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ASSESSING THE IMPACTS OF PAUCITY OF FIELD ENGAGEMENTS IN GEOSCIENCE EDUCATION: A CASE STUDY OF PUBLIC UNIVERSITIES IN ANAMBRA STATE, NIGERIA

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Abstract

Field studies have long been recognized as effective in geoscience education, demonstrating successful and proficient learning outcomes. Therefore, the significance of field engagement in geoscientific education cannot be overstated. However, its lack, due to insecurity and lack of funds, has led to several effects on the students and the quality of geoscience education. One of these impacts is the diminishing interest of students in geoscience education. Hence, this study aims to investigate the relationship between the lack of field engagements and students' declining interest in the geoscience education system in public universities in Anambra State, Nigeria.

Additionally, it seeks to identify other negative consequences of the scarcity of field engagements on students and the overall quality of geoscience education in the study area. Geoscience students enrolled in public universities in the study area serve as the primary case studies. Data was collected using a questionnaire and analyzed through ordinal regression analysis to examine the correlation between declining interest in geoscience education and the limited availability of field engagement

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opportunities. The study's hypotheses suggest that the lack of field engagement significantly contributes to students' diminishing interest in geoscience education. The findings reveal insufficient funding, security concerns, and excessive student admissions as major factors hindering adequate field studies for geoscience students. As a recommendation, the study proposes the integration of practical field engagements into the geoscience education curriculum. It also advocates for collaborative partnerships between academia, industries, and non-governmental organizations (NGOs) to secure student funding and internship opportunities. Including dual internship terms in the geoscience department during the second and third years is suggested to sustain students' interest and enthusiasm in the geoscience education system. Implementing these recommendations can positively impact students' interest, enthusiasm, and overall learning outcomes in geoscience education.

Keywords
Geoscience, quality education, field engagement, Anambra State, paucity.

INTRODUCTION

Field engagement includes field trips and fieldwork, an outdoor group visit to a place of special interest (education, research, or exploration) for direct understanding, firsthand observation, and experience at such a noteworthy site (Donaldson, Fore, Filippelli, & Hess, 2020). The utilization of field engagements in teaching and learning realizes successful and proficient geoscience learning (Donaldson et al. 2020). It ensures that teachers and learners meet their obligations by guaranteeing its use to encourage learning valuable concepts and enable students to make abstract thoughts more concrete (Sitali-Mubanga, Lukonga, & Denuga, 2018). Furthermore, Sodipo (2014) opined that students' exposure to field engagements fosters team spirit, which is crucial for a successful field investigation.

However, some limitations have resulted in a declining rate of students' exposure to field engagements due to inadequate funding of university systems and insecurity (Ezeani, 2018).

Consequently, these limitations have led to the paucity or lack of field engagements in geoscience education, especially in public universities in Nigeria, resulting in a high rate of graduate um-employments, declining interest in geoscience education, inability to appreciate geologic structures in textbooks and classroom, and inability to recall theory-based concepts after examinations (Ogbonna & Ezeji, 2020). This study investigates the association between the lack of field engagement and the decline in students' interest in geoscience education within public universities in Anambra State, Nigeria. The research aims to determine whether the lack of field engagement contributes to the declining interest among students in geoscience education. Furthermore, the study sampled students' opinions in the study area. Finally, it conducted statistical analysis to prove or disprove the assumptions and identified other impacts of the lack of field engagements in the study area. This study aligns with experiential and situated learning theories, emphasizing the importance of hands-on experiences and authentic contexts in the learning process.

Experiential learning theory, proposed by David Kolb, posits that learning occurs through a cycle of concrete experience, reflective observation, abstract conceptualization, and active experimentation (Kolb, 1984). Field engagements provide students with concrete experiences in real-world geoscience settings, allowing them to actively engage with the subject matter and make meaningful connections. This experiential learning process helps students develop a deeper understanding of geoscience concepts and fosters the application of knowledge in practical contexts.

Situated learning theory, developed by Jean Lave and Etienne Wenger, emphasizes the importance of learning in authentic social and cultural contexts (Lave & Wenger, 1991). Field engagements provide students with opportunities to engage in situated learning, where they participate in geoscience activities alongside experts and peers, thereby immersing themselves in the professional practices and discourse of the discipline. By being situated in real-world geoscience environments, students develop a sense of belonging and identity as geoscientists, and their learning becomes more meaningful and applicable to real-world challenges.

REVIEW OF LITERATURE

Recently, the impacts of the paucity of field engagements have been voiced around Nigerian universities; hence, there are many studies on the relevance and impacts of the paucity of field engagements in Nigeria (Edinyang et al., 2015b; Emeke & Ezeokoli, 2018; Ezeani, 2018a; Ezeani, 2018b; Ogunode et al., 2021; Sodipo, 2014). However, few are in the public universities in Anambra state. In Nigeria, there have been many reports that most science graduates fail to meet the expectations of employers in earth science-related industries because they cannot be readily mobilized for fieldwork (Ezeani, 2018; Ogunode et al., 2021). Due to the country's economic challenges, many companies do not have the financial capacity for intensive field training of entry-level graduates. For this reason, most science graduates from public universities in Nigeria are regarded as unemployable (Ezeani, 2018; Noor, 2011). This misfortune is often attributed to the poor funding of public universities, lack of quality lecturers, reduced interest in education, and corruption in tertiary institutions (Ezeani, 2018b; Ogunode et al., 2021). While the problems mentioned above contribute to the degrading quality of sciences graduates from most public universities in Nigeria, the lack or inadequate exposure to field engagements has been assumed to be the primary reason for the un-employability of geoscience graduates in particular (Sodipo, 2014). This is because geology, as a branch of science, uses the field as its laboratory. Most theoretical-based studies in geoscience, such as geologic structures and landforms, which are taught in class in their abstract form, may not be clearly understood if the students are not exposed to field observations. Therefore, it may be practically impossible to acquire the required industrial skills through theoretical studies alone.

Talking more about the impacts of a lack of field investigations, Edinyang et al. (2015) observed that most graduates, though with excellent grades and good theoretical backgrounds, could not carry out basic site investigations in the field. The graduates' inability to carry out basic site investigations was attributed to inadequate field engagement during their undergraduate studies. This observation made by Edinyang et al. (2015) is a serious issue bedeviling most recent graduates in Nigeria.

While it has been generally assumed that the un-employability of the geoscience graduate could be attributed to the lack of or inadequate exposure to field engagements, there have been only a few works to back up this assumption. For this reason, it becomes imperative to sample the opinions of the people (postgraduates, recent graduates, and undergraduates) that are directly involved in geosciences. This will help to ascertain the factual cause and implications of inadequate field engagement in geoscience education in Nigerian public universities. Furthermore, the derived knowledge from the study will help the targeted audiences and the country at large to realize the implications of the lack of field engagements in the geoscience system of education.

METHODOLOGY

The ordinal qualitative statistical analysis, which involves ranking responses, was employed to analyze the responses obtained from the participants. This approach allowed for examining the relative order and magnitude of the responses on the Likert scale. Additionally, nominal quantitative statistical analysis, which entails naming or classifying responses, was utilized during the data analysis. This allowed for categorizing and identifying distinct response patterns within the data set. A comprehensive understanding of the participants' perspectives and trends in their responses was achieved by employing ordinal and nominal analyses.

