Research Article

Colleges of education science student engagement in Emergency Remote Teaching amidst COVID-19 in Nigeria

Bello Ganiyu [a,1,*]

[a] Department of Science Education, Faculty of Education, University of Ilorin, P.M.B 1515, Ilorin, Nigeria
[1] bello.g@unilorin.edu.ng
[*] Corresponding author

ARTICLE INFO

ABSTRACT

There is paucity of studies on the affective, behavioural, and cognitive dimensions of student engagement under Emergency Remote Teaching (ERT) during COVID-19 pandemic, especially among pre-service science teachers in Colleges of Education in Nigeria. The purpose of this descriptive survey study was to examine the affective, behavioural, cognitive, and general level of engagement of pre-service science teachers in Colleges of Education in Kwara State, Nigeria in online ERT class. Purposive and snowballing sampling techniques were used to select six education colleges and 241 students which participated in the study respectively. The reliability coefficient of the online questionnaire used for data collection in the study was 0.81. The data gathered in this study were analysed using mean and independent t-test. The findings indicated that the level of student general engagement was high and there was significant gender difference in the levels of student behavioural engagement ($X^2(2) = 7.561$, $p = 0.023 < .05$) in favour of male students. It was concluded that Colleges of Education students' level of affective, behavioural, cognitive, and general engagement in ERT was high. The researcher recommended that students should extend their high level of general engagement in online ERT class to face-to-face classes after COVID-19 pandemic.

INTRODUCTION

Education has been widely acknowledged to be a potential tool for sustainable growth and development in every facet of the society. Indeed, the mandate of the education industry is to advance the frontiers of knowledge, socioeconomic transformation, wealth creation, poverty reduction, employment generation, and so forth (Griffin & Care, 2015). This has also been occurred in Nigeria to become a free and democratic society, a just and egalitarian society, a united, strong and self-reliant nation, a great and dynamic economy and a land full of opportunities for all citizens. It is obvious that the Nation relies on education sector for nation building in addition to sustainable socio-economic development. To achieve its mandate, education industry relies on teachers to

embark teaching and research (Adeyemo, 2010; Rokhman et al., 2017). It is thus, important for policy makers to place premium value on teacher education (Shen et al., 2009).

Education quality is believed as a crucial issue worldwide. However, in recent time, the quality of education in Nigeria has come under public scrutiny due to unsatisfactory performance of students in public examinations. Moreover, the high rate of declination enrolment in science subject (Aina & Ayodele, 2018) has been the undergirding reason for this public distrust. Stakeholders believe that the education quality has fallen below its standard. It has undergone progressive drop in the last two decades which resulted on student migration to other nations for better quality education. Indeed, Nigerian education was ranked the 124th position in the world and the 25th in Africa. Moreover, the literature accessed by Nigerian student in science subjects are unsatisfactory (Abimbola, 2013).

The trend of secondary school students' enrolment and performance in science subjects in the last decade showed that biology was the most popular science subjects among Nigerian students compare to Chemistry and Physics (The West African Examination Council, 2019). Enhancing student engagement in large classes often present enormous challenges (Barghaus et al., 2017). However, enrolment in biology is on downward trend in contrast to the upward enrolment trend in chemistry and physics. Also, the performances of students fluctuate with biology lagging behind chemistry and physics yearly. The trend of students' enrolment in science subjects at secondary school level has been observed to be the same with enrolment pattern in science teacher education especially at College level (Aina & Ayodele, 2018). According to the aforementioned researchers, the student number enrolled for biology in Colleges was higher than chemistry and physics. Hence, it behoove teacher educators to continuously focus their researches on how to improve student achievement (Sunday & Kola, 2014) and particularly on the quality of science teacher education programme. In view of the robust linkage between learning outcome and student engagement, it is imperative to improve both in-service and pre-service science teachers' level of engagement in the programme to ensure the production of high quality science teachers. In this direction, several studies have been conducted on student engagement as part of efforts to enhance learning outcome and quality education (Barghaus et al., 2017).

