Medical Education

Disposition and Challenges of Alternative to Physical Classroom Teaching and Learning in a Pandemic; an Appraisal of Biochemistry Students COVID-19 Learning with WhatsApp

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Abstract
The objective of the study was to assess the disposition and challenges of students towards teaching and learning of biochemistry through WhatsApp.

Materials and Methods: The study was a cross-sectional survey which had 200 level (Second Year) and 400 level (Fourth Year) students of biochemistry as respondents. Data collection was done using a self-developed questionnaire administered through the WhatsApp group created for learning and collected through a designated e-mail address. Data analysis was carried out using the mean and standard deviation setting a mean score of 2.5 as a benchmark for accepting or rejecting statements made in the questionnaire.

Results: The study revealed that students had a level of openness to using online teaching resources for biochemistry; they do not believe that the use of WhatsApp for teaching and learning of biochemistry as a means of alternative to face to face classroom interaction will be effective in imparting the right knowledge in biochemistry. Several challenges identified are linked to not just money but is hinged around the curriculum structure of the biochemistry programme.

Conclusion: It is concluded that WhatsApp represents a potential means of instruction but may be hampered by challenges hinged on the curriculum structure of biochemistry

Keywords
Disposition; Challenges; Pandemic; COVID-19; WhatsApp

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Problem statement and analysis of the latest research

The emergence of the global pandemic novel coronavirus disease (COVID-19) affected all facets of human living in the year 2020. The novel coronavirus (SARS COV 2) disease which emerged from the city of Wuhan in China is said to be a respiratory tract disease that is traceable to a family of other coronavirus families [1, 2]. Owing to its high degree of transmission and the rate at which deaths were reported in different parts of the world, the World Health Organization (WHO) formally declared it as a public health emergency which the entire human race was to put hands together to combat [3]. The outbreak of this pandemic no doubt came with its attendant economic challenge as every nation kept struggling on how to reduce the spread [4].

In the wake of the global struggle, Nigeria announced its incident case COVID-19 on the 27th of February, 2020. Days after days, other cases were announced and in less than one month the cases were running into hundreds [5, 6].

As most nations declared compulsory stay at home orders so as to reduce congregation of people which is a ma-
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jor factor to the transmission of COVID-19, the Nigerian government also rose up to the task especially after putting the challenge faced by our health sector which led to a declaration of immediate vacation of all institutions of learning including primary and tertiary [6, 7]. In order to stand up to the challenges being faced and the need to continue academic activities in institutions, most primary, secondary and tertiary institutions gradually started transiting into online and distance learning systems by exploring several e-learning tools including the use of social media apps [8–10]. Although this new online learning interface adopted by most school in itself does not end the pandemic, it by all means reduces one on one contact between teachers and students and the proximity of student-student contacts during actual classroom learning since contact and congregation is a major means and factor that promotes the transmission of the disease.

The virulence and rate of transmission amongst people congregating led to the suspension of academic activities in the Nigerian school system which led to transition to various forms of online learning platforms. At the Delta state University, Abraka Nigeria, prior to the development of the Universities Distance Learning Platform, Faculties were encouraged to keep contact with their students through active online teaching and mentoring using the direct messaging app, WhatsApp. The application is known to work across several platforms which can be easily accessible amongst people of different ages. According to Gon and Rawekar [11] the WhatsApp application has features that allow the users to exchange different types of multimedia outside text such as pictures, videos, audios and the feature of dropping offline messages, calls, video calls and group chats of over a 100 persons. It has been successfully employed in the teaching of different courses in higher education which also includes medical education [9, 10].

Biochemistry is one of the important preclinical courses taken by most health professionals during training [13, 14]. The importance of Biochemistry was emphasized in 1977 by Margot Kogut [15] to be the bedrock of clinical practice. It is obvious that the COVID-19 pandemic-stimulated lockdown will impact on the training of health workers who are at the front line in the fight against the disease.

The objective of this research therefore was hinged on examining the disposition and challenges of students towards teaching and learning biochemistry using WhatsApp messenger as an alternative to the face to face interface during the COVID-19 pandemic. Therefore, two major research questions arose: Research question 1: What is the disposition of male and female undergraduate biochemistry students on the use of WhatsApp in teaching and learning? Research question 2: What is the challenge of second year and fourth year level undergraduate biochemistry students on the use of WhatsApp in teaching and learning?

