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Undergraduate students' predilection for seating pattern and their engagement in a collaborated blended learning in the science education classroom

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ABSTRACT

The purpose of this study was to examine the influence of undergraduate students' predilection of seating pattern on their engagement and achievement in a collaborated blended learning in a science education classroom. The sample of this study constituted 120 third year science education students. This research employed a mixed method design by using qualitative and quantitative studies. Two instruments named: Student's performance and predilection for seating pattern (SPAPFSP) and Students' class experience with the U-shape seating pattern (SCEUSP), choice of seating pattern and why the choice were used. The Cronbach alpha reliability for the instrument ranged from 0.89 to 0.91. Results of the analysis using a 2 by three analysis of variance indicated that the students in the U-shaped classroom achieved more than those in the row-column arrangement. A paired sample t-test analysis test results reported that students preferred the U-shape seating pattern in their classrooms. The implication of this study is that the seating pattern adopted by a teacher influences the educational outcome of students. It was therefore recommended among others that the U-shape seating arrangement be used in a blended science instruction.

Contribution/Originality: This study is a pioneer research as previous studies have not incorporated blended learning in a science education classroom to examine the importance of seating arrangement during teaching and learning. The study shows how teachers and educators should use U-shape seating arrangement in their science classrooms to attain the desired learning outcomes.

1. INTRODUCTION

Blended learning is an innovative pedagogical approach in which the use of technology, mobile learning and online activities are incorporated into the traditional technique of teaching (Rao, 2019). Most times, blended learning was viewed as a teaching approach in which the teacher being physically present in the classroom made use of online learning techniques as well in the lesson delivery. According to Friesen (2012), blended learning can also be said to be a form of lesson delivery in which students learned at least in two parts namely; via delivery of content

and instruction through use of technology in form of digital and online media in the class and at home; and secondly, having the teachers exert control of the students in terms of place, time and pace.

In a University, the blended learning approach is a mix of flexible and comfortable use of e-learning, technology and media being incorporated to face-to face interactions with the instructor (Al-Kahtani et al., 2022), that give rise to students' benefits of flexible learning as well as enhanced student learning outcomes (Chen, 2022). Lecturers in the University are enjoined to encourage their students to actively participate in a blended classroom with the aim of enhancing their performance and engagement in the classroom (Chen, 2022; Vaughan, 2014).

The learning space is the physical environment where learning takes place and is made up of the seating pattern (Nja et al., 2023). This seating arrangement is vital when educators seek to facilitate active learning environment particularly in a blended learning classroom (Clinton & Wilson, 2019; Ochola & Achrazoglou, 2015; Serrano, Dea-Ayuela, Gonzalez-Burgos, Serrano-Gil, & Lalatsa, 2019). Many researches have indicated that active learning contributed to a greater extent high academic achievement of students (Idiege, Nja, & James, 2021; Mello & Less, 2013; Momani, Asiri, & Alatawi, 2016; Nja et al., 2022a). Active students' engagement is paramount in the teaching of science education courses as it enhances students' interest in the course which in turn leads to improved learning outcomes (Nja & Ideba, 2021; Nja, Ukwetang, Orim, Cornelius-Ukpepi, & Ndifon, 2022b; Reinke, 2019). Students' engagement in the classroom especially in a blended learning classroom in the University further improves students learning outcomes (Reinke, 2019).

1.1. Theoretical Framework

Mccroskey, Valencic, and Richmond (2004) recommended a general model of instructional communication. This model of instructional communication theory postulates necessary constituents including teacher student perceptions, instructional environment, and instructional outcomes. The theory indicated a relationship between learning outcomes and students' perceptions. Students' predilection has a great influence on students learning as it has a psychological influence on their thinking. When a student approves a particular seating pattern, such a student will be actively engaged in that class and that will lead to desirable learning outcome. The teacher communication behavior is capable of influencing student perceptions. The theory also states that student predilection is represented by teachers' credibility and handling of content. The theory reiterates that the credibility of the teachers' communication behavior is evident in the manner they handle content especially the space teachers occupy in the classroom.

Instructional environment like the seating arrangement has a relationship with students' engagement, collaboration and learning outcome. In a seating arrangement that is conducive, active learning takes place. In a classroom where instructional videos are utilized, the seating position will influence the amount of information received by the learner. The outcome components of the theory include cognitive learning and affective learning. Cognitive learning is estimated by the learning-loss measure, when students are taught by teachers who used undesirable seating pattern and are compared with those who used desirable seating pattern.

1.2. Purpose of the Study/ Research Questions

From the fore going, it can be said that learners' engagement can be influenced by seating pattern and learners' predilection. Hence, the need to examine students' predilection and knowledge in various seating patterns with the aim of incorporating them into the classroom teaching and learning. This research aimed at examining how learners' seating pattern influences their engagement with regard to the three forms (attention, consistency and classroom climate). Students' predilection and its influence on learners' engagement was another area of interest in this research. Specially, since active classroom is predominantly used as an effectual, creative and interactive strategy in chemistry blended learning instruction; this study goal was to answer these two research questions:

(1) When are students engaged in collaboration instruction during science education in a blended learning classroom in the University and what are students' classroom experiences in U-shape and rows - columns seating pattern?