Student engagement has been indicated by student interest, and attention in learning activities in terms of curiosity, optimism, and passion. Students with high level of engagement often have high level of self-esteem and socially appropriate behaviours. This engagement arise from the realization of the sturdy impacts of cognitive, psychological, physical, social and behavoural factors on student learning and social development processes. Singh and Srivastava (2014) argued that students' engagement is characterize by their strong connections with the institution, learning, and development experiences. Not only are they motivated by getting engaged, but they are also, passionate, curious, and ready for academic and institutional activities. Hence, they regularly partake in collaborative learning activities by reading, discussion, working on projects, in addition to preparing for tests and examinations. Engaged students often display a high sense of belonging to the institution and feels proud to be active participants in institutional activities. In contrast, disengaged students often bring disruptions into the class and are even more problematic than the low achieving students (Spruit & Joosten, 2019). However, one of the huge teachers' challenges often encountered in the class is student engagement.

Acknowledging the crucial point of student engagement, reserachers focused their study on this matter. Some of them observed the differences of the engagement based on gender (Havik & Westergård, 2020; Teoh et al., 2013; Tison et al., 2011) and age. Meanwhile, some of them chose behaviour (Mohiuddin et al., 2018), affective, and cognitive (Ayub et al., 2017) as the objects observed.

In addition to the obstacles of student engagement cultivation challenges, student academic engagement in regular face-to-face class setting was abruptly interrupted by the sudden outbreak of COVID-19 pandemic in the last quarter of 2019. Globally, all education systems were shut down due to the minimization of social interaction to prevent the spread of the pandemic. Therefore, distance education started in the form of online Emergence Remote Teaching (ERT). However, problems were encountered in student participation in online distance education such as students inconvenience in attending online classes (Aguilera-Hermida, 2020; Knudson, 2020), the negative impact on student engagement (Perets et al., 2020), the additional responsibility on parents and siblings in terms of learning management, ERT accessibility, and students motivation (Garbe et al., 2020), as well as increasing and changing teachers' workload.

In view of the fact that under the prevailing COVID-19 pandemic, ERT became the predominant mode of instructional delivery globally. Having utilizing this mode, educators are still assessing its merits and failures (Perets et al., 2020). In addition, the former researchers also investigated various points related to ERT such as technological issues in delivering laboratory content (Gares et al., 2020), students' perception (Shin & Hickey, 2021; Tang et al., 2020). Although, gradually a clear pattern of students' perceptions, attitudes, experiences, and challenges in online ERT mode of instructional delivery is emerging from literature, a lucid pattern of student engagement level in online ERT amidst COVID-19 pandemic is yet to emerge.

Therefore, this study aimed at observing the level of student engagement among pre-service science teachers of Education Colleges in terms of affective, behaviour, and cognitive domains as well as in general way. The findings of this research will contribute to fulfill the paucity of studies which focused on student engagement under ERT mode of instructional delivery in the mist of COVID-19 pandemic. Thus, this can be the basic information as considerations for policy makers in education field.

METHODS

The descriptive-survey research design was adopted in conducting this study to describe general or specific behaviors and attributes of population. In this study, large data were collected and analysed to identify, measure, and describe student engagement level among pre-service science teachers in Education Colleges. Therefore, the researcher considered the descriptive survey design to be appropriate for this study.

Pre-service teachers in Colleges of Education in Kwara State were the population of this study. Purposive sampling method was used to select all the six Colleges of Education in Kwara State that switched over to the online ERT lectures during the COVID-19 pandemic school lockdown and students were mandated to stay-at-home. Snowball sampling technique was used to select 241 pre-service science teachers who completed the online questionnaire in the six selected Colleges of Education in Kwara State within a period of six weeks.

The research instrument used for data collection in this study was a questionnaire entitled Colleges of Education Student Engagement Questionnaire (COESEQ) which was adapted from Maroco et al. (2016). There were only four sections in the questionnaire .Section A sought for the biodata of the students, while sections B, C, and D sought for the level of the students' affective, behavioural, and cognitive engagement respectively. There were five items in each sections of B, C, and D. The reliability coefficient of the instrument was calculated with Cronbach alpha in which the value was 0.81.