Research Methods

Ethical Statement & Informed Consent
The approval for the research and its protocol was granted by the Departmental ethics and board of studies committee. The study was also conducted according to the declaration of Helsinki involving human subjects who made all participants to sign a written and informed consent.

Recruitment of Study Participants
The present study was a cross-sectional survey which was carried out using the 200 level (second year) and 400 level (final year) students of Biochemistry, Faculty of Science, Delta State University, Abraka, Nigeria as participants. Recruitment of participants was done through the WhatsApp group created for learning purpose and this was done after series of attempts by lecturers to teach the students as directed by the school management.

Instrument of Data Collection
A questionnaire titled Disposition and challenges of online learning through WhatsApp was developed by the researcher. It comprised of three sections. The first section was targeted at collecting the gender and level distribution of respondents. The second and third sections contained 11 items each containing statements that sought students’ opinion on their disposition towards the use of WhatsApp and challenges faced for teaching and learning of Biochemistry respectively. The statements were rated on a four point Likert scale of Strongly Agreed (SA), Agreed (A) Disagreed (D) and Strongly Agreed (SD). The respondents were free to tick their responses based on their level of agreement with the statements made.

Validity of the Instrument
The developed instrument for the study was validated by two experts at the Department of Biochemistry, Faculty of Science, Abraka, Nigeria. Based on their understanding of the underpinning challenges for the implementation of the biochemistry curriculum, they made necessary inputs and corrections and adjudged the instrument good enough to elicit responses on the disposition and challenges of students towards teaching and learning of biochemistry through WhatsApp. Thus they approve the instruments through face and content validity.

Reliability of the Instrument
The instruments reliability was not tested based on the existing online interface of the school system due to the COVID-19 pandemic. Hence the researchers relied only on the face and content validity.

Instrument Administration and Retrieval
The instrument was administered by attaching the questionnaire as a word document in the WhatsApp group created by each class for online learning. The objective and the aim of the study was explained to the students and they were required to fill the questionnaire and return through a designated email.
address within five days. At the end of the five days period, all returned questionnaire through the email was downloaded and printed and was examined for appropriateness and eligibility to be included in the data analysis process. At the end a total of 173 valid questionnaires were selected for analysis.

**Method of Data Analysis**

Responses of respondents were entered into the template of the computer software Statistical package of the social sciences version 23 (SPSS 23). This was followed by frequency counts and a mean analysis of the individual items. A benchmark of 2.5 was set as the minimum mean score to accept the statements made in each of the items. The choice of the 2.5 benchmark was made based on the average of the 4, 3, 2 and 1 points of the likert scale for scoring the responses (SA, A, D and SD). Based on the scores obtained per item, the researchers made adjudged the students disposition and the challenges faced by them towards the use of WhatsApp for teaching and learning of biochemistry.

### Results and Discussion

The respondents were made up of 27.7% males comprising 48 persons and 72.3% of females comprising of 125 respondents. Also, 49.7% comprising 86 200 level students and 50.3% comprising of 87 400 level students participated in the study (Table 1).

| Variable      | Frequency | Percentage |
|---------------|-----------|------------|
| Sex           |           |            |
| Male          | 48        | 27.7%      |
| Female        | 125       | 72.3%      |
| Level of Study|           |            |
| 200 Level (2nd Year) | 86    | 49.7%      |
| 400 Level (4th Year)  | 87    | 50.3%      |
| Total         | 173       | 100%       |

Table 1. Distribution of Respondents by gender and class of Study.

Table 2 presents responses of students regarding their disposition towards use of WhatsApp for teaching and learning of biochemistry. Based on the mean response scores, they rejected social networking as a design for other social activities and not for teaching and that they were not used to any form of electronic learning. It was also rejected by the respondents that learning biochemistry through WhatsApp will enhance students’ performance in biochemistry and that WhatsApp is not designed for learning. They were also not of the opinion that biochemistry lecturers cannot effectively use smart phones. On the other hand, respondents agreed that the network strength in Nigeria does not encourage use of WhatsApp in teaching and learning and that proper learning of biochemistry required a face to face contact because the methods used for teaching biochemistry is not applicable to WhatsApp. The respondents were also of the opinion that biochemistry students had no bright future if taught through WhatsApp and that it can’t be used by lecturers to pass all necessary information across to students. Concerns for the possibility of the app expiring at the time it is most needed were also raised by the students.