(2) Which seating pattern is students' predilection, U-shape or rows -columns and how does students' predilection influence their engagement in the classroom experiences in science education blended learning instructions in the University?

2. LITERATURE REVIEW

2.1 Classroom Seating Pattern and Students' Engagement

Currently, the importance of space in a classroom where learning takes place is modeled upon the manner in which teaching and learning occurs. A physical reality or a classroom learning space consists of environmental change, which is influenced by teachers and students directly or indirectly involves a miniature of behavior of community, magnanimous worth, and which functionally and energetically regulates the function of a classroom (Lim, O'Halloran, & Podlasov, 2012).

There is no controversy that day by day there is a paradigm shift in the resources and the environment of a classroom (Reinke, 2019; Serrano et al., 2019). Instructors are expected to employ creative strategies that will enhance conformity to the digital age as to assure the involvement of high school learners in the twenty-first century notwithstanding, getting learners needs accomplished (Kuhlthau, Maniotes, & Caspari, 2015). Present-day learning environments embolden students to lead their learning as they collaborate and utilize creative and critical thinking to find a solution to intricate problems It is obvious as the frequent changes in the educational sector over the last few decades are from didactic teacher-led instruction to students'-centered instruction (Niemi, Nevgi, & Aksit, 2016).

It has been proven that the constructivist approaches to learning in the last decades has replaced the didactic type of teachers' instruction as the educational segment had witnessed a paradigm shift (Prain et al., 2013). For educators to employ the student-centered approach in the classrooms there is a need to reflect on pedagogy in terms of the terrain of the classrooms. The exemplified classroom of rows of desks and chairs are gradually giving way to the present-day educational practices (Byers, Imms, & Hartnell-Young, 2014). Nowadays, virtual space is incorporated into the classroom and thereby the classroom landscape is modified (Chandra & Mills, 2015). Modifications in school learning spaces have begun internationally and thereby inventing novel learning environments that foster more vigorous teaching and learning.

Studies by Cleveland (2016) and Stern and Etheridge (2008) have indicated that when learning environments are effectively designed, there is a facilitation of the constructivist pedagogy which enhances learners' engagement. In a study conducted by Lewinski (2015), it indicated that the seating patterns was very crucial in fostering high performance of students as a result of effective manipulation of the classroom seating arrangement. This seating arrangement effect on students' academic performance is felt mostly in the blended learning classroom which is a marriage of online instructions as well as face-to-face interaction. When an effective classroom layout is constructed, it is germane to the promotion of student engagement level, learning outcomes and experiences (Bolden III, Oestreich, Kenney, & Yuhnke Jr, 2019).

A review from previous research on seating patterns can be subsumed into three facets. Firstly, the seating pattern in the classroom influences the level of communication in the classroom. The pattern of classroom seats determines to a greater extent the level of interaction in the classroom (Harmer, 2007). In a classroom where the teacher utilizes the lecture method as teaching methodology, the rows-and-columns pattern of seats is preferable. All the students are expected to face a particular direction where the teacher can be viewed clearly as instructions are given out (Ochola & Achrazoglou, 2015). The rows-and-columns pattern of seating does not allow students in front to view those behind and those behind cannot communicate and interact with those in front. Such

arrangement hinders students' interactions with each other and therefore leads to inactive students' engagement in the classroom. There is poorly visibility of the white board and even the instructor by students who sat at the corner of the classroom or at the back of the classroom (Wei, Yang, Chen, & Hu, 2018). A U-shape seating pattern is at variance with the rows-and-columns pattern where there is no seating position advantages (Park & Choi, 2014). The U-shape seating pattern allows the instructor to walk around the classroom in a blended learning environment without hindrances. As such, the instructor is able to answer students' questions give guidance where necessary, as well as students having a smooth and unhindered discussion (Kinahan, 2017). In addition, students who sit in a U-shape seating pattern, have direct eye contact with each other and as such can ask each other questions and interact with themselves very freely as against rows--columns pattern (Gremmen, Van Den Berg, Segers, & Cillessen, 2016; Ochola & Achrazoglou, 2015). Asino and Pulay (2019) paper on blended learning and students seating arrangement preference, findings indicated that were in favor of round tables with chairs in a computer-supported collaborative learning instruction.

Secondly, concentration is a very influential factor during teaching and learning that determine the level of students' engagement and learners' learning outcome (Adedokun, Parker, Henke, & Burgess, 2017; Shernoff et al., 2017). Learners' concentration in the classroom is a prerequisite for their learning outcome. This concentration is affected by: nature of the concept to be taught, teaching method employed, instructional materials, time of the day, learning space. seating arrangements, and aesthetics, which are seen as a potent force in classroom concentration of students (Fisher, Godwin, & Seltman, 2014). Some students are able to learn well in a classroom with rows-and-columns pattern of seat arrangement, students who sit toward the rear or corners of the learning environment are physically distant from the instructor. This can lead to psychological feelings of a dislike attitude in the classroom. However, in a U-shape pattern of seat arrangements every student has the same opportunity to be close to the instructor. Learners' attention is increased as they work in groups as against in rows (Lotfy, 2012). In rows-and-columns pattern of seating, because students face the teacher, they must move chairs, while the instructor is disseminating information, which disturbs class concentration as chairs are moved around (Robichaux, 2016).