The instrument (COESEQ) was administered online using Google Form. The Uniform Resource Locator (URL) for the online questionnaire was made available for science students through the research assistant in each of the six purposively selected Colleges of Education that switched over to online ERT during COVID-19 pandemic. The science students were encouraged by the research assistants to share the URL with other science students (snowball sampling) who were taking lectures through the online ERT in their college and colleagues in other Colleges of Education in Kwara State that adopted online ERT.

The data extracted from the completed online COESEQ on Google Form were subjected for descriptive and inferential statistical analyses. Specifically, response to each item in Sections B, C, and D was scored on 4-Point Likert Scale viz: always (4), sometimes (3), rarely (2), and never (1). The mean score of less than 2.00 was considered to be low engagement level, while those which between 2.00 and 3.00 indicated moderate engagement level, and the mean score above 3.00 was considered to be high engagement level.

RESULTS AND DISCUSSION

The data gathered in this study were subjected to both descriptive and inferential statistical analyses aided using SPSS version 21 software. The results of the analyses were presented in tables. The student affective engagement level through online ERT class during COVID-19 pandemic is determined based on their responses to the items in section B of the COESEQ. The analysis results of the responses are served in Table 1.

Table 1. Tha analysis results of student affective engagement level

Item	N	Sum	Mean	Std. Deviation
My Emergency Remote Teaching class is an interesting place to be	241	826	3.43	.727
I am interested in the Emergency Remote Teaching class works	241	824	3.42	.782
I feel excited about the Emergency Remote Teaching class works	241	799	3.32	.885
I like being at Emergency Remote Teaching class	241	792	3.29	.815
I don't feel very accomplished at Emergency Remote Teaching class lessons	241	720	2.99	.864
Aggregate Mean Score			**3.29**	

Based in Table 1, it can be clearly seen that the mean scores were in the range of 2.99 to 3.43 while the aggregate mean score was 3.29. Notwithstanding that the lowest mean value was 2.99, yet the aggregate mean score was within the range of high level of engagement. Hence, it can be stated that the student affective engagement level was considered to be high in the online ERT class during the COVID-19 pandemic.

These results suggested that the students were emotionally excited to resume academic activities through online ERT class when educational institutions were lockdown for several months to prevent further spread of COVID-19 pandemic. Such favourable emotional disposition might have enhanced students' interest in online

ERT lectures, thereby led to the observed high level of affective engagement. The results were a tell-tale sign that the students most likely found the online ERT class as an interesting place to learn. They became enthusiastic to complete class works, developed feeling of connectedness with online ERT as well as feeling of learning accomplishment. In addition, the absence of school environment stressors in online ERT mode of instruction might equally be a contributor to the students' high level of affective engagement. The result was consistent with several previous findings. Ayub et al. (2017) reported that student affective engagement during online classes tended to be at moderate level.

Furthermore, in term of gender difference, the level of student affective engagement in online ERT class during COVID-19 pandemic was tested using Independent Samples t-Test. The results of the test are served in Table 2.

Table 2. Independent samples t-test resuts for student affective engagement Level

Affective engagement	Levine's test for equality of variances		t-test for equality of means					95% confidence interval of the difference	
	F	Sig.	t	df	Sig. (2-tailed)	Mean difference	Std. error difference	Lower	Upper
Equal variances assumed	.798	.372	.239	.239	.811	.094	.393	-.679	.867
Equal variances not assumed			.252	166.350	.801	.094	.373	-.642	.830

Table 2 shows that the results of the Levene's test for equality of variances revealed that the mean variances between male and female were not significantly different (p = 0.37). Meanwhile, the t-test result showed that there was no significant difference in the level of student affective engagement in online ERT class during COVID-19 pandemic based on gender [$t(0.239)=0.239$, $p > 0.05$].

Students' behavioral engagement in online ERT class during COVID-19 pandemic was also observed in this study. This indicator was determined by analyzing students' responses on section C of the COESEQ. The analysis results of the indicator are served in Table 3.