Previous studies have elicited on the use of WhatsApp and several social media and online platforms in teaching and learning in tertiary institution [16–18]. This assertion agrees with the present investigation that appraised the use of WhatsApp in the teaching and learning of Biochemistry. The observation made in this study reveals that the students quite have a level of positive disposition for teaching and learning. However, it may be hampered by several bottlenecks. Their rejection of the opinion that social networking is not designed for teaching gives a hint to their openness to the innovation of incorporating e-learning into their curriculum (Table 2). This openness of students to WhatsApp teaching has been previously reported by Alloy et al. [19] who reported positive attitudes and successful outcomes amongst Saudi Arabia students for the improvement of students-teachers interaction as a classroom support system. Likewise, Studies carried out by Amry [20] reported positive outcomes in the achievement test of a controlled experimental group using WhatsApp relative to classroom interaction. It is important to note that the students did not believe that using WhatsApp to teach will enhance their academic outcomes in Biochemistry. This submission is further given credence by their later agreement that biochemistry requires interaction as methods in biochemistry teaching are not easily applicable in WhatsApp.

The possible reason for this may be likened to the nature and structure of the biochemistry curriculum which most students have to learn several calculations and the drawing of biochemical structures thus lecturers may not be able to pass in detail all needed information that ought to be passed according to the students, they agreed that their lecturers can effectively use smart phones however the poor network strength in Nigeria may not encourage the teaching and learning of biochemistry properly. Their identification of network strength as a limitation to the use of WhatsApp for teaching biochemistry is similar to the limitations encountered by students of pathology in India as reported by Gon and Rawekar [11].

Data presented in Table 3 show details of students’ perceived challenges to the teaching and learning of biochemistry through WhatsApp. Challenges identified by the students were lack of money for data subscription purchase, inadequate network, inability to afford smart-phones, instability of unavailability of electrical power for charging of phone, hampering of teaching due to update of WhatsApp application. Other perceived challenges identified include students not being able to always come online for lectures, vulnerability to loss of course contents and materials in smart phones, the presence of several side distractions in smart phones and the inability to teach calculations and drawings via the WhatsApp application.

These identified challenges are similar to the identified problem and limitation faced by University students in Namibia.
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Table 2. Students Disposition towards use of WhatsApp in Biochemistry Lectures.

| S/N | Items                                                                 | SA | D  | A  | SD | Mean | SD  | Remark |
|-----|----------------------------------------------------------------------|----|----|----|----|------|------|--------|
| 1   | Social networking is designed for other social activities and not for teaching and learning | 26 | 58 | 45 | 44 | 2.31 | 1.01 | Reject |
| 2   | The network strength in Nigeria does not encourage the use of WhatsApp in teaching and learning | 48 | 69 | 51 | 5  | 2.9  | 0.83 | Accept |
| 3   | The method applied when teaching Biochemistry cannot be applied through WhatsApp | 89 | 64 | 17 | 3  | 3.38 | 0.73 | Accept |
| 4   | Seeing the lecturer face-to-face is required in learning Biochemistry     | 69 | 61 | 31 | 12 | 3.08 | 0.92 | Accept |
| 5   | I am not used to any form of electronic learning                        | 25 | 62 | 60 | 36 | 2.38 | 0.97 | Reject |
| 6   | I feel that learning through WhatsApp will enhance students’ performance in Biochemistry | 8  | 31 | 71 | 63 | 1.91 | 0.85 | Reject |
| 7   | WhatsApp is not designed for teaching and learning                      | 27 | 53 | 68 | 25 | 2.47 | 0.92 | Reject |
| 8   | I feel that Biochemistry lecturers cannot effectively use smartphone   | 15 | 19 | 85 | 54 | 1.97 | 0.88 | Reject |
| 9   | Biochemistry students do not have a bright future if taught through WhatsApp | 41 | 62 | 39 | 31 | 2.65 | 1.03 | Accept |
| 10  | Lecturers cannot use WhatsApp to pass all necessary information across to students | 76 | 60 | 27 | 10 | 3.16 | 0.90 | Accept |
| 11  | WhatsApp application can expire at the time it is needed most.          | 70 | 78 | 14 | 11 | 3.20 | 0.84 | Accept |