Thirdly, the discernment of the learning classroom climate by students like pleasantness, adjustability and all - embracing, also perform an important function in modeling students' engagement during classroom instruction. (Imms & Byers, 2017; Reinke, 2019). For blended learning classrooms to be effective, it is pertinent that the seating pattern be adjustable, conducive and all-embracing to create an atmosphere in the classroom that will equip both teachers and students with skills for team-work (Ochola & Achrazoglou, 2015). It is natural to find students appreciate a learning environment that is adjustable during work and convenient during group work (Clinton & Wilson, 2019). When a classroom is conducive, and adjustable, it creates a classroom climate that brings about a positive indicator of learners' engagement and academic performance (Barrett, Zhang, Moffat, & Kobbacy, 2013).

In a study by Clinton and Wilson (2019), learner' insight on classroom seating arrangement indicated that learners' insight in a blended learning classroom climate, having adjustable tables and chairs, was better than the rows-column seating pattern. Students enjoyed learning activities more than those in rows-column arrangement. Generally speaking, a classroom environment that supports students to positively engage in collective learning (Rocca, 2010) and create a feelings of addition can enhance learners' engagement in the classroom (Alesech & Nayar, 2021; Kinahan, 2017; Reinke, 2019; Rocca, 2010).

A successful learning outcome is achieved when an individual has the feelings that he/she is accepted in the group they belong to. It is therefore necessary that the learning climate should be inclusive and widely accepted. Meanwhile, very scanty researches have sought out the types of seating pattern that enhances students' feelings of inclusion in learning climate during blended learning in the University.

2.2. Students' Predilection and Engagement

Marcela and Mala (2016), study discovered learner's attitude as the predictor for students' learning outcome. The implication of the study is that a positive attitude is necessary for positive academic performance. Attitude is the emotion and mental entity which makes individuals behave the way they do (Perloff, 2016). Students' feeling about the classroom climate is capable of affecting their learning, characteristics and spark (Clinton & Wilson, 2019; Reinke, 2019). Therefore, it is imperative to investigate students' predilection for seating pattern and why their predilection for seating arrangement (Park & Choi, 2014).

Furthermore, learners can supply unique visions for the classroom seating arrangement, and a good seating pattern that students' learning activities will gain. Concerning students' seating predilection, only a few studies have attempted to proffer solutions to the topic under investigation. Taking the case of McCorskey and McVetta (1978), their study indicated that learners who possessed low communication indicated higher predilection for semicircular seat arrangement.(high-interaction) and those with high communication preferred rows and columns (low-interaction seating). Meeks et al. (2013) studied the effect of seating location and seating type on student performance and recorded a non-significant difference in the performance of students.

This review makes it evident that there is a dearth of studies that have investigated the influence of seating patterns, and not enough attention has been given to students' predilection and engagement particularly in science education blended instruction classrooms in the University. The current study, therefore, aimed to fill this research gap and contribute to the domain a new avenue of learning.

3. METHOD

The design of this study was a mixed method as both quantitative and qualitative research methods were used. This type of design was chosen because it gives an in-depth and thorough understanding of the research topic under investigation as against using one research method (Creswell & Creswell, 2018). The graphical presentation of the study is shown in Figure 1.

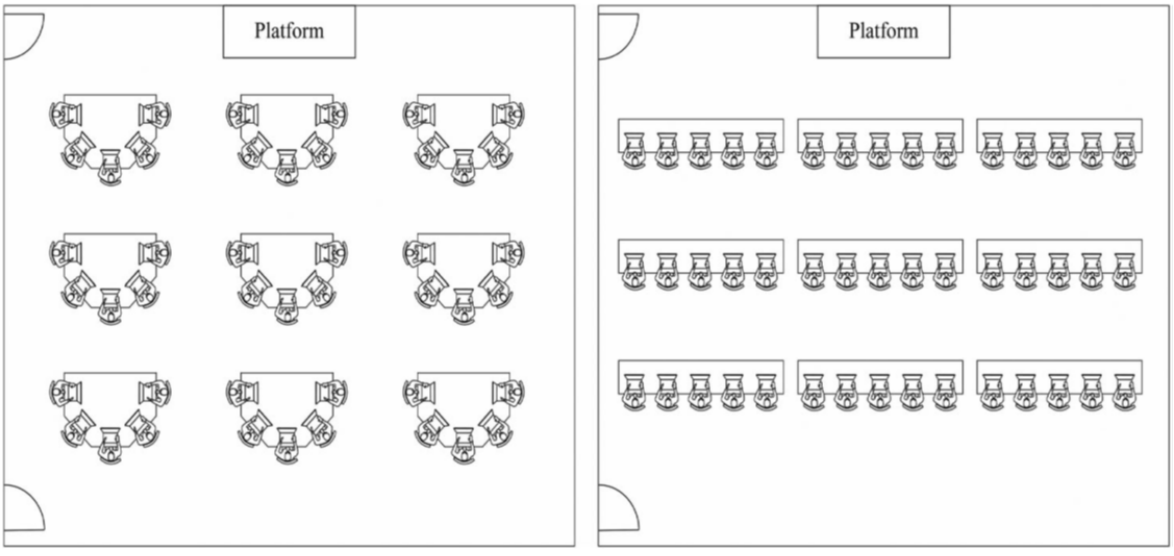

Figure 1. Classroom seating pattern: U-shape and rows- columns.