Table 3. The analysis results of student behavioural engagement level

Item	N	Sum	Mean	Std. deviation
I followed the rules in the Emergency Remote Teaching class	241	866	3.59	.659
I paid attention during Emergency Remote Teaching class lessons	241	839	3.48	.731
I usually participated actively in group assignments during Emergency Remote Teaching class lessons	241	829	3.44	.820
I usually do homework given during Emergency Remote Teaching class lessons	241	812	3.37	.890
When I have doubted, I asked questions and participated in debates/discussions in Emergency Remote Teaching class lessons	241	778	3.23	.895
Aggregate Mean Score			**3.42**	

Table 3 depicts that the mean scores ranged from 3.23 to 3.59, while the aggregate mean score was 3.42. As the aggregate mean score was greater than 3.00, this means that student behavioural engagement level was considered to be high. In other words, the students actively participated in learning activities such as assignment completions, class discussions, question and answer sessions, and in addition adhered to class rules and regulations, among another student academic behaviour. The result was consistent with the findings of Al Mamun et al. (2016) which reported the high level of student behavioural engagement in self-paced online learning among students. This also partially compatible with the study of Ayub et al. (2017) who found that student behavioural engagement was tended to be at moderate level during online classes.

In contrast with the student affective engagement, the difference student behavioral engagement between male and female was significant [$t(0.239)$ = 2.875, p = 0.004]. The analysis results of the t-test performed are served in Table 4. The t-test was carried out after ensuring that the variance was homogene (p = 0.08)

Table 4. The analysis results of independent sample t-test for student behavioural engagement Level

Levene's test for equality of variances			t-test for equality of means						
	F	Sig.	t	df	Sig. (2-tailed)	Mean difference	Std. error difference	95% confidence interval of the difference	
Behavioural engagement								Lower	Upper
Equal variances assumed	3.098	.080	2.875	.239	.004	1.182	.411	.372	1.991
Equal variances not assumed			3.075	172.934	.002	1.182	.384	.423	1.940

The level of student cognitive engagement in online ERT class during COVID-19 pandemic was determined descriptively based on students' responses on section D of COESEQ. The detail analysis results are served in Table 5.

Table 5. The analysis results of student cognitive engagement level

Item	N	Sum	Mean	Std. deviation
When I read/listen during Emergency Remote Teaching class, I questioned myself to make sure I understand the topic I'm learning about	241	840	3.49	.725
If I do not understand the meaning of a word taught during Emergency Remote Teaching class lesson, I tried to solve the problem, for example by consulting a dictionary or asking someone else	241	836	3.47	.769
I tried to integrate topics /concepts from different subjects taught during Emergency Remote Teaching into my general knowledge	241	833	3.46	.724
I tried to integrate the acquired knowledge during Emergency Remote Teaching lesson in solving new problems	241	819	3.40	.741
I talked to other people on topics/matters that I learned in Emergency Remote Teaching class	241	790	3.28	.847
Aggregate mean score			**3.42**	

Table 5 serves the information that the mean scores ranged from 3.28 to 3.49 with the aggregate mean score was 3.42. These results implied that the level of student cognitive engagement was high as the aggregate mean score was greater than 3.00. This implies that the students consciously made intellectual efforts to correctly comprehend the topics taught in the online ERT classes. This might be the outcome of intellectually challenging content and instructional strategies employed in the online ERT classes. In addition, based on this finding, it is suggested that the students need to be engaged in collaborative learning through dialogue with their peers to clarify what they found in term of difficulties to understand. They also need to be engaged in self-learning by integrating new topics to what they already learnt to transfer their knowledge across disciplines to solve novel problems found. The results were in accordance with the findings of Ayub et al. (2017) who reported that student cognitive engagement tended to be at moderate level during online class.

Meanwhile, the difference of student cognitive engagement in online ERT class during COVID-19 pandemic between male and female was insignificant [t(239)= 1.248, p=0.213]. The t-test was done after ensuring that the variance of the two groups was homogene (p = 0.713) based on Levene's test. These all-test results are depicted in Table 6.