Table 3. Students Challenges in the teaching and learning of Biochemistry via WhatsApp.

| S/N | Items                                                                 | SA | D  | A  | SD | Mean | SD  | Remark |
|-----|----------------------------------------------------------------------|----|----|----|----|------|------|--------|
| 1   | Students’ need incentives to enable them use WhatsApp in learning     | 61 | 17 | 83 | 12 | 3.12 | 0.85 | Accept |
| 2   | Lack of money for data subscription discourages students from using WhatsApp to learn | 121| 7  | 45 | -  | 3.66 | 0.55 | Accept |
| 3   | Inadequate network hampers students’ use of smart-phone              | 88 | 3  | 70 | 12 | 3.40 | 0.698| Accept |
| 4   | Students cannot afford smart-phones that effectively use WhatsApp    | 31 | 18 | 65 | 19 | 2.63 | 0.90 | Accept |
| 5   | Students are not able to ask lecturers question through WhatsApp      | 18 | 21 | 50 | 84 | 2.38 | 0.83 | Reject |
| 6   | Electricity power is not readily available to charge the phone        | 94 | 4  | 65 | 10 | 3.44 | 0.71 | Accept |
| 7   | Students cannot be online all the time to receive lectures           | 101| 2  | 63 | 7  | 3.52 | 0.63 | Accept |
| 8   | Updating an expired WhatsApp application can hamper the teaching and learning process | 72 | 9  | 72 | 19 | 3.20 | 0.84 | Accept |
| 9   | Lecturers’ materials can easily be lost due to mismanagement of smart phone | 61 | 4  | 86 | 22 | 3.18 | 0.74 | Accept |
| 10  | Calculations and drawings in biochemistry is very difficult to understand through WhatsApp | 106| 2  | 48 | 17 | 3.49 | 0.72 | Accept |
| 11  | WhatsApp is surrounded with a lot of distractions                      | 107| 4  | 49 | 13 | 3.50 | 0.74 | Accept |

that tried to incorporate an online WhatsApp teaching method. They submitted in their study that the WhatsApp teaching impacted negatively on learning outcomes and experiences and that there was a variance on balancing online activities and academic preparations especially as it relates to assignment completion [16]. Also of importance is that the challenges faced in the incorporation of WhatsApp to the teaching of biochemistry in the face of the COVID-19 pandemic is not similar to those experienced by students and instructors in teaching of plastic surgery in the United Kingdom and Pharmacy students in Pakistan [9, 10].

Conclusions

It can be concluded that although students have a level of openness to using online teaching resources for biochemistry, they do not believe that the use of WhatsApp for teaching and learning biochemistry as a means of alternative to face to face classroom interaction will be effective in imparting the right knowledge in biochemistry. Several challenges identified are
linked to not just money but is hinged around the curriculum structure of the biochemistry programme.

Conflict of Interest
The authors declare that no conflicts exist.

Financial Disclosure
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References
[1] Rajab MH, Gazal AM, Alkattan K. Challenges to Online Medical Education During the COVID-19 Pandemic. Cureus [Internet]. 2020 Jul 2. Available from: https://doi.org/10.7759/cureus.8966

[2] Ahmed S, Jafri L, Majid H, Khan AH, Ghani F, Siddiqui I. Challenges amid COVID-19 times - Review of the changing practices in a clinical chemistry laboratory from a developing country. Annals of Medicine and Surgery [Internet]. 2020 Jul;55:300–304. Available from: https://doi.org/10.1016/j.amsu.2020.06.004

[3] WHO. WHO Director-General’s opening remarks at the media briefing on COVID-19 - 11 March 2020 [Internet]. 2020. Available from: https://www.who.int/director-general/speeches/detail/who-director-general-s-opening-remarks-at-the-media-briefing-on-covid-19—11-march-2020

[4] Olum R, Chekwech G, Wekha G, Nassozzi DR, Bongomin F. Coronavirus Disease-2019: Knowledge, Attitude, and Practices of Health Care Workers at Makerere University Teaching Hospitals, Uganda. Frontiers in Public Health [Internet]. 2020 Apr 30;8. Available from: https://doi.org/10.3389/fpubh.2020.00181

[5] Nigerian Centre for Disease Control (NCDC). Frequently asked questions on Coronavirus—29/02/20 [Internet]. 2020. Available from: https://covid19.ncdc.gov.ng/faq/