Note: Yang, Zhou, and Hu (2022).

For the qualitative phase of the study, two questionnaires were used, both having two sections each (See Appendix). The first section comprised open ended questions where students were required to share their views and opinions. The second section had closed-ended questions where students were expected to express themselves and "why" questions were found in this part of the questionnaire, with multiple answers to choose from. The students were expected to tick the answer that appealed to them. These questionnaires were used for the data collection on

student engagement and seating predilection, coding and data analysis. The data so obtained was also used to examine the influence of seating arrangements and students' predilection, impact on students' engagement and learning outcomes in science education blended learning classrooms.

3.1. Participants

The sample of this study was made up of 120 science education undergraduate students comprising 70 females and 50 males. The sample mean age was 17 years. The sample was drawn from all the units in science education department: biology =60, chemistry =35, physics =10 and mathematics education = 15. At the commencement of this study, students were divided into groups of five each. These students attended science school laboratory which was a compulsory course in their year three.

This research was conducted in the first semester; all participants were in their third year of the university. While students attended their secondary schools, they were exposed to the row-column seating pattern and had found the U-shape seating pattern in the classroom for the first time. Prior to the commencement of the research, the researchers sought the consent of each participant. The given study was also conducted under the approval of Cross River Quality Assurance Committee.

3.2. Instruments

The researchers developed two instruments that were used for data collection (See Appendix). The first instrument named (SPAPFSP) was a questionnaire that had two sections: 1 and 2. Section 1 was made up of 8 items on a four-point Likert scale of Strongly Agree (SA), Agree (A), Disagree (D) and Strongly Disagree (SD), with SA= 4 points, A= 3 points, D= 2 points and SD= 1. For the SPAPFSP in section 1 the highest score for a respondent was 32 and the least score was 8 points.

Section 2 of SPAPFSP was an open-ended questionnaire where students were allowed to state in specific term what seating pattern appealed to them and why. The second instrument was also a 4-point Likert scale questionnaire which was divided into 3 sections of engagement; Communication, Attention sustenance and Classroom climate.

This section investigated the two-seating patterns, questioning students' class experience with different seating patterns, what seating pattern they would choose and why (SCESP). Each sub-section had 5 items on a four point Likert scale of Strongly Agree (SA), Agree (A), Disagree (D) and Strongly Disagree (SD) with SA= 4 points, A= 3 points, D= 2 points and SD= 1 point. The highest score for communication = 20, attention sustenance = 20 and classroom climate = 20 and the least was 5 points for each aspect pf engagement. The second section of SCEUSP required participants to freely express their seating pattern predilection and reason for such answer.

In the cause of the construction of these two instruments, experts in department of science education were consulted. The essence was to ascertain the face and content validity of the items in the instruments. For SPAPFSP, initially, 12 items were presented for scrutiny, 4 items were jettisoned for being inappropriate and 5 items were revised and finally 8 items were accepted.

The second instrument had 6 items each prior to meeting the expert and eventually ended with 5 items each when checks were performed for face and content validity. In addition to the validity test, Pearson Product Moment correlation was done by correlating every questionnaire item, and results were measured with Statistical Package for the Social Sciences (SPSS)Version 26. The result obtained ranged from 0.52 to 0.79 as shown in Table 1, indicating that the items on this second questionnaire were valid and therefore accepted (Gliner, Morgan, & Leech, 2017).

To ascertain the reliability of the instrument, a prior test was conducted by administering the questionnaire to first year students at the department of sciences education in Cross River State University. These students were found to be equivalent in academic levels with the students that were used for the study. The responded

questionnaires were coded and analyzed using Cronbach alpha reliability coefficient. Cronbach alpha was used because the data were polychotomous. The reliability ranged from 0.72 to 8.56.

Table 1. Statistical information on questionnaire 2.

Range	Items in section1	Items in section 2	Cronbach' s α (Section1 /2)
Communication	Item 1 (r = 0.68**)	Item 1 (r = 0.68**)	0.738/.823
	Item 2 (r = 0.71**)	Item 2 (r = 0.76**)	
	Item 3 (r = 0.78**)	Item 3 (r = 0.71**)	
	Item 4(r = 0.74**)	Item 4 (r =0.66**)	
	Item 5 r = 0.70**)	Item 5 (r =0.70**)	
Classroom climate	Item 6 (r = 0.76**)	Item 6 (r =0.60**)	0.720/.791
	Item 7 (r = 0.78**)	Item 7 (r =0.78**)	
	Item 8 (r = 0.76**)	Item 8 (r =0.75**)	
	Item 9 (r = 0.70**)	Item 9 (r = 0.78**)	
	Item 10 (r = 0.72**)	Item 10 (r =0 .79**)	
Attention sustenance	Item 11(r = 0.79**)	Item 11 (r = 0.59**)	0.787/.856
	Item 12 (r =0.52**)	Item 12 (r =0.62**)	
	Item 13 (r =0.62**)	Item 13 (r =0.60**)	
	Item 14 (r = 0.59**)	Item 14 (r = 0.62**)	
	Item 15 (r =0.61**)	Item 15 (r =0.69**)	

Note: ** p < .01 (two-tailed).