Objectives

To investigate the impacts of paucity of field engagements in geoscience education, this study will carry out the following objectives:

1. Investigate if the lack of field engagement contributes to the declining interests of students in the geoscience education system in the study area.
2. Examine other consequences of the impacts of lack of field engagement on students and in the geoscience system of education in the study area.
3. Evaluate the rate of geoscience students' participation in field engagements.
4. Evaluate the rate at which students appreciate scales of geologic structures without actually seeing them on the field.
5. Investigate geoscience students' ability to recall theory-based topics.
6. Investigate students' perception of the possible causes of lack of field engagement and how to reduce the effects.
7. Discuss possible solutions to the lack of field engagements.

Data analysis and hypothesis

The collected data were subjected to an in-depth analysis using ordinal regression analysis to examine the relationship between the dependent variable – participants' declining interest in geoscience education amidst the scarcity of field engagement opportunities. In addition, this analysis aimed to determine if a significant association existed between the dependent and independent variables.

The analysis in this study focused on the participants' interest in geoscience education in relation to the lack of field engagements in the study area. The participants' responses were used as the dependent variable and measured using a five-point Likert scale. The numerical values assigned to the responses were as follows: strongly agree (5), agree (4), neutral (3), disagree (2), and strongly disagree (1). This value assignment facilitated the statistical analysis of the collected data, ensuring ease of interpretation and analysis.

The analysis in this study included several independent variables and their corresponding numerical ratings/values. These variables consisted of the participants' academic level (postgraduate, 400 level, 300 level, and 200 level), their ability to appreciate scales of geologic structures (rated as Excellently appreciated (5), Well appreciated (4), Fairly appreciated (3), Poorly appreciated (2), and None appreciated (1)), and the number of field exposures they had experienced (rated as 4 and above (5), 3 (4), 2 (3), 1 (2), and Not even once (1)). These independent variables were selected assuming they could potentially influence the participants' interest in geoscience education in the context of the limited field engagement in the study area.

After eliminating missing values and irrelevant columns, the data were prepared in MS Excel. The transformed data, categorized as ordinal and nominal variables, were imported into IBM SPSS Software (version 28). To examine the significance of the relationship between the participants' interest in geoscience education and the lack of field engagement, an ordinal regression analysis was performed with the following test hypotheses:

a) Null Hypothesis (H_0): Lack of field engagement does not significantly contribute to the declining rate of students' interest in geoscience education in the study area.
b) Alternative Hypothesis (H_A): Lack of field engagement significantly contributes to the declining rate of students' interest in geoscience education in public universities in the study area.

A significance level of 0.05 was used for the statistical analysis, and the relationship between the dependent and independent variables was assessed using the goodness of fit (chi-square) test. IBM SPSS version 28, a widely recognized software package for statistical analysis, was utilized for these analyses.

Furthermore, descriptive statistics were employed to provide summary statistics of the data. Measures such as the total, mean, standard deviation, minimum, and maximum were computed to summarize the data distribution. Excel spreadsheets presented the results in clear and visually appealing tables and charts.

Notably, the current study shares similarities with the research conducted by Regina et al. (2021), which investigated the factors influencing students' academic performance at Njala University, Sierra Leone. Their study also employed a significance level of 0.05 and identified study time as one of the factors affecting students' performance.

Research questions

This study aimed to answer the following questions:

1. How well are geoscience students exposed to field engagements?
2. Are students still interested in the geoscience education system amidst insufficient field exposure?
3. Is lack of adequate funding and insecurity among the significant causes of lack of field engagements?

4. Is there a need for curriculum adjustment to accommodate multiple internships before graduation to encourage industry and field experience?
5. Can virtual field engagement substitute physical field engagements?
6. What can be the available solutions to reduce the impacts?

Methods

The target population for this research comprised geoscience students, including postgraduates, and those in the 400 level, 300 level, and 200 level of their programs, enrolled in the two public universities within the study area. Through a random sampling technique, a total of 251 responses were obtained from the participants, ensuring a diverse representation across academic levels. A structured, closed-ended questionnaire (Table 7) was administered to collect responses from the participants, which were measured using Likert scales to assess their level of agreement. First-year students were excluded from participating in this investigation because it was assumed they had inadequate or insignificant knowledge about the field of study; hence, it could introduce bias to the derived information. The research questions in the questionnaire were divided into three sections to get the participants' responses on the impacts, causes, and how to curb the effects of the paucity of field engagements in the study area. The responses collected were categorized on a five-point Likert-scale formula: Strongly Agree (SA), Agree (A), Strongly Disagree (SD), and Disagree (D). However, some of the questions required a response of either Yes, No, or Maybe. The questionnaires, in the form of Google Forms, were distributed by WhatsApp group chat links sourced from the departmental presidents and course representatives of the concerned universities.

Tools

This study was targeted at the universities within the study area of the authors, and samples were distributed in other to get a wide range of people that are directly involved in geosciences, such as undergraduate students (400L, 300L, and 200L), postgraduates of the two public universities in Anambra state, Nigeria.

Questionnaire: The questionnaire comprised 11 questions designed to get the students' opinions concerning the problem in a Google form format.

Microsoft Excel: MS Excel Software was used to analyze the data generated from the students' responses.

SPSS Software: The IBM SPSS version 28 was employed to conduct advanced statistical analyses and generate meaningful insights from the collected data.

Study area

The study area is located in Anambra state, in southeastern Nigeria. This area has a population of about 5,527,809 (National Bureau of Statistics, 2016), distributed in numerous towns and villages.

There are various primary and secondary institutions estimated to be 1,292 (World Data Atlas, 2021). In addition, there are about 29 tertiary institutions in the state, only two of which are public universities. One of these public universities is owned by the Federal government, while the State government owns the other.

The relatively high volume of educational institutions resulted in a high literacy rate within the state, estimated by the National Literacy Survey 2010 body to be 75.1%. In addition, females contributed 68.8% to the literacy rate, while males contributed 78.9% (National Literacy Survey, 2010).

RESULTS AND DISCUSSION

This section provides comprehensive interpretations and discussions of the study's findings. The results are presented and discussed under two main categories: inferential observations and descriptive observations. The inferential observations focus on the outcomes of the ordinal regression analysis, while the descriptive observations utilize summary statistics to explore the various effects of the lack of field exposure on the participants, as indicated by their responses. To ensure a comprehensive interpretation of the observed responses, the descriptive observations are further divided into the following subsections: participants' details, impacts of the paucity of field engagements on participants in the study area, potential causes of the scarcity of field engagements in the study area, and possible strategies to address this declining trend. Organizing the descriptive observations into these subsections enabled a holistic understanding of the participants' experiences and the wider implications of the lack of field engagement.

Inferential observations

This subsection presents the inferential observation, which entails interpreting and discussing the results obtained through the ordinal regression analysis. The primary objective of this analysis was to ascertain if there exists a significant relationship between the declining interest of participants in geoscience education and the limited availability of field engagement opportunities. By examining the relationship between the dependent and independent variables, valuable insights were gained regarding the influence of inadequate field engagements on the participants' interests in geoscience education. The subsequent sections provide a thorough exploration of the findings and their profound implications, providing statistical evidence and interpretations to support the research hypotheses and shed light on the relationship between participants' declining interest in geoscience education and the lack of field engagements.