[6] Reuben RC, Danladi MMA, Saleh DA, Ejembi PE. Knowledge, Attitudes and Practices Towards COVID-19: An Epidemiological Survey in North-Central Nigeria. Journal of Community Health [Internet]. 2020 Jul 7. Available from: https://doi.org/10.1007/s10900-020-00881-1

[7] Ogolodom M, Mbaa A, Alazigha N, Erondo O, Egbe N, Golden I, et al. Knowledge, Attitudes and Fears of HealthCare Workers towards the Corona Virus Disease (COVID-19) Pandemic in South-South, Nigeria. Heal Sc J [Internet]. 2020;(Sp. Iss. 1):002. Available from: https://www.hsij.gr/abstract/knowledge-attitudes-and-fears-of-healthcare-workers-towards-the-corona-virus-disease-covid19-pandemic-in-southsouth-nigeria-28185.html

[8] Radha R, Kumar S, Saravanakumar A, Mahalakshmi K. E-Learning during Lockdown of Covid-19 Pandemic: A Global Perspective. Int J Control Autom [Internet]. 2020 Jun 1;13(4 SE-Articles):1088–1099. Available from: http://sersc.org/journals/index.php/IJCA/article/view/26035

[9] Hughes BA, Stallard J, West CC. The use of WhatsApp as a way to deliver plastic surgery teaching during the COVID-19 pandemic. Journal of Plastic, Reconstructive & Aesthetic Surgery [Internet]. 2020 Jul;73(7):e1–e2. Available from: https://doi.org/10.1016/j.bjps.2020.05.034

[10] Khan TM. Use of social media and WhatsApp to conduct teaching activities during the COVID-19 lockdown in Pakistan. International Journal of Pharmacy Practice [Internet]. 2020 Jul 26;10(2):ijpp.12659. Available from: https://doi.org/10.1111/ijpp.12659

[11] Gón S, Rawekar A. Effectivity of E-Learning through WhatsApp as a Teaching Learning Tool. MVP Journal of Medical Sciences [Internet]. 2020 Jul 7. Available from: https://doi.org/10.18311/mvpjms/0/v0/i0/8454

[12] Hockenberry M, Mulemba T, Nedege A, Madumetse K, Higgins J. Distance-Based Education for Nurses Caring for Children With Cancer in Sub-Saharan Africa. Journal of Pediatric Oncology Nursing [Internet]. 2020 Jul 13;37(5):321–329. Available from: https://doi.org/10.1177/1043454220938355

[13] Bunting PS, Goldberg DM. Education in clinical biochemistry: The canadian scene. Clinica Chimica Acta [Internet]. 1994 Dec;232(1-2):63–84. Available from: https://doi.org/10.1016/0009-8981(94)90163-5

[14] Maldonado-Frías S. Bioquímica. La importancia de las áreas básicas en la odontología. Revista Odontológica Mexicana [Internet]. 2013 Apr;17(2):74–75. Available from: https://doi.org/10.1016/S1870-199X(13)72019-6

[15] Kogut M. The uses of biochemistry in clinical medicine. Biochemical Education [Internet]. 1977 Jan;5(1):12–14. Available from: https://doi.org/10.1016/0307-4412(77)90012-7

[16] Mbukusa NR. Perceptions of students’ on the Use of WhatsApp in Teaching Methods of English as Second Language at the University of Namibia. Journal of Curriculum and Teaching [Internet]. 2018 Nov 18;7(2):112. Available from: https://doi.org/10.5430/jct.v7n2p112
[17] Gashegu J, Mfashingabo Fl, Shingiro AM, Mugisha D, Mokaya NN, Kiswezi A. Using WhatsApp Discussion Groups in Learning at Higher Education Institutions: The Experience with Level 1 University of Rwanda Medical Students in Anatomy. Rwanda Journal of Medicine and Health Sciences [Internet]. 2019 Mar 25;2(1):30. Available from: https://doi.org/10.4314/rjmhs.v2i1.6

[18] Correia A-P, Liu C, Xu F. Evaluating videoconferencing systems for the quality of the educational experience. Distance Education [Internet]. 2020 Sep 27;41(4):429–452. Available from: https://doi.org/10.1080/01587919.2020.1821607