3.3. Procedure for Data Collection

This study was conducted during the second semester of 2020/2021 academic year. The participants of this study attended the science education blended learning classes once a week for 120 minutes. The class took place in a U-shape seating pattern and lasted for three weeks. Before the commencement of the blended learning in science education, the first questionnaire was administered to determine their seating predilection pattern. Teaching was done with students watching videos on the course taught and working in groups to accomplish task given. Prior to blended learning teaching, the first questionnaire (SPAPFSP) was administered and collected at the spot. This was done to determine students' academic achievement and their predilection for seating pattern. After three weeks, the second questionnaire (SCEUSP) was administered and retrieved the same day.

3.4. Data Analysis

SPAPFSP and SCEUSP data obtained from the seating pattern predilection and engagement range questionnaire were analyzed using descriptive and inferential statistics. This was employed in calculating and comparing the mean achievement scores for pre/post-students' predilection and presenting it in percentages, independent t- test for the learning experiences of students in U-shape and rows- columns seating pattern and two ways ANOVA for two seating types (U-shape and rows-columns) and the three aspects of students' engagement (Communication, Attention sustenance and Classroom climate) were used in this study. In this study, the seating patterns type and the three ranges in classroom engagement were the independent variables while the students' achievement was the dependent variable.

An independent sample t- test was used for analysis because two independent groups were used; students in U-shape and rows-columns pattern of seating classroom. ANOVA was used because testing was done for more than two variables. In this case it was for three aspects of students' engagement (Communication, Attention sustenance and Classroom climate). Students were required to tick listed phrases on a Likert four-point scale of Strongly Agree (SA), Agree (A), Disagree (D) and Strongly Disagree (SD) with SA=4 points, A=3 points, D=2 points and SD=1point. Engagement Questionnaire items were 5 each in aspects of Communication, Classroom climate and Attention sustenance. For the qualitative aspect of the questionnaire, a count of how many students gave the same or similar response was used as the information to analyze. Data collected from the pre-and post-achievement tests were analyzed using descriptive statistics and parametric testing after the standard-issue of the data was

ascertained. A paired sample t-test was conducted to examine if the students' predilection changed from SPAPFSP to SCESP after they had experienced both types of seating pattern.

The research thus took into cognizance the qualitative, quantitative and descriptive aspects of the participants answers to the questionnaires and students' achievement on science education class exercises. The quantitative aspect of this research analysis is captured in Table 2, 3 and 4. The qualitative analysis is presented in Table 5.

4. RESULTS

4.1. U-Shape and Rows- Columns Seating Patterns and Students' Learning Experiences

This research undertook two seating patterns via; U-shape and rows-columns, learning experiences types were communication, classroom climate, and attention sustenance. Analysis of data using ANOVA is shown in Table 2, which presents that the major impact of main seating pattern as statistically significant, F (1, 119) = 66.859, p= <. 05, learning experiences types was not significant F (1, 119) = 2.210, p>.088 at 95% and the interaction between seating pattern and learning experiences was significant F (1, 119), p= .014 at 95% was p= <. 05. The main aim of this study was ascertaining the influence of two seating patterns on students' learning experiences in a blended collaboration learning instruction, the results therefore were reported for effects on each classroom pattern.

Table 2. A two by three (2×3) analysis of variance (ANOVA) for seating patterns and learning experiences.

Source	Type III sum of squares	Df	Mean square	F	Sig.	Partial eta squared
Corrected model	6187.127[a]	6	1031.188	20.846	0.000	0.353
Intercept	5317.210	1	5317.210	107.491	0.000	0.319
Seating arrangement	3307.285	1	3307.285	66.859	0.000	0.226
Experience	328.010	3	109.337	2.210	0.088	0.028
Seating arrangement and experience	432.903	2	216.451	4.376	0.014	0.037
Error	11327.805	229	49.466			
Total	89930.000	239				
Corrected total	17514.932	237				

Note a. R squared = 0.353 (Adjusted R squared = 0.336).

4.2. ANOVAS

The analysis in Table 3 shows that students in the U-shape classroom pattern have a significantly higher score than those in the rows-columns seating pattern for Attention sustenance, Classroom climate and Communication 16.69 against 14.46 F(1, 237) = 6.505, p= .012 (p= <. 05), 16.66 against 12.46 F (1, 237) =21.907 p= .000 (p= <. 05) and 17.05 against 14.76 and F (1, 237) = 5.045, p= .027 (p= <. 05) respectively. These results indicate that undergraduates' students, who studied science education in a U-shape seating pattern in blended collaborated learning classroom, had a higher learning experiences types of attention sustenance, classroom climate and communication than those who were engaged in the rows-columns seating pattern.

Table 3. ANOVA analysis for the comparison of learning experience types between two seating patterns.

