testing using blended learning and lecture method. Furthermore, Table 4 shows that the t-test value of 10.42 was obtained at a significant level of 0.00. Since the calculated value of 0.00 is less than the significant level of 0.05, the null hypothesis is hereby not accepted. This implies that there is a significant difference in the achievement of pre-service teachers' taught classroom testing using blended learning and those pre-service teachers' taught classroom testing using lecture method in favour of those taught using blended learning.

4. Discussion

The effectiveness of blended learning has been investigated in previous studies especially as it concerns the achievement of students in a tertiary education course (Gambari et al., 2017; Kiviniemi, 2014; Onyenma, Abraham, 2020; Onyenma, Olele, 2020). This present study built on previous research as it investigated the effect of blended learning on a tertiary education course, classroom testing. The study investigated the effect of blended learning on pre-service teachers' achievement in classroom testing. The finding from the study revealed that pre-service teachers' taught classroom testing using blended learning had a greater mean score than the pre-service teachers' taught classroom testing using the face-to-face lecture method. In other to ascertain if the effect of blended learning was significant in terms of the difference recorded in the achievement of pre-service teachers from the two groups, the researchers hypothesized that there is no significant difference in the achievement of pre-service teachers' taught classroom testing using blended learning and those pre-service teachers' taught using lecture method. This hypothesis was not accepted because the intervention (blended learning) significantly improved pre-service teachers' achievement in classroom testing. This finding support recent findings that found a significant effect of blended learning on student's achievement and performance (Alsalhi et al., 2019; Onyenma, Abraham, 2020; Onyenma, Olele, 2020). This finding also opposes the investigations of Adas and Abu (2011); and Akpan and Aminikpo (2017) who did not find a significant effect of blended learning on student achievement and performance.

5. Limitations

This study has limitations and it should be acknowledged when considering the findings and their implications. The study design, quasi-experimental, was not truly experimental because intact

classes of pre-service teachers were used for the investigation hence, we cannot be confirmed if the two groups were equivalent but participants in the two groups already passed the prerequisite course for classroom testing. It is of great essence to acknowledge that other factors like the students' characteristics might account for a small portion of the differences recorded.

6. Conclusion

This investigation evaluated the effect of blended learning on the achievements of pre-service teachers on the course, classroom testing. The study combined the use of WhatsApp and Telegram with face-to-face teaching as the type of blend for blended learning. This study is considered novel because it provided empirical bases of this type of blended learning on the achievement of pre-service teachers in the course, classroom testing. The results of this study can be adopted by classroom testing lecturers in teacher training institutions to improve the achievement of students in the course. The data used in this study was limited to only four science-related disciplines out of six disciplines taking the course classroom testing. The use of blended learning appears to make pre-service teachers achieve better in classroom testing hence it is recommended for use. Further investigation of the effectiveness of blended learning can be carried out on larger participants. Again, the effectiveness of blended learning can also be tested on other courses taking by pre-service teachers in their different teacher training institutions.

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8. Conflict of Interest Statement

No conflict of interest was declared by the researchers.

References

Abdulkareem, 2016 – *Abdulkareem, S.T.* (2016). Effect of blended learning on performance and retention of senior secondary school student's in English Language in Kaduna State, Nigeria. [Unpublished doctoral dissertation]. Ahmadu Bello University Zaria Nigeria.

Adas, Abu, 2011 – *Adas, D., Abu, S.W.* (2011). Students' perceptions towards blended learning environment using the OCC. *An-Najah University Journal for Research Humanities*. 25(6): 1681-1710.

Akinbobola, 2006 – *Akinbobola, A.O.* (2006). Effects of teaching methods and study habits on students' achievement in senior secondary schools' physics, using a pictorial organizer. [Unpublished doctoral thesis]. The University of Uyo, Uyo, Nigeria.

Akpan, Aminikpo, 2017 – *Akpan, K.P., Aminikpo, N.R.* (2017). Blended learning approach on students' academic achievement and retention: A case study of air force secondary school river state, Nigeria. *International Journal of Multidisciplinary Research and Development*. 4(12): 15-21.

Alsalhi et al., 2019 – *Alsalhi, N.R., Eltahir, M.D., Al-Qatawneh, S.S.* (2019). The effect of blended learning on the achievement of ninth grade students in science and their attitudes towards its use. *Heligon*. 5: 1-11.

Federal Ministry of Education, 2020 – Federal Ministry of Education. (2020). Management of coronavirus pandemic, FME/PSE/HE/1041/C.I/Vol.1/137.

Friesen, 2014 – *Friesen, N.* (2014). Defining blended learning. [Electronic resource]. URL: http//www.learningspace.org/papers/Defining_Blended_Learning_NF.pdf (date of access: 23.01.2020).