[19] Albloy AM, Mohamed WM. Perceptions And Attitudes of Saudi Arabia University Students Towards Adopting WhatsApp As Students-teachers’ Interactive Tool. Advances in Social Sciences Research Journal [Internet]. 2019 Nov 17;6(11):93–109. Available from: https://doi.org/10.14738/assrj.611.7331

[20] Amry AB. The impact of WhatsApp mobile social learning on the achievement and attitudes of female students compared with face to face learning in the classroom. Eur Sci J [Internet]. 2014 Aug 29;10(22):116–136. Available from: http://eujournal.org/index.php/esj/article/view/3909

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Appendix

A QUESTIONNAIRE ON STUDENT’S CHALLENGES AND THEIR DISPOSITION TOWARD THE TEACHING AND LEARNING OF BIOCHEMISTRY WITH WHATSAPP

Department of Biochemistry,
Delta State University, Abraka

Date: ______________________

Dear Respondent,

Kindly complete the questionnaire below. The information to be provided is strictly for the purpose of research. All responses will be strictly confidential.

Yours Sincerely,
Fidelis Achuba

Section A: Respondents Personal data Instruction: Please tick (✓) in the box provided

(i) Sex: Male [ ] Female [ ]
(ii) Level of study: 200 [ ] 400 [ ]

Section B: Please tick (✓) only one option in each of the following statement: note that SA is Strongly Agree; A is Agree; SD is Strongly Disagree while D is Disagree

| S/N | Items                                                                 | SA | A | D | SD |
|-----|----------------------------------------------------------------------|----|---|---|----|
|     | Students’ disposition toward use of WhatsApp in Biochemistry lectures: |    |   |   |    |
| 1   | Social networking is designed for other social activities and not for teaching and learning |    |   |   |    |
| 2   | The network strength in Nigeria does not encourage the use of WhatsApp in teaching and learning |    |   |   |    |
| 3   | The method applied when teaching Biochemistry cannot be applied through the use of WhatsApp |    |   |   |    |
| 4   | Seeing the lecturer face-to-face is required in learning Biochemistry |    |   |   |    |
| 5   | I am not used to any form of electronic learning                     |    |   |   |    |
| 6   | I feel that learning through WhatsApp will enhance students’ performance in Biochemistry |    |   |   |    |
| 7   | WhatsApp is not designed for teaching and learning                   |    |   |   |    |
| 8   | I feel that Biochemistry lecturers cannot effectively use smart-phone |    |   |   |    |
| 9   | Biochemistry students do not have a bright future if taught through WhatsApp |    |   |   |    |
| 10  | Lecturers cannot use WhatsApp to pass all necessary information across to students |    |   |   |    |
| 11  | WhatsApp application can expire at the time it is needed most       |    |   |   |    |

|     | Students’ challenges in the teaching and learning of biochemistry: |    |   |   |    |
| 1   | Students’ need incentives to enable them use WhatsApp in learning   |    |   |   |    |
| 2   | Lack of money for subscription discourages students from using WhatsApp to learn |    |   |   |    |
| 3   | Inadequate network hampers students’ use of smart-phone            |    |   |   |    |
| 4   | Students cannot afford smart-phones that effectively use WhatsApp  |    |   |   |    |
| 5   | Students are not able to ask lecturers question through WhatsApp    |    |   |   |    |
| 6   | Electricity power is not readily available to charge the phone      |    |   |   |    |
| 7   | Students cannot be online all the time to receive lectures         |    |   |   |    |
| 8   | Updating an expired WhatsApp application can hamper the teaching and learning process |    |   |   |    |
| 9   | Lecturer materials can easily lose due to mismanagement of smart-phone |    |   |   |    |
| 10  | Calculations and drawing in Biochemistry is very difficult to understand through WhatsApp |    |   |   |    |
| 11  | WhatsApp is surrounded with a lot of distractions                  |    |   |   |    |
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Chukwudi Ogwu is a Nigerian academia and researcher. Born in the 1960s, he holds two doctorate degrees in Environmental Resources Management (Ecotoxicology) from Lagos State University, Lagos Nigeria and a second Doctor of Philosophy (Ph.D.) degree in Vocational Agriculture from Delta State University, Delta Nigeria. He has published many research articles in learned journals. Chukwudi Ogwu lectures in the Department of Vocational Education (Agriculture Education Unit) of Delta State University, Abraka.

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