Aspects	Sum of squares	df	Mean square	F	Sig.
Attention					
Between groups	147.661	1	147.661	6.505	.012
Within groups	2633.153	237	22.700		
Total	2780.814	239			
Classroom climate					
Between groups	521.220	1	521.220	21.907	.000
Within groups	2759.864	237	23.792		
Total	3281.085	239			
Communication					
Between groups	154.449	1	154.449	5.045	.027
Within groups	3551.525	237	30.617		
Total	3705.975	239			

4.3. Student Predilection for Seating Pattern and Achievement

The results of students' predilection prior to their collaboration in the different seating pattern indicated that 100 students (83.33%) were in favor of the U-shape and 20 students (16.67%) preferred the rows-columns seating pattern. At the end of the collaboration instruction in a blended learning classroom with U-shape and rows-columns seating pattern, the mean score of students was 93.22% for students who had predilection for U-shape (n=110) and 6.78% preferred the rows-columns seating pattern (n=8). A paired sample t-test was done to compare students' predilection prior and at the end of the intervention. Results obtained as indicated in Table 4 shows that students' predilection did not change as they were still in favor of the U-shape classroom seating pattern. The t-test value was $t = 0.8584$ at $df = 238$, p-value was $0.3915 (p>.05)$. The p-value needed to be equal to or less than .05 for the result to be said to be significant.

Table 4. A paired sample t-test for students' seating pattern predilection.

Group	U-shape	Rows-columns	t-test	df	P-value
Mean	0.88	0.92	t = 0.8584	238	0.3915
SD	0.32	0.28			
N	120	120			

4.4. On the Whole, Classroom Climate Played the Most Crucial Influence on Students' Predilection for a Particular Seating Pattern

Concerning students' achievement, after the intervention, 10 times more learners mentioned that the U-shape seating pattern enabled them to accomplish their assignment faster as against students who mentioned that they were able to accomplish their assignment in the rows-columns seating pattern as indicated in SPAPFSP and SCESP).

Table 5. Learners' individual reasons for their predilection in SPAPFSP and SCESP.

Predilection	Group	Reasons	Counts	
			SPAPFSP	SCESUP
U-shape	Attention sustenance	Keen attention	24	27
	Classroom climate	Can talk with my friend easily Conducive and friendly Have a sense of being accepted in my group	97	98
	Communication	Could hear both my teacher and team mates clearly Did not need to shout before I will be heard	5	9
	Others	Not stimulating Teachers' eye contact too much on me	4 7	6 5
Rows-columns	Attention sustenance	Keen attention	6	8
	Communication	Could hear both my teacher and team mates clearly Did not need to shout before I will be heard	3 6	5 5
	Others	Not stimulating Teachers' eye contact too much on me	6 3	9 6

5. DISCUSSION

This study examined the impact of students' predilection in two types of seating pattern on their engagement and achievement in a collaborated blended learning instruction of undergraduate students. The results indicated that a majority of the students who participated in this study had enhanced instruction experiences in the U-shape seating classroom pattern when compared with those in the rows- columns seating pattern.

The first research question stated: When students are engaged in collaboration instruction during science education in a blended learning classroom in the University what are students' classroom experiences in U-shape

and rows - columns seating pattern? This study reported that students in the U-shape seating pattern had effective interaction in Attention sustenance, Classroom climate and Communication with classroom climate recording the highest arrangement when compared with those in the row-columns seating columns. These results agreed with previous studies done by Gremmen et al. (2016) and Wilburn et al. (2019). This result indicated that when learners are placed in a classroom in a –U-shape seating pattern, students can talk with their friends easily; the environment is conducive and friendly; and there a sense of acceptability in the group, in comparison to learners in the row-column seating pattern who sit and face the front of the classroom that hinders group discussion in a collaborated blended classroom instruction (Wannarka & Ruhl, 2008).

The results also revealed that in classrooms where students sit in rows- columns pattern, free communication is hindered, therefore, the classroom climate cannot be conducive. Students who sit at the corner and the back of the class during collaborated blended classroom instruction find it difficult to collaborate due to their sitting positions. Communication is also not smooth as they cannot hear each other clearly. This also hinders their attention sustenance in the classroom. These deficiencies in this rows-columns seating pattern affect students' engagement level in class activities. The suggestion of this study is that future study needs to be carried to determine the exact distance between students in the classroom during instruction that will enhance good classroom climate.

The second research question stated: Which seating pattern is students' predilection, U-shape or rows - columns and how does students' predilection influence their engagement in the classroom experiences in science education blended learning instruction in the University? In teaching and learning, there are factors that affect students' concentration that cannot be controlled by teachers like boredom, fatigue and memory attention span. However, the seating pattern in the classroom is definitely within the teachers' control (Robichaux, 2016). Wannarka and Ruhl (2008) indicated that the rows-columns seating pattern is effective in getting learners engagement in the classroom when the method of instruction involved independent task or assignment. In this study, results indicated that students had a better concentration in the U-shape seating pattern when compared to those in the rows- column seating format in collaborated blended learning in science education. Participants were not lost in thought easily and could listen attentively to their group mates when they perform activities in the U-shape seating pattern. It has been mentioned that participants enjoyed a favorable classroom climate as they had feelings of inclusiveness, they could hear each other clearly.

They had keen attention and were not easily confused by the students in front or behind them because of the U-shape arrangement. The synergy among attention sustenance, classroom climate and communication that occurred during the U-shape seating pattern could have been responsible for the interaction between the seating pattern and the experiences types (Attention sustenance, Classroom climate and Communication). It was also observed that noise from groups that were much closed to one another which reduced participants' concentration in their various groups.

It is therefore, imperative to take cognizance of the group closeness when concentration of students is required in seating pattern. It was also reported that in a blended learning classroom that included face-face instruction, online learning achieved high students' concentration spanning throughout the duration of the class and class management was very easy to achieve.