Table 6. Independent samples t-test for student cognitive engagement level

Levene's test for equality of variances			t-test for equality of means						
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
Cognitive Engagement								Lower	Upper
Equal variances assumed	.136	.713	1.248	239	.213	.449	.360	-.260	1.159
Equal variances not assumed			1.252	159.311	.198	.449	.348	-.237	1.136

The level of student general engagement in online ERT class during COVID-19 pandemic was investigated descriptively by analyzing student responses to all items in sections B, C, and D of the instrument (COESEQ) used for data gathering in present study. Table 7 serves the summary of the data analyzed.

Table 7. The descriptive analysis results of student general engagement level

Item	N	Sum	Mean	SD
I followed the rules in the Emergency Remote Teaching class	241	866	3.59	.659
When I read/ listen during Emergency Remote Teaching class, I question myself to make sure I understand the topic I'm learning about	241	840	3.49	.725
I paid attention in during Emergency Remote Teaching class lessons	241	839	3.48	.731
If I do not understand the meaning of a word, taught during Emergency Remote Teaching class lesson, I try to solve the problem, for example by consulting a dictionary or asking someone else	241	836	3.47	.769
I tried to integrate topics /concepts from different subjects taught during Emergency Remote Teaching into my general knowledge	241	833	3.46	.724
I usually participate actively in group assignments during Emergency Remote Teaching class lessons	241	829	3.44	.820
My Emergency Remote Teaching class is an interesting place to be	241	826	3.43	.727
I am interested in the Emergency Remote Teaching class works	241	824	3.42	.782
I tried to integrate the acquired knowledge during Emergency Remote Teaching lesson in solving new problems	241	819	3.40	.741
I usually do homework given during Emergency Remote Teaching class lessons	241	812	3.37	.890
I felt excited about the Emergency Remote Teaching class works	241	799	3.32	.885
I like being at Emergency Remote Teaching class	241	792	3.29	.815
I talked to other people on topics/matters that I learned in Emergency Remote Teaching class	241	790	3.28	.847
When I have doubted, I ask questions and participate in debates/discussions in Emergency Remote Teaching class lessons	241	778	3.23	.895
I don't feel very accomplished at Emergency Remote Teaching class lessons	241	720	2.99	.864
Aggregate mean score			**3.38**	

According to the Table 7, it can be seen that the mean scores ranged from 2.99 to 3.59 while the aggregate mean score was 3.38. As the aggregate mean score was in between the range of 3.01 and 4.00, it implied that, generally, the level of student engagement was considered to be high. Most likely the online ERT classes employed active learning strategies which enhanced the students' engagement. Furthermore, the students might have even been motivated to embrace ERT as the rewarding alternative platform to escape idleness and boredom associated with school lockdown during the COVID-19 pandemic. Besides, most tertiary educational institution students are digital natives and enthusiasts, so that they are often engaged in online activities. This might have contributed to the observed high level of engagement in online ERT class during the COVID-19 pandemic school lockdown. The novelty of online ERT mode of instruction could equally have stimulated and enhanced student engagement. This finding was consistent with the results of similar studies (Gares et al., 2020; Teoh et al., 2013). Yet, the results were, however, in contrast to Perets et al. (2020) who reported the low level of student engagement under ERT mode of instruction. These findings showed that in spite of challenges associated with online ERT mode of instruction (Aguilera-Hermida, 2020; Garbe et al., 2020; Gares et al., 2020; Knudson, 2020; Tang et al., 2020), student engagement level was not impacted negatively.

The assessment of student engagement in online ERT class during COVID-19 pandemic in gerenal was also done based on gender approach (Table 8). Table 8 shows two main points of the test. First, the variance of the two groups tested were homogene (p = 0.317). Second, there was no significant different of student engagement between male and female students in online ERT class during COVID-19 pandemic in general [$t(239)$ = 1.738), p = 0.083].