Ordinal regression analysis results and discussions

Table 1 presents the case processing summary of the ordinal regression analysis, providing a comprehensive overview of the individual contributions of the dependent and independent variables.

The statistical significance of the model was assessed using the test result presented in Table 2. At a significance level of 5%, the analysis revealed a lower significant chi-square statistic ($p = .000$), indicating that the final model significantly fits the baseline or intercept-only model. The inclusion of independent variables such as participants' level, frequency of field engagement, and appreciation of geologic scales has proven to be instrumental in enhancing the baseline model.

Table 3 displays the results of the Chi-square test of goodness of fit, which examined the relationship between the categorical independent variables and the categorical ordinal dependent variable. The null hypothesis of this test assumes no relationship between the two categorical variables, indicating that knowledge of one variable does not aid in predicting the value of the other variable. Conversely, the alternative hypothesis suggests a dependence between the variables, meaning that knowledge of one variable contributes to predicting the value of the other variable.

Based on the output presented in Table 3, the p-value for the Pearson Chi-square test is 0.977 ($p>0.05$). This indicates that the null hypothesis is rejected in favor of the alternative hypothesis for the two categorical variables. Thus, significant relationships exist between the dependent variable and each of the categorical independent variables considered in the ordinal regression analysis.

The pseudo-R-square, as shown in Table 4, provides insight into the amount of variance explained by the independent variable. Nagelkerke's pseudo-R2 statistics were employed to estimate the variance explained by the independent variables in the ordinal logistic regression model. The pseudo-R-square values (Nagelkerke = 0.134 = 13%) presented in Table 4 indicate that the ordinal logistic regression model, along with its independent variables, accounts for a relatively small proportion of the variation observed between the independent and dependent variables. This suggests that including additional independent variables is necessary to enhance the comprehensiveness of the analysis. Therefore, future studies should consider incorporating a more comprehensive set of independent variables to further investigate the case study.

Table 5 presents the parameter estimates and their significance, providing insights into the impact of each independent variable on the dependent variable. The p-value, when below 0.05 ($p < 0.05$), leads to the rejection of the null hypothesis in favor of the alternative hypothesis. The null hypothesis assumes no contribution of each independent variable to the dependent variable, while the alternative hypothesis contradicts this assumption.

Table 5 shows that the *levels of the participants* exhibit a significant value of 0.03, falling below the 0.05 threshold. Consequently, we accept the null hypothesis, leading us to conclude that the levels of the participants (Postgraduates, 400 level, 300 level, and 200 level) do not significantly contribute to the declining interest in geoscience education among participants (Table 5).

On the contrary, the null hypothesis is rejected when evaluating the second independent variable, *Appreciated_scales,* in relation to the dependent variable. *Appreciated_scales* represent the extent to which participants appreciate scales of geologic structures without real-life experiences. The ordinal regression model estimates that participants who have a poor appreciation for scales of geologic structures in the classroom, indicated by *Appreciated_scales*=2, have the highest positive estimate, suggesting a greater contribution to the declining rate of interest in geoscience education compared to other response categories (Table 5).

With a significant value of 0.181, which exceeds the threshold of 0.05, the null hypothesis is rejected in favor of the alternative hypothesis. Thus, the conclusion is that the participants' inability to appreciate scales of geologic structures in the classroom and through textbooks, without actual field experience, contributes to the declining interest rate in geoscience education among the participants.

Furthermore, Table 5 illustrates that according to the regression model estimates, the category of participants who have not engaged in fieldwork even once (Times_of_field_engagement=1) demonstrates the lowest contribution to the decline in participants' interest in geoscience education. This suggests that the *Not even once* category has the least impact on participants' declining interest compared to other response categories. It is important to note that the observed percentage of responses for this category is relatively low (3.8%), as shown in Table 1 and could be the results of the observed outcome. However, it is significant to highlight that the p-values for all categories exceed the 0.05 threshold. These findings provide statistical evidence to reject the null hypothesis, accept the alternative hypothesis, and conclude that a lower number of field engagements significantly contributes to the decline in participants' interest in geoscience education. In other words, as the amount of field engagement decreases, there is a corresponding increase in the drop in students' interest in geoscience education.

Table 6 is the result of the test of parallel lines, which evaluates whether this assumption holds or not. It does so by examining the significance of the p-value associated with the test. If the p-value is greater than the chosen level of significance, alpha (α=0.05), it suggests that the assumption of parallel lines is valid and the relationship between the independent variables and the outcome is consistent across the categories. Hence, we fail to reject the null hypothesis. On the other hand, if the p-value is less than alpha, it indicates a violation of the parallel lines' assumption, implying that the effect of the independent variables varies across the categories of the dependent variable giving support to the alternative hypothesis.

Based on the findings from the test of parallel lines in the ordinal regression analysis, the obtained p-value of 0.002 indicates statistical significance at a predetermined significance level of 0.05 (Table 6). Consequently, we reject the null hypothesis and provide evidence to support the notion that the paucity of field engagement significantly contributes to the declining rate of students' interest in geoscience education in public universities in Anambra State, Nigeria.

These results suggest that students who have limited exposure to field engagements in geoscience education are more prone to experiencing a decrease in their interest in the subject. The practical experience gained through field engagement plays a pivotal role in sustaining students' enthusiasm and interest in geoscience education.

The outcomes underscore the importance of integrating field engagement opportunities into the geoscience education curriculum of public universities in Anambra State, Nigeria. By providing students with hands-on experiences in the field, educational institutions can potentially enhance students' interest, engagement, and overall learning outcomes in geoscience education.

It is crucial to acknowledge that the statistically significant result establishes a relationship between the lack of field engagement and the decline in interest in geoscience education. Nonetheless, further research and investigation are recommended to explore additional factors that may influence students' interest and to develop comprehensive strategies for effectively addressing this issue.

Descriptive observations

In this subsection delves into the descriptive observations derived from the participants' responses, which shed light on the multifaceted impacts of the paucity of field engagements on geoscience students. Through the use of summary statistics, charts, and tables, we explore the broader effects and implications of the lack of field exposure on their educational experiences and overall interest in geoscience education.

Participants' details

The data reveals that out of 251 total numbers of participants, 55% are from Nnamdi Azikiwe University (NAU), whereas 45% are from Chukwuemeka Odumegwu Ojukwu University (COOU) (Fig. 1). Postgraduate and 400-level students comprise of 18% each of the total respondents, whereas 300 level and 200 level students comprise of 39% and 29% (Fig. 2), respectively.

The respondents' ages range between 16–30, with a mean range of about 21 years (Table 8a and 8b). This implies that all the participants are adults since none was below the age of 16 years, which is regarded as the minimum age of adulthood (Sawyer et al., 2018).