5.1. Seating Arrangements and Classroom Environment

Class room climate has recently been reported as a vital force that drives students' learning outcome (Clinton & Wilson, 2019) and hence conscious attempts have been made to make the learning environment hospitable to make gains in teaching and learning. Nevertheless, a seating pattern that is ideal is hinged on the flow of communication during a task (Wannarka & Ruhl, 2008). In a collaborated blended instruction as indicated in this study, students feel that the class room climate in a U-shape is better than the rows-column seating pattern. Participants reported

that the U-shape seating pattern is more conducive, homely, inclusive and humane and hence increase class participation in groups as against the rows-columns seating pattern.

Interestingly, even though the results indicated that learners feel that the classroom climate for U-shape was more hospitable for teaching and learning than the rows-column seating pattern, it was observed that some students were casual in the U-shape and their attention was not on the learning task but rather on their groupmates. At times some students got involved in discussion that had nothing to do with the learning task as against the rows- column class where there will be no side talk and concentration will be on the learning task. With the issue of informal behaviour during learning in a collaborated blended learning instruction, this study therefore, suggests that the aspect of informal and formal behavior during U-shape seating arrangement be investigated upon when students' feelings of the class climate are to be examined.

5.2. Effects of Seating Preferences on Student Engagement

Students also preferred the U-shape seating pattern for increased classroom achievement and engagement. The novel findings in this study are that classroom climate was the strongest interaction between seating pattern and the class achievement in a collaborated blended learning in science education. As evident in Table 5 the reason for students' predilection of seating pattern and increased achievement in the task in the collaborated blended instruction is a conducive classroom climate. In a collaborated blended learning instruction, learners were instructed to work in groups and collaborates with their group members to accomplish a project; as such learners depended on the interaction and communication among group members to conduct practical and to achieve quantitative analysis skills. Hence participants valued the class room climate that was made available by the U-shape seating arrangement. This study also showed that attention sustenance was another vital predictor to learners seating predilection and enhanced achievement.

The present study also indicated that the classroom climate was the first predictor in learners' seating predilection, and their achievement in the learning task activities as evident in Tables 2 and 3**,** most of the students stated that they liked the U-shape arrangement as against the rows- columns seating format and achieve better in a given task due to that fact the environment was homely. Students described the U-shape class climate as more conducive, homely, inclusive and humane and convenient class room climate. It is worthy of note that the number of participants who preferred the U-shape seating pattern increased after they had experienced the two-seating class room seating pattern. From the fore going, it can be said in summary that the likeness by students for U-shape can be attributed to the humane, convenient and comfort the U-shape avail to students during learning activities. Students having a flexible learning environment that will enable to work comfortably among their group members was highly valued (Byers et al., 2014). It can also be said that this result would have be so because students were assigned to group which led to acceptability of students in different groups (Cornell, 2002). This study suggested that inclusion in seating format can influence learners' active engagement in class learning activities. An environment that helps students to engage in active learning in a symbiotic form can make students gain from that learning (Rocca, 2010).

Hence, this study recommended that when teachers use blended instruction, the seating format should be in such a way that will enable students to get involved in active group discussion environment as well as prompt feedbacks and directions to students.

6. CONCLUSION

The essence of this paper was geared toward providing information to the increasing awareness of active learner's engagement, interaction with classroom seating pattern and students' predilection in collaboration blended learning instruction among undergraduates. Optimistically, this study has been able to provide insights on how learners' classroom seating pattern in the U-shale and rows-columns type influence their learning experiences

as well as the classroom seating during this post – COVID era where blended learning instruction is on the increase.

The findings of this study advocated the U-shape seating format as it increased learners' engagement than the rows-column seating arrangement in the collaborated blended learning in science education. Students had a hospitable and comfortable classroom climate with the U-shape seating format. This led to attention sustenance and increased communication as such there was better class achievement compared to the rows-column format. When teachers have an understanding of the interaction patterns of factors in the classroom, they were able to design the classroom for active students' engagement and achievement in a blended collaboration instruction.

6.1. Limitations and Future Implications

The study was limited to science students in year three and not the whole programme. Students' psychological factors like locus of control, stress level, parental background may influence their preferences that were not investigated. Such psychosocial variables like gender, age, and attitude, locus of control, satisfaction and self - efficacy can play a mediating role when students are taught in a U-shape seating arrangement in a blended classroom. This study therefore suggests that academics should undertake a study that will incorporate psychosocial variables as mediating factors.

Future studies should also be done in other departments offering science and those which require active students' engagement. Researches should also be replicated in different classrooms size and data for the research gathered from teachers. The authors also suggest grouping students according to gender and ages in the U-shape to check for their learning outcomes. Studies should be conducted on the impact of U-shape seating pattern on students' psychological variables like, self-efficacy, locus of control, attitude and satisfaction. Lastly research should be conducted on the mediating effect of social status of students' parents when they sit in a U-shape pattern in a blended learning classroom. Seating arrangement should also be made in a U-shape with blended instruction.

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Transparency: The authors state that the manuscript is honest, truthful, and transparent, that no key aspects of the investigation have been omitted, and that any differences from the study as planned have been clarified. This study followed all writing ethics.
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APPENDIX

Questionnaire :1 Student's performance and predilection for seating pattern (SPAPFSP)

Gender:_____Age:_____Major: _____

Section1. Student's performance in science education classroom.