The observed high level of affective, behavioural, cognitive and general engagement in this study was indicative that the students were most likely at authentic level of academic engagement classification. The highest level of student engagement is characterized by meaningful learning, recognition of value of academic work, eagerness to learn, self-direction and transfer of knowledge, all of which are integral components of the three subclasses of student engagement. The participation of student in online ERT mode of instructional delivery was likewise indicative of their strong connections with their institutions, as well as readiness for academic work and institutional activities, all of which are attributes of highly engaged students as stated by Singh and Srivastava (2014).

Table 8. Independent samples t-test for students' general engagement level

General engagement	Levene's test for equality of variances		t-test for equality of means						95% Confidence interval of the difference	
	F	Sig.	t	df	Sig. (2-tailed)	Mean difference	Std. error difference		Lower	Upper
Equal variances assumed	1.004	.317	1.738	239	.083	1.725	.992		-.230	3.679
Equal variances not assumed			1.880	177.763	.062	1.725	.918		-.086	3.536

Gender difference in student engagement has been well researched. The findings of this issue in current study showed that gender difference does not exist in student affective engagement level. This finding implied that male and female students had similar emotional experiences and disposition during the COVID-19 pandemic school lockdown. However, the findings in this study also clearly revealed that there was significant difference in the level of student behavioural and cognitive engagements between male and female students. It is assumed that the stress from domestic choirs might have impacted negatively on female students who culturally engaged in more domestic works than male students. Hence, somehow, it can be the undergirding reason of the difference occur between male and female students in their behavior during their participation in online ERT learning activities. These findings are in accordance with the studies of Teoh et al. (2013) and Ayub et al. (2017) which recorded gender difference in online learning engagement. In other study, Tison et al. (2011) also reported the gender difference in student engagement based on the engagement types. In the other words, there might be several factors which played as intervening variables and influenced student affective, behavioural, and cognitive engagement levels differently. For instance, motivation (Osagie & Alutu, 2016), learning style (Ojeh et al., 2017), learning activity (Sata et al., 2015), perception (Reddy, 2017), and so forth.

The general student engagement level was, however, not influenced by gender as revealed in this study. These results suggested that the online ERT mode of instruction most likely provided gender neutral learning environment. Similarly, the absence of gender disparities and distractors in social and physical school climate in online ERT class could also, partially, accounted for the absence of gender difference in student general engagement level. As the results were inconsistent with many previous studies mentioned, the more detail investigation needs to be done to elaborate the possible factors associated with the different results. Thus, the more proper policies can be determined.

The inconsistency in the results of this study with previous studies may be due to the fact that student engagement levels were not assessed under the online ERT instructional mode in most previous studies as done in this study. Several intervening variables such large (face-to-face) class has been documented to be hindrance to student engagement (Barghaus et al., 2017). Moreover, the large classes existed in Colleges of Education, especially in Biology education programme (Aina & Ayodele, 2018) can be also the reason for different results. Yet, the results of this study indicated a high level of student engagement contrary to the fact in large face-to-face classes. These results tended to suggest that online ERT mode of instruction delivery annulled the problem of promoting student engagement in large (face-to-face) classes.

CONCLUSION

Summarily, there are findings of this study i.e. during online ERT class COVID-19 pandemic, the student engagement is high in terms of affective, behavior, cognitive as well as in general learning. Morever, based on gender approach, only in behavior aspect the difference exists significantly between male and female students, while in the affective and cognitive, as well as in general, the differences were insignificant. Therefore, based on these findings, several recommendations were made: 1) lecturers in Colleges of Education should employ dynamic learning activities to sustain the high level of student engagement in learning process post Covid-19 pandemic; 2) Colleges of Education science students should extend their high level of engagement in online ERT class during COVID-19 pandemic to the face-to-face class after the COVID-19 pandemic; 3) lecturers in Colleges of Education should employ gender-neutral active learning instructional strategies to eliminate gender difference in student behavoural engagement; 4) Colleges of Education lecturers should periodically assess students' level

of engagement in their courses and take appropriate steps to improve upon it; 5) there is a need for further studies on the underlying factors responsible for gender difference in student behavioural engagement.