Impacts of the paucity of field engagements on students

From the results of the analysis, Figure 3 shows that 54%, 62%, 59%, and 45 % of the postgraduate, 400-level, 300-level, and 200-level students, respectively, which is more than half of the sample population, strongly agreed that the paucity of field engagement is among the major reasons for the declining rate of students' interest in geoscience. Figure 3 also presents that out of the total responses, none of the postgraduate and 400-level students and 5% and 10% of the 300-level and 200-level students, respectively, strongly disagree that geoscience students are losing interest in geoscience education due to insufficient fieldwork. The disparity of results here might result from some hierarchical experiences, as the postgraduates must have had more experiences in geoscience education relative to the 200 and 300 levels with probably little appreciation of the system. For this reason, despite the relatively small turn-up of postgraduates, their answers are considered more relevant than that of the other classes of the participants. This result agrees with the observation of Boyle et al. (2007), who observed that the insufficient provision of firsthand experiences through field engagements had been one of the major causes of the fast-declining rate of students' interest in geoscience. The effects have also contributed to the declining rate of geoscience graduates' employability (Bassey & Atan, 2012; Noor, 2011), as they fail to possess the requisite employers' expectations.

In addition to the high un-employability rate of geoscience graduates, which is a socio-economic consequence of the lack of field engagements (Eneji et al., 2013), lack of field engagements through insufficient hands-on experiences has also triggered personality deprivation among geoscience students in the study area. Figure 4 reveals that 70% of postgraduate, 75% of 400-level, 75% of 300-level, and 47% of 200-level students, which constitutes more than half of the sample population, feel intimidated or discouraged among their colleagues who have more field experience than them. This result, compared to the 27% of postgraduates, 10% of 400 level, 8% of 300 level, and 15% of 200 level students that responded *No,* can agree with the observations of Boyle et al. (2007), who lamented that self-humiliation and intimidation could result into generally loss of interests in their course of study. However, this result is contrary to the observations of (Behrendt & Franklin, 2014), who examined the importance of science field trips as educational tools to connect students to classroom concepts.

The study also showed that even the postgraduate and the 400-level students, who are thought to have familiarized themselves with the system, feel intimidated by their colleagues.

This could possibly be a result of their inability to contend in terms of field experience with such colleagues who do more field work, hence, triggering its associated self-humiliation. This outcome is attributed to students' inability to appreciate scales of geologic structures in classrooms, and textbooks, without real-life experiences. Figure 5 reveals that 20% of postgraduate and 400-level students altogether do not appreciate scales of geologic structures without seeing them in real life. In contrast, a higher percentage of the postgraduates, 400-level, 300-level, and 200-level, respectively, fairly appreciate scales of geologic structures without seeing them. From the result also, insufficient field experiences have deprived students of the sense of visualization, promoting fictional, non-concrete knowledge of geologic structures. And this has resulted in students' inability to appreciate the scale of geologic structures – such as landforms, faults, etc., as described in textbooks and slides. Of course, this result justifies geoscience as physical science and that field engagement, which is one of its strongholds, cannot be efficiently substituted for in geoscience education (Cliffe, 2017; Duncan, 2012).

Again, from the analysis of the responses, the low self-esteem among recent graduates could result from insufficient hands-on experiences from field activities. Figure 6 shows that 25% of the postgraduates and 8% of 400-level students have not been to fieldwork more than three times, whereas 2% have not been to fieldwork even once. This effect might be one of the contributing factors to the declining rate of geoscience graduates' employability (Longe, 2018). The relatively higher percentages of *not even once* responses, from the undergraduate students, especially in the 300 and 200 levels (Fig. 6), are discouraging about the employability rate of geoscience graduates in the nearest future as these students are going to be the future graduates.

The relatively higher percentage of *4 times and above* responses (22%) from postgraduate students compared to other classes of participants in Figure 6 is perhaps possible as it is expected that an average postgraduate should be equipped with field experiences. But on a contrary note, the relatively low percentage of *4 times and above* from 400 and 300 levels is imbalanced. This is one of the reasons why students poorly appreciate the scale of geologic structures and, thus, feel intimidated amidst their colleagues who do more fieldwork.

In addition to the difficulty of students appreciating the scale of geologic structures in the classroom, Figure 7 presents that more than half of the respondents agree that lack of field engagement has also contributed to students' inability to recall theory-based geoscience concepts and topics after the exam. Figure 7 reveals that 60% of postgraduate and 400-level students each replied *Yes* – that they find it difficult to recollect most theoretical concepts and topics even after writing the exams. In comparison, 15% and 10% of postgraduates and 400-level students, respectively, replied *No* to the statement. In as much as the number of responses from postgraduates and 400-level students is relatively smaller than the other classes of participants, their answers are considered to have more weight as it is believed that they must have had a better understanding of the system. In this effect, the percentages of that postgraduates and 400 level students that replied *Yes* in Figure 7 pinpoint that teaching the geoscience concepts without associated field experiences is making teaching and learning aimless since most of them are hardly recalled. This effect has contributed enormously to lowering the standards of geoscience education.

The high percentage of *Yes* responses from postgraduates indicates why students pass through the system without the system going through them (Samuel et al., 2012). Samuel et al. (2012) were worried about the recent reports of students not passing through the system of education, which hiked the unemployability rate among recent graduates. In other words, the highest percentage of *Yes* responses (77%) from the 300-

level class of participants shows that the system may continue to produce half-baked geoscience graduates who neither meet employers' expectations nor have the requisite competencies to compete in the labor market. And such results steer low graduates' employability rates, as Noor (2011) submitted.

Figure 8 reveals future perceptions of students on the current trend of geoscience in their schools. From the figure, 5%, 15%, 20%, and 20% of postgraduate, 400 level, 300 level, and 200 level respectively responded *Yes*; that with the current trend of geoscience education, they will practice geoscience as their future career. Figure 8 also reveals that 60%, 42%, 55%, and 38% of postgraduate, 400 level, 300 level, and 200 level students responded *No*. A similar percentage of 35%, 40%, 24%, and 42% of postgraduate, 400 level, 300 level, and 200 level students responded *Maybe* to the research question. The trend of *Maybe* and *No* responses from the analysis of the result shows that most students in the study area are not sure about practicing geoscience as their future career. This could probably result from being tagged unemployable in the labor market due to inadequate firsthand experience in the field.

The decline of students' interest in geoscience, as observed from the trend of the responses, could also as a result of students finding teaching and learning difficult without firsthand experience from field engagements. Again, this loss of interest could arise from students' inability to appreciate scales of geologic structure in textbooks and classrooms. These trends of responses agree with (Samuel et al., 2012), who lamented the increasing rate of *half-baked* geoscience graduates who passed through the system without the system passing through them.

Possible causes of the paucity of field engagements in the study area

It is doubtful that the causes of the paucity of field engagements in the geoscience system of education in the study area are deliberate, as no one would attempt to bridge such an experimental platform of geoscience education. Recently, the major reasons behind the paucity of field engagement in the study area are lack of funding in institutions and insecurity (Ezeani, 2018; Ogunode et al., 2021). It is factual that the field is the geoscience's laboratory and it is requisite for geoscience cognitive learning (Petcovic et at., 2014). At times, places of special intrigue are usually far off the comfort zones and thus require many preparations in terms of mobility funding, renting of equipment, and accommodation. In such cases, many necessary arrangements must be set before going to the field. In the situation of insufficient funding, it becomes one of the major causes of the lack of field engagements, especially in public universities (Ogunode et al., 2021). Figure 9 shows that 68%, 50%, 60%, and 48% of postgraduate, 400-level, 300-level, and 200-level students, respectively, strongly agreed that lack of funding and insecurity are the major causes of the paucity of field engagement in their universities. The trend of the responses here shows that more than half of the respondents have experienced the associated effects of lack of field engagement due to the inadequate security conditions in their various areas and inadequate funding needed for satisfactory field engagements.