SA: Strongly Agree A: Agree D: Disagree SD: Strongly Disagree

	SA	A	D	SD
(1) When I am in the class, I listen to my instructor keenly	☐	☐	☐	☐
(2) I keenly take notes in class. .	☐	☐	☐	☐
(3) I keenly finish my class exercises.	☐	☐	☐	☐
(4) I effectively answer questions in class.	☐	☐	☐	☐
(5) While working in groups in the classroom I attentively listen to others	☐	☐	☐	☐
(6) While engaging in group work, my views are expressed actively.	☐	☐	☐	☐
(7) When I have a question, I request the help of my teacher for answers.	☐	☐	☐	☐
(8) When I have a question,I request the help of my classmates for answers.	☐	☐	☐	☐

Section 2 Students' classroom seating patterns predilection and the reasons for the predilection.

- What is your predilection for seating pattern (U-shape or rows-and-columns) in science education class? Briefly state the reason for your preference.

_____

_____

Questionnaire 2: Students' class experience with the U-shape seating pattern, choice of seating pattern and why the choice (SCEUSP)

A. Part A. Your class experience with the semicircular seating arrangement.

SA: Strongly Agree A: Agree D: Disagree SD: Strongly Disagree

SA A D SD

Communication

(1) I am able to achieve effective communication with my team mates when actively involved in the U-shape seating pattern ☐ ☐ ☐ ☐

(2) My eye contact is consistence when I do activities in the class with the U-shape seating pattern ☐ ☐ ☐ ☐

(3) The sound quality when I undertake activities in the class is perfect in the U-shape seating pattern ☐ ☐ ☐ ☐

(4) I find it difficult to detect clearly what groupmates say while carrying out activities in the U-shape seating pattern. ☐ ☐ ☐ ☐

(5) My communication with the instructor is perfect when performing activities in the U-shape seating pattern. ☐ ☐ ☐ ☐

Classroom climate

(6) I have a relaxed feeling when I conduct activities in the U-shape seating pattern ☐ ☐ ☐ ☐

(7) I have a feeling of loneliness when I perform activities in the U-shape seating pattern. ☐ ☐ ☐ ☐

(8) I have a lively atmosphere when I perform activities in the U-shape seating pattern ☐ ☐ ☐ ☐

(9) I have a feeling of closeness to teammates when I conduct activities in the U-shape seating pattern ☐ ☐ ☐ ☐

(10) I feel accepted when I perform activities in the U-shape seating pattern ☐ ☐ ☐ ☐

Attention sustenance

(11) I can be lost in thought easily when I perform activities in the U-shape seating pattern ☐ ☐ ☐ ☐

(12) I listen attentively to my group mates when I do perform activities in the U-shape seating pattern ☐ ☐ ☐ ☐

(13) I am able to focus on an assignment when I undertake activities in the U-shape seating patter ☐ ☐ ☐ ☐

(14) I am unable to concentrate when I perform activities in the U-shape seating pattern ☐ ☐ ☐ ☐

(15) I find it easy to focus on the group discussion when I do an activity in the semicircular seating arrangement.

Students' class experience with the rows-columns seating pattern, choice of seating pattern and why the choice.

B. Part B. Your class experience with the rows-and-columns seating arrangement.

Tick the appropriate answer SA A D SD

Communication

(1) I am able to achieve effective communication with my team mates when actively involved in the rows-and-columns seating pattern ☐ ☐ ☐ ☐

(2) My eye contact is consistence when I do activities in the class with the rows-and-columns seating pattern ☐ ☐ ☐ ☐

(3) The sound quality when I undertake activities in the class is perfect in the rows-and-columns seating pattern ☐ ☐ ☐ ☐

(4) I find it difficult to detect clearly what groupmates say while carrying out activities in the rows-and-columns seating pattern. ☐ ☐ ☐ ☐

(5) My communication with the instructor is perfect when performing activities activity in the rows-and-columns seating pattern. ☐ ☐ ☐ ☐

Classroom climate

SA A D SD

(6) I have a relaxed feeling when I conduct activities in the rows-and-columns seating pattern. ☐ ☐ ☐ ☐

(7) I have a feeling of loneliness when I perform activities in the rows-and-columns seating pattern.

☐ ☐ ☐ ☐

(8) I have a lively atmosphere when I perform activities in the rows-and-columns seating pattern.

☐ ☐ ☐ ☐

(9) I have a feeling of closeness to teammates when I conduct activities in the rows-and-columns seating pattern.

☐ ☐ ☐ ☐

(10) I feel accepted when I perform activities in the rows-and-columns seating pattern. ☐ ☐ ☐ ☐

Attention sustenance

(11)It is easy for me to become absent-minded when I do an activity in the rows-and-columns seating arrangement.

☐ ☐ ☐ ☐

(12) I listen to other group members attentively when I do an activity in the rows-and-columns seating arrangement. ☐ ☐ ☐ ☐

(13) I can concentrate on the task when I do an activity in the rows-and-columns seating arrangement.

☐ ☐ ☐ ☐

(14) I am easily distracted when I do an activity in the rows-and-columns seating arrangement.

☐ ☐ ☐ ☐

(15) I find it easy to focus on the group discussion when I do an activity in the rows-and-columns seating pattern