REFERENCES

Abimbola, I. O. (2013). *The misunderstood word in science: Towards a technology of perfect understanding for all* (Issue The inaugural lecture; one hundred and twenty-third (123rd), p. 57). Library and Publications Committee, University of Ilorin. https://searchworks.stanford.edu/view/12855527

Adeyemo, S. A. (2010). Students' Ability Level and Their Competence in Problem-Solving Task in Physics. *International Journal of Educational Research and Technology*, *1*(2), 35–47. http://www.soeagra.com/ijert/vol2/7.pdf

Aguilera-Hermida, A. P. (2020). College students' use and acceptance of emergency online learning due to COVID-19. *International Journal of Educational Research Open*, *1*(July), 100011. https://doi.org/10.1016/j.ijedro.2020.100011

Aina, J. K., & Ayodele, M. O. (2018). The decline in science students' enrolment in Nigerian colleges of education: Causes and remedies. *International Journal of Education and Practice*, *6*(4), 167–178. https://doi.org/10.18488/journal.61.2018.64.167.178

Al Mamun, M. A., Lwarie, G., & Wright, T. (2016). Student behavioural engagement in self-paced online learning. *ASCILITE Adelaide 2016 Show Me The Learning*, 381–386. http://2016conference.ascilite.org/wp-content/uploads/ASCILITE-2016-full-proceedings-Updated-1512.pdf

Ayub, A. F. M., Yunus, A. S. M., Mahmud, R., Salim, N. R., & Sulaiman, T. (2017). Differences in students' mathematics engagement between gender and between rural and urban schools. *AIP Conference Proceedings*, *1795*(January 2017). https://doi.org/10.1063/1.4972169

Barghaus, K., Fantuzzo, J., LeBoeuf, W., Henderson, C., Li, F., & McDermott, P. (2017). Problems in Classroom Engagement: Validation of an Assessment for District-Wide Use in the Early Primary Grades. *Early Education and Development*, *28*(2), 154–166. https://doi.org/10.1080/10409289.2016.1197012

Garbe, A., Ogurlu, U., Logan, N., & Cook, P. (2020). Parents' experiences with remote education during COVID-19 school closures. *American Journal of Qualitative Research*, *4*(3), 45–65. https://doi.org/10.29333/ajqr/8471

Gares, S. L., Kariuki, J. K., & Rempel, B. P. (2020). Community Matters: Student-Instructor Relationships Foster Student Motivation and Engagement in an Emergency Remote Teaching Environment. *Journal of Chemical Education*, *97*(9), 3332–3335. https://doi.org/10.1021/acs.jchemed.0c00635

Griffin, P., & Care, E. (2015). *Assessment and teaching of 21st century skills*. Springer Dordrecht Heidelberg. https://doi.org/10.1007/978-94-017-9395-7

Havik, T., & Westergård, E. (2020). Do teachers matter? Students' perceptions of classroom interactions and student engagement. *Scandinavian Journal of Educational Research*, *64*(4), 488–507. https://doi.org/10.1080/00313831.2019.1577754

Knudson, D. (2020). A tale of two instructional experiences: student engagement in active learning and emergency remote learning of biomechanics. *Sports Biomechanics*, *00*(00), 1–11. https://doi.org/10.1080/14763141.2020.1810306

Maroco, J., Maroco, A. L., Bonini Campos, J. A. D., & Fredricks, J. A. (2016). University student's engagement: Development of the University Student Engagement Inventory (USEI). *Psicologia: Reflexao e Critica*, *29*(1). https://doi.org/10.1186/s41155-016-0042-8

Mohiuddin, M., Al Mamun, A., Syed, F. A., Masud, M. M., & Su, Z. (2018). Environmental knowledge, awareness, and business school students' intentions to purchase green vehicles in emerging countries. *Sustainability (Switzerland)*, *10*(1534), 1–18. https://doi.org/10.3390/su10051534