The higher percentage of *strongly agree* and *agree* responses relative to other classes of responses from participants in Figure 9 suggests that poor funding and insecurity have contributed enormously to the deteriorating quality of geoscience education in the study area. This result is in line with the finding of Ogunode et al. (2021), who disclosed that the lack of adequate funding and sponsorships from the government and other NGOs for public universities is responsible for the deteriorating quality of the geoscience education system in public Universities in Nigeria.

Possible ways to curb the impacts of lack of field engagements

Seeing insufficient funds and insecurity as the major causes of the retrograde culture in the study area, this subsection discusses the possible strategies to reduce its effects on the geoscience system of education. Knowing a problem is the first step to solving it. To reduce the impacts of paucity of field engagements in the geoscience education, efforts must be made to generate funds for sufficient field engagements.

In the lights of funds generation, geoscience departments should collaborate with international geoscience communities to attract grants needed for field studies. Figure 10 reveals participants' responses to this fund-raising idea. It reveals that 72%, 74%, 78%, and 68% of postgraduate, 400-level, 300-level, and 200-level, respectively, strongly agree that geoscience departments should collaborate with international geoscience communities for fieldwork grants and sponsorships. Also, 26%, 18%, 14%, and 18% of postgraduate, 400-level, 300-level, and 200-level, respectively, agree that geoscience departments should also source funds and grants from international geoscience communities. This collaboration can complement funds allocated for field activities by the departments, thereby improving the geoscience education of these universities. In addition, field trip grants can assist the departments' internal revenue for educative and noteworthy field experiences, thereby improving the system of geoscience education. Also, Ogunode et al. (2021) suggested that contributions from NGOs, alumni, and private sectors are among the potential sources of funds, hence, a potential solution to insufficient field engagements.

Again, Figure 11 presents participants' responses on reducing the effects of this retrograde culture by checking the number of students admitted into the geoscience department. Again, 34%, 54%, 45%, and 42% of postgraduate, 400-level, 300-level, and 200-level, respectively, strongly agree that the number of students admitted into the geoscience departments in the study area should be limited to a number the departments can provide for, amidst insufficient resources. These responses here, compared with a relatively lower percentage of responses from disagree and strongly disagree respectively, agree with observations of Akinola (1990), who opined that the higher institution education systems direly need funds to cater for both their capital and recurrent needs, and hence, the number of students admitted into the departments should be checked such that departments can cater for its students. However, the relatively low percentage of *Neutral* responses to the statement here pinpoints that reducing the students' admission could be detrimental to the revenue generation and smooth running of the department. Still, sourcing for more research grants and other field activities will drastically increase the number of field activities in each academic session. To this effect, the ideal resolutions are to seek field study sponsorships, field trip grants, and collaborations from the government, alumni, NGOs, and international geoscience communities to ameliorate field engagements.

Furthermore, in extreme conditions of lack of funds for field engagements, one of the remedies to reduce the effects of the lack of firsthand field engagements could be to adjust the curriculum to accommodate multiple internship programs in the third and second years to enhance more field/industry experiences. Figure 12 shows the participants' responses to the statement. Here, the relatively high percentage of *strongly agree* responses from 45%, 54%, 45%, and 42% of postgraduate, 400-level, 300-level, and 200-level students, coupled with a similar trend from the *agree* response, is pinpointing that if the industry-academia relationship is strengthened through the involvement of internships, workshops, and lecture series, students will be nurtured with industry-ready skills sets that will enable them to cope in the labor market. This will be of great help in building the students' practical skill sets as well as increase the chances of automatic employment for fresh graduates, as companies may retain some excellent interns.

Also, in situations where funds and insecurity cannot be handled, virtual field trips (VFTs), online conferences, and teaching of geoscience software can minimize the effects of the paucity of field engagements and equip fresh graduates with industry-ready skill sets. Figure 13 presents a similar trend of *Yes* and *Maybe* responses for all respondent classes. Figure 13 presents that 45%, 50%, 48%, and 52% of postgraduate, 400-level, 300-level, and 200-level students agree that virtual field engagements could be helpful in teaching and learning geoscience. However, similar responses of 45%, 54%, 45%, and 42% from *Maybe* and the same class of respondent, respectively, is indecisive. However, geoscience is a physical science. The *Yes* responses here could be because virtual field excursions and online workshops are cheaper and safer than actual field engagements. Still, the similar responses from the *Maybe* option could suggest that there is no exact substitute for field experience. Although cheaper, virtual field engagement and workshops may still lack the solutions to insufficient field engagements. This is because the online presence may still be deficient in the true 3-dimensional nature of geologic structures (Weili & Thomas, 2002), hence, less effective in teaching practical skills than actual fieldwork (Cliffe, 2017).

CONCLUSIONS AND RECOMMENDATIONS

This study examined the impacts of the paucity of field engagements in geoscience education within the context of public universities in Anambra State, Nigeria. The findings have shed light on the significant role that field engagements play in shaping students' interest, understanding, and practical skills in geoscience education. In addition, the research highlighted the challenges faced by students due to limited exposure to field experiences, including declining interest, difficulty in appreciating geologic structures, and struggles in recalling theory-based concepts.

Conclusions

The use of field engagements in geoscience has realized successful results that have retained the quality of geoscience education. Because the field is the geoscience lab., its significance in teaching and learning geoscience cannot be overemphasized. But recently, due to inadequate funding of the tertiary education system and insecurity, the quality of geoscience education has reduced drastically. This study, in its form, revealed the impacts of the paucity of field engagements on the quality of geoscience education and possible recommendations on how to curb the retrograde culture in public universities in Anambra state, Nigeria.

Achieving its specified objectives, the study found that a vast percentage of postgraduate and 400-level students have not been to the field more than three times. Consequently, they have not appreciated the scales of geologic structures in textbooks and classrooms. In other words, geoscience students find it more difficult to recollect theoretical lectures than field works. But, then, what else could be the aim of geoscience education?

The impacts of field engagements pose a serious issue in the study area as this study reveals the feeling of self-deprivation and low self-esteem among students who engage in fewer field experiences than their colleagues who have more field experiences, probably, due to their inability to contend in terms of field experience. This has generally triggered an overall decline in students' interest in geoscience education and the inclusive feeling of being un-employable.

The study also showed that lack of funds and insecurity have been the major drivers of the paucity of field engagements in the study area. Just like Ezeani (2018) opined, the implications of the lack of field engagements have been worsened by inadequate funding and insecurity. However, this study made many possible suggestions for mitigating these effects. The results of this study, the majority of the responses, suggest that geoscience departments in the study area should collaborate with international geoscience bodies to attract field study grants. Furthermore, to effectively manage the limited funding, geoscience departments should admit the number of students they can cater to. Although doing this could be detrimental to the smooth running of the departments, sourcing for more research grants will be a better remedial substitute. Also, the study suggests that amidst limited funds for field engagements, the curriculum should be adjusted to accommodate multiple internships, which can increase geoscience students' employability by preparing them for industry sort-after skills sets and experiences. Furthermore, the study suggests using virtual field trips as a cheaper method for students' exposure to, although the effectiveness of this ideal has been controversial among the participants and even past works of literature (Weili & Thomas, 2002).