Gambari et al., 2017 – *Gambari, A.I., Shittu, A.T., Ogunlade, O.O., Osunlade, O.R.* (2017). Effectiveness of blended learning and e-learning modes of instruction on the performance of undergraduates in Kwara State, Nigeria. *Malaysian Online Journal of Educational Sciences*. 5(1): 25-36.

Graham, 2013 – *Graham, C.R.* (2013). Blended learning systems: Definition, current treads and Future directions. In C. J. Bonk & C.R. Graham (Eds.). The Handbook of Blended Learning Global Perspectives, Local Designs, (pp 2543-2556), Pfeiffer, San Francisco.

Huntington-Klein, Gill, 2020 – *Huntington-Klein, N., Gill, A.* (2020). Semester course load and student performance. *Research in Higher Education*. 62: 623-650.

Jonathan, 2014 – *Jonathan, O.C.* (2014). Challenges facing effective utilization of blended learning model in teacher education programmes in Nigeria. A paper presented at 10th Annual National Conference of Qualitative Education in Nigeria (ASSEQEN) with the Theme Reorienting and Alternative Education to Build a Better Future for All at the Benue State University Markurdi. [Electronic resource]. URL: http://www.unn.edu.ng/publications/files/12302_Challenges_facing_Effective_Utilization_of_Blended_Learning_Model_in_Teacher_Education_Programmes_in_Nigeria.pdf (date of access: 23.01.2020).

Khader, 2016 – *Khader, N.S.* (2016). The effectiveness of blended learning in improving students' achievement in third grade science in Bani Kenana. *Journal of Education and Practice*. *7*(35): 109-116.

Kiviniemi, 2014 – *Kiviniemi, M.T.* (2014). Effects of a blended learning approach on student outcomes in a graduate level public health course. *BMC Medical Education*. 14(47): 1-7.

Nigeria Education in Emergencies Working Group, 2020 – Nigeria Education in Emergencies Working Group. (2020). Nigeria Education Sector COVID-19 Response Strategy in North East, pp. 1-18. [Electronic resource]. URL: https://planipolis.iiep.unesco.org/en/2020/nigeria-education-sector-covid19-response-strategy-northeast-6998

Norm, 2012 – *Norm, F.N.* (2012). Defining blended learning. [Electronic resource]. URL: http://www.learningspace.org/papers/defining-blended (date of access: 23.01.2020).

Nyamupangedengu, 2017 – *Nyamupangedengu, E.* (2017). Investigating factors that impact the success of students in a higher education classroom: A case study. *Journal of Education (University of KwaZulu-Natal)*. 68: 113-130.

Ogunleye, Babajide, 2011 – *Ogunleye, B.O., Babajide, V.F.T.* (2011). Generative instructional strategy enhances senior secondary school students' achievement in physics. *European Journal of Educational Studies*. 3(3): 443-463.

Olaniyan et al., 2015 – *Olaniyan, A.O., Omosewo, E.O., Nwankwo, L.J.* (2015). Effect of polya problem solving model on senior secondary school student performance in current electricity. *European Journal of Science and Mathematics Education*. *3*(1): 97-104.

Onyenma, Abraham, 2020 – *Onyenma, C., Abraham, L.K.* (2020). Effect of blended learning on students' academic performance in physics in federal colleges of education in South East, Nigeria. *British Journal of Education*. 8(1): 66-77.

Onyenma, Olele, 2020 – *Onyenma, C., Olele, C.N.* (2020). Effect of blended learning on students' retention of physics in federal colleges of education in South East, Nigeria. *International Journal of Education, Learning and Development*. 8(1): 66-76.

Suleiman et al., 2017 – *Suleiman, M.S., Salaudeen, B.M., Falode, O.C.* (2017). Effects of computer-based blended learning strategy on secondary school chemistry students' retention in individualised and collaborative learning settings in Minna, Niger State, Nigeria. *Bulgarian Journal of Science and Education Policy*. 11(2): 267-278.

Tandoh et al., 2014 – *Tandoh, K., Flis, N., Blankson, J.* (2014). Blended learning: History, implementation, benefits, and challenges in higher education. [Electronic resource]. URL: www.igi-global.com/chapter//blended-learning/92962 (23.01.2020).

Umoh, Akpan, 2014 – *Umoh, J.B., Akpan, E.T.* (2014). Challenges of blended e-learning tools in mathematics: Students' perspectives. *University of Uyo Journal of Education and Learning*. 3(4): 60-70.

Utami, 2017 – *Utami, I.S.* (2017). The effect of blended learning model on senior high school students' achievement. SHS Web of Conferences. 42: e00027. DOI: https://doi.org/10.1051/shsconf/20184200027