Ojeh, N., Sobers-Grannum, N., Gaur, U., Udupa, A., & Majumder, M. A. A. (2017). Learning style preferences: A study of pre-clinical medical students in Barbados. *Journal of Advances in Medical Education & Professionalism*, *5*(4), 185–194. http://www.ncbi.nlm.nih.gov/pubmed/28979913

Osagie, R. O., & Alutu, A. N. (2016). Factors affecting gender equity in the choice of science and technology careers among secondary school students in Edo State, Nigeria. *International Education Studies*, *9*(10), 231–236. https://doi.org/10.5539/ies.v9n10p231

Perets, E. A., Chabeda, D., Gong, A. Z., Huang, X., Fung, T. S., Ng, K. Y., Bathgate, M., & Yan, E. C. Y. (2020). Impact of the emergency transition to remote teaching on student engagement in a non-stem undergraduate chemistry course in the time of covid-19. *Journal of Chemical Education*, *97*(9), 2439–

2447. https://doi.org/10.1021/acs.jchemed.0c00879

Reddy, L. (2017). Gender differences in attitudes to learning science in grade 7. *African Journal of Research in Mathematics, Science and Technology Education*, *21*(1), 26–36. https://doi.org/10.1080/18117295.2017.1279450

Rokhman, F., Ahmadi, F., & Kusumaningtyas, R. D. (2017). The strategic role of teacher training institute (LPTK) in building professional teacher. *Advances in Social Science, Education and Humanities Research*, *118*, 23–32. https://doi.org/10.2991/icset-17.2017.5

Sata, Y., Wongpho, B., & Chankong, U. (2015). Development of a Learning activity management model with the community learning sources for environmental education. *International Forum of Teaching and Studies*, *11*(1/2), 13–23.

Shen, J., Gerard, L., & Bowyer, J. (2009). Getting from here to there: The roles of policy makers and principals in increasing science teacher quality. *Journal of Science Teacher Education*, *21*, 283–307. https://doi.org/10.1007/s10972-009-9180-5

Shin, M., & Hickey, K. (2021). Needs a little TLC: examining college students' emergency remote teaching and learning experiences during COVID-19. *Journal of Further and Higher Education*, *45*(7), 973–986. https://doi.org/10.1080/0309877X.2020.1847261

Singh, A. K., & Srivastava, S. (2014). Development and Validation of Student Engagement Scale in the Indian Context. *Global Business Review*, *15*(3), 505–515. https://doi.org/10.1177/0972150914535137

Spruit, M., & Joosten, P. (2019). Managing student engagement in higher education institutions: The case of curpa. In *Management and Administration of Higher Education Institutions at Times of Change* (pp. 167–187). https://doi.org/10.1108/978-1-78973-627-420191010

Sunday, S., & Kola, J. (2014). Improving Students' Academic Performance in Nigerian Schools: the Role of Teachers. *International Journal of Research in Humanities and Social Studies*, *1*(2), 1–6. https://www.ijrhss.org/pdf/v1-i2/1.pdf

Tang, T., Abuhmaid, A. M., Olaimat, M., Oudat, D. M., Aldhaeebi, M., & Bamanger, E. (2020). Efficiency of flipped classroom with online-based teaching under COVID-19. *Interactive Learning Environments*, *0*(0), 1–12. https://doi.org/10.1080/10494820.2020.1817761

Teoh, H. C., Abdullah, M. C., Roslan, S., & Daud, S. (2013). An Investigation of Student Engagement in a Malaysian Public University. *Procedia - Social and Behavioral Sciences*, *90*(InCULT 2012), 142–151. https://doi.org/10.1016/j.sbspro.2013.07.075

The West African Examination Council. (2019). *Release of provinsional results for the WASSCE for school candidates*. The West African Examination Council. https://www.waecgh.org/article/57/release-of-provisional-results-for-the-wassce-for-school-candidates-2019/

Tison, E. B., Bateman, T., & Culver, S. M. (2011). Examination of the gender-student engagement relationship at one university. *Assessment and Evaluation in Higher Education*, *36*(1), 27–49. https://doi.org/10.1080/02602930903197875