Recommendations

This study recommends various ways to mitigate the impacts of the paucity of field engagements in geoscience education and enhance the quality of geoscience education in the study and Nigerian public universities. The recommendations include the following:

1. The Geoscience curriculum should include multiple internship opportunities for undergraduate students in Nigeria to acquire enough industry sort-after skill sets. Efforts should also be made to ensure that these internship programs offer maximum exposure to the interns to industry sort-after skillsets and software.
2. There should be an increment in the fund allocations designated for field studies by the school management to ameliorate field studies. Where the allocations are

limited, geoscience departments should also source funding and sponsorship from alumni.

3. The geoscience education system could be adjusted so that research and publication will be a requisite for promotion to a higher level under the close supervision of a lecturer. This will improve students' research experience, critical thinking, and analytical skills, which will make them industry-ready after graduation.
4. Geoscience departments should collaborate and partner with international geoscience bodies to attract grants and sponsorships for field studies.

Where funding is not available, the curriculum could be adjusted to enhance academia and the industries by introducing internship programs at the 200-level and 300-level to enhance more field experiences.

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APPENDICES

Table 1

Case processing summary of the dependent and independent variables

		N	Marginal Percentage
Impact_interest	Disagree	12	5.1%
	Neutral	16	6.8%
	Agree	76	32.1%
	Strongly agree	133	56.1%
Appreciated_geologic_scales	Poorly appreciated	102	43.0%
	Fairly appreciated	69	29.1%
	Well appreciated	35	14.8%
	Excellently appreciated	31	13.1%
Times_of_field_engagement	Not even once	9	3.8%
	1	84	35.4%
	2	63	26.6%
	3	38	16.0%
	4 and above	43	18.1%
Valid		237	100.0%
Missing		22	
Total		259	

Table 2
The model fitting information

Model	-2 Log Likelihood	Chi-Square	df	Sig.
Intercept Only	273.020			
Final	243.525	29.495	8	.000

Table 3
The Chi-square goodness of fit information

	Chi-Square	df	Sig.
Pearson	139.809	175	.977
Deviance	156.304	175	.842

Table 4
The Chi-square goodness of fit information

Cox and Snell	.117
Nagelkerke	.134
McFadden	.061

Table 5
Parameter estimates

		Estimate	Std. Error	Wald	df	Sig.	95% Confidence Interval	
							Lower Bound	Upper Bound
Threshold	[Impact_interest = 2]	-3.648	.687	28.226	1	.000	-4.994	-2.302
	[Impact_interest = 3]	-2.661	.648	16.854	1	.000	-3.931	-1.390
	[Impact_interest = 4]	-.716	.621	1.326	1	.249	-1.934	.502
Location	Level	-.432	.143	9.119	1	.003	-.713	-.152
	[Appreciated_scales=2]	.563	.421	1.789	1	.181	-.262	1.387
	[Appreciated_scales=3]	-.249	.430	.334	1	.563	-1.092	.595
	[Appreciated_scales=4]	-.704	.487	2.090	1	.148	-1.658	.250
	[Appreciated_scales=5]	0^a	.	.	0	.	.	.
	[Times_of_field_engagement=1]	-.316	.697	.206	1	.650	-1.683	1.050
	[Times_of_field_engagement=2]	.423	.396	1.144	1	.285	-.352	1.199
	[Times_of_field_engagement=3]	.418	.404	1.072	1	.301	-.373	1.209
	[Times_of_field_engagement=4]	.846	.448	3.565	1	.059	-.032	1.724
	[Times_of_field_engagement=5]	0^a	.	.	0	.	.	.

Table 6
Test of parallel lines

Model	-2 Log Likelihood	Chi-Square	df	Sig.
Null Hypothesis	254.957			
General	234.479[b]	20.478[c]	6	.002

Table 7
Sample of questionnaire and survey questions

Survey Questions	Expected responses				
Section A					
1. Insufficient field engagements have led to an increasing decline rate of students' interest in Geoscience Education.	SA	A	D	SD	NT
2. Do you feel intimidated among colleagues who are more involved in field studies than you?	Y	N		M	
3. How much do you appreciate scales of geologic structures such as faults, landforms, without actually seeing them on field?	EA	WA	FA	PA	NA
4. How many times have you been to the field for hands-on experiences?	Once	Twice	Thrice	4 times or above	
5. Most times you do not recall abstract-based topics after writing the exams.	Y	N		M	
6. With the current trend of the geoscience education in your school, will you like to practice geoscience as your future career?	Y	N		M	
Section B					
7. Lack of field funds for field engagements and insecurity are some of the causes of insufficiency of field engagements.	SA	A	D	SD	NT
Section C					

8. To reduce the effect of the retrograde culture, the geoscience departments should collaborate with international geoscience bodies to attract grants for field activities.	SA	A	D	SD	NT
9. To reduce the effects of this retrograde culture, the number of admitted students into geoscience departments should be limited to a number the department can carter for.	SA	A	D	SD	NT
10. Where fieldwork funding and sponsorships are not available, the curriculum should be adjusted to accommodate dual internship programs at 300 and 200 levels to enhance field experiences.	SA	A	D	SD	NT
11. Virtual field trips and teaching of geoscientific software such as Petrel, surfer, programming languages etc., can minimize the effects of paucity of field engagements?	Y	N		M	

SA = strongly agree, A = Agree, D = Disagree, SD = strongly disagree, NT = Neutral
Y = Yes, N = No, M = Maybe
EA = Excellently Appreciated, WA = Well Appreciated, FA = Fairly Appreciated, NA = Not Appreciated

Table 8a
Age distribution of the respondents

Age	Class of participants				
	PG	**400L**	**300L**	**200L**	**Total**
Below16	0	0	0	0	0
16-20	0	14	39	51	104
21-25	33	27	48	21	129
26-30	9	5	2	0	16

Mean age = approx. 21 yrs.

Table 8b

Summary statistics of the age distribution of participants

Summary statistics of age	
Total	249
Mean	20.58
Max	29
Min	16

Mean age = approx. 21 yrs.

Figure 1

Percentage distribution of the respondents in the study area

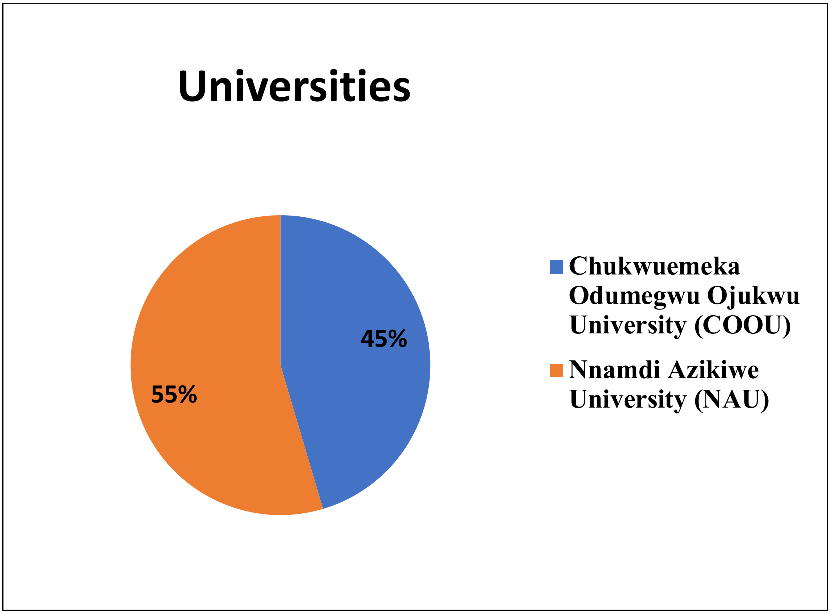

Figure 2

Percentage distribution of classes of participants

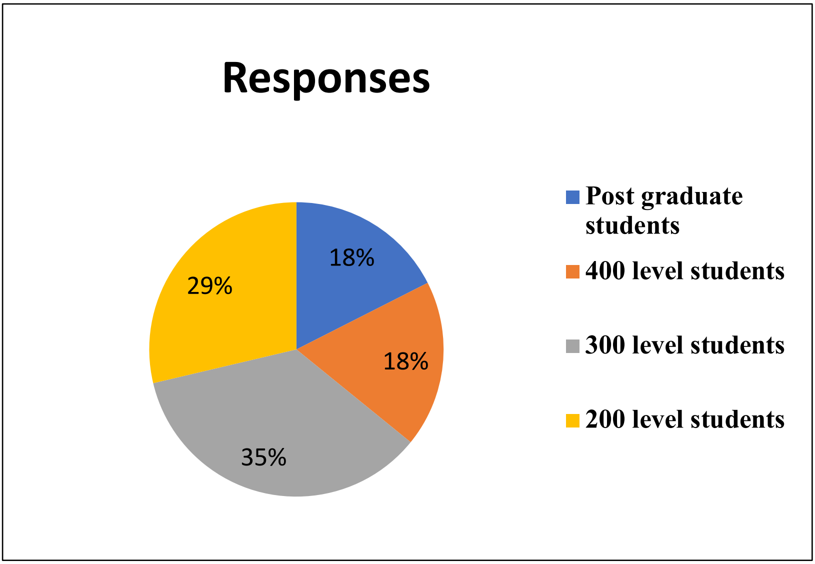

Figure 3

Insufficient field engagement has led to decline rate of students interests in geoscience

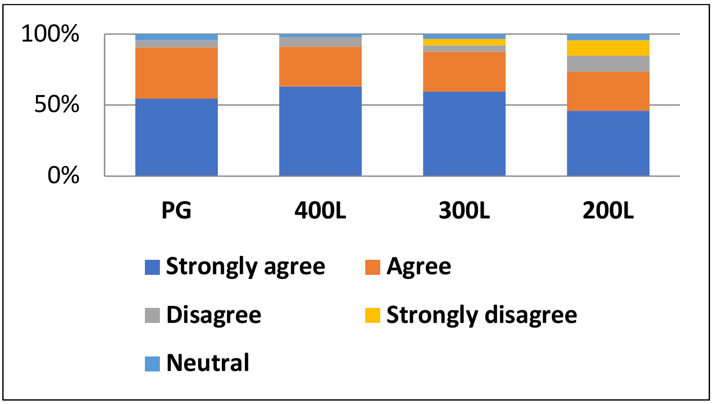

Figure 4

Participants feel intimidated amongst colleagues with more field experiences

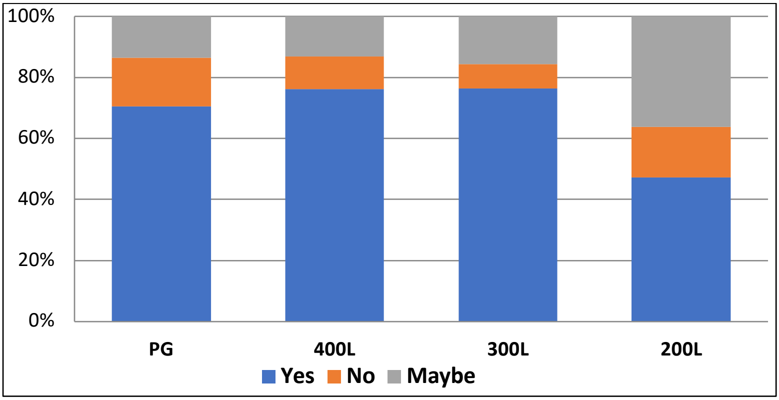

Figure 5

Appreciation of geologic scales and structures in textbooks and classroom

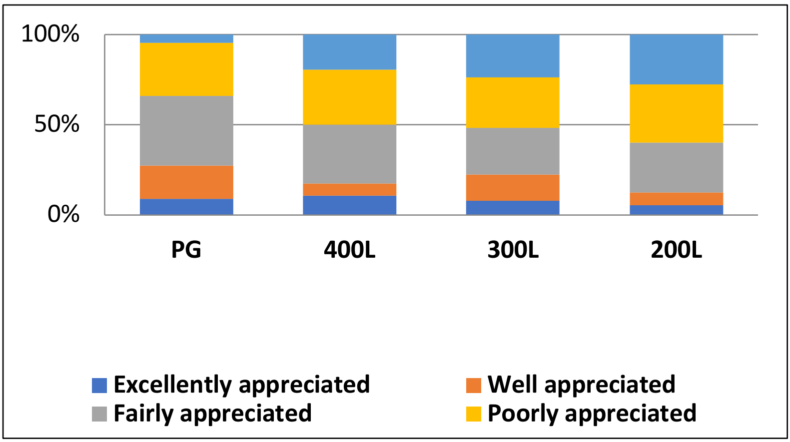

Figure 6

Participants' exposure to fieldwork

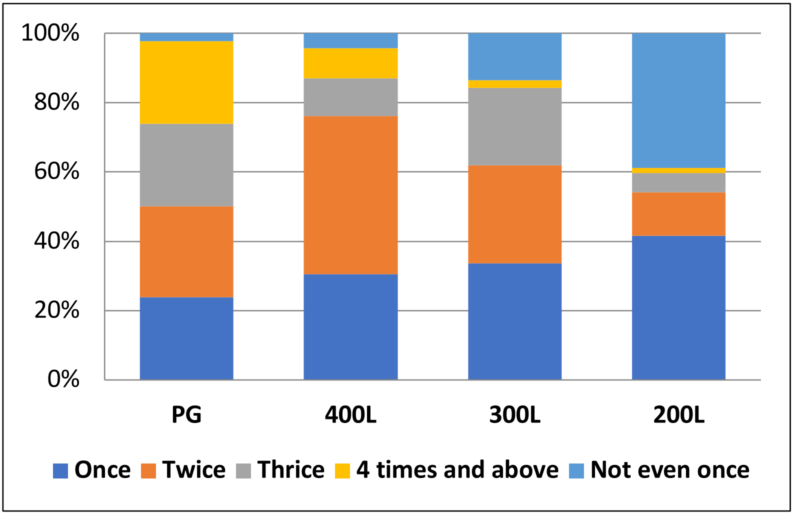

Figure 7

Participants' ability recall theory classes after examination

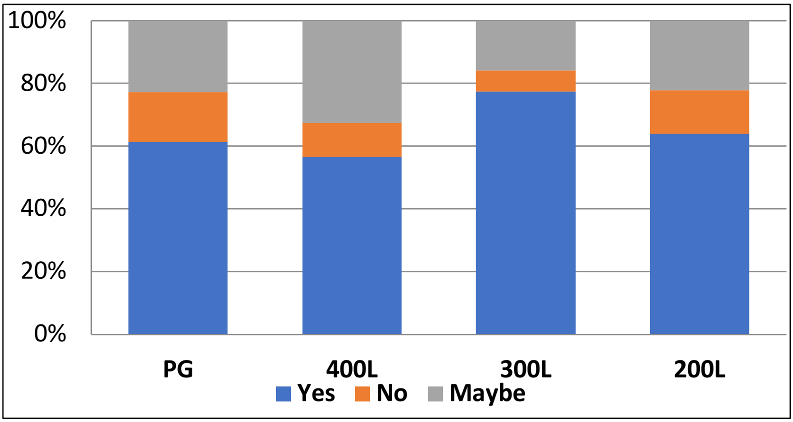

Figure 8

Students interest in geoscience admits declining quality of geoscience education

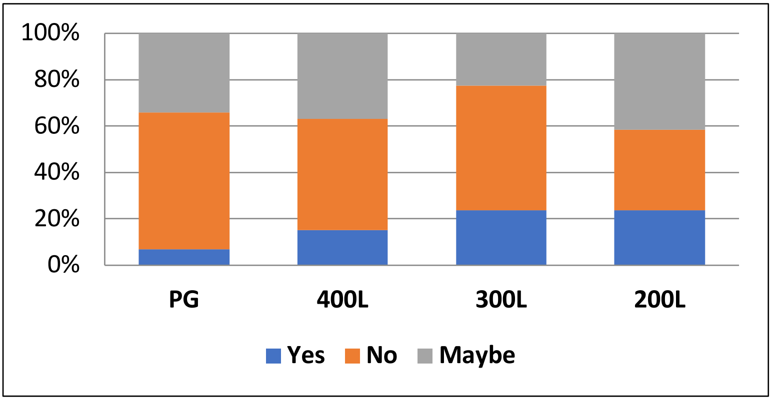

Figure 9

Insecurity and poor funding are among the causes lack of field engagement

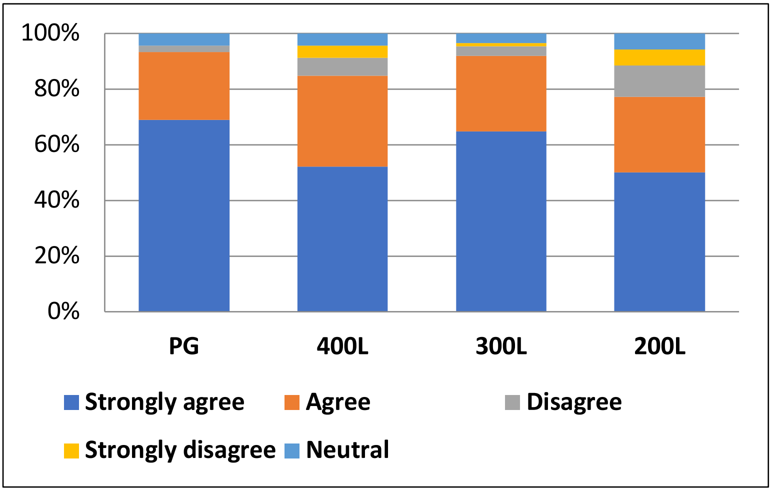

Figure 10

Geoscience departments should collaborate with international bodies for fieldwork grants and funds

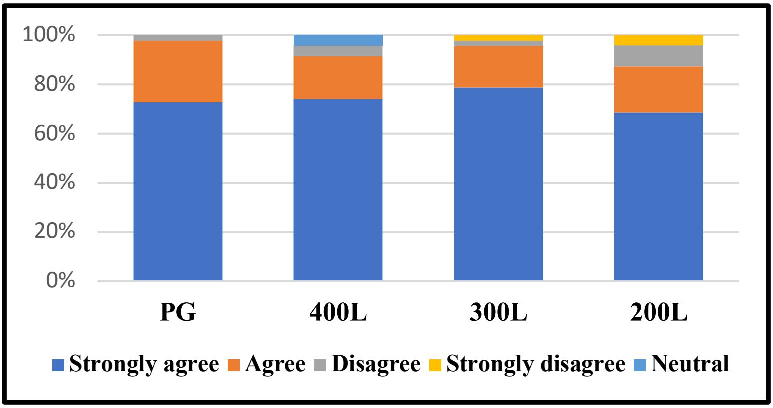

Figure 11

Geoscience departments should monitor students' admission for proper managements of allocated funds

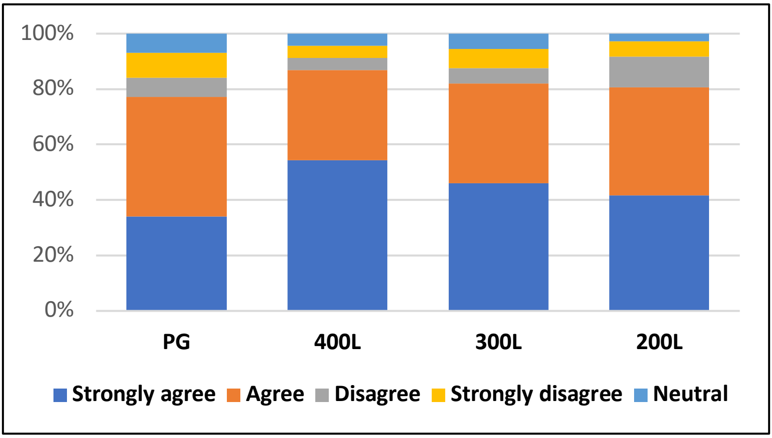

Figure 12

Geoscience curriculum should be adjusted to accommodate multiple internships to enhance firsthand experience where there is limited funding

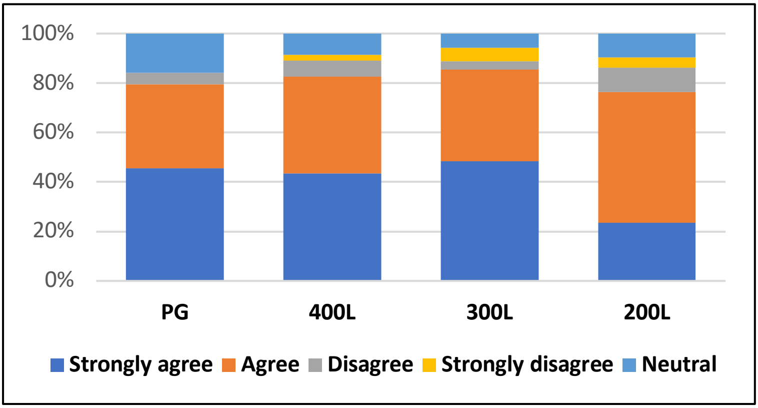

Figure 13

Virtual field trip should be used where there is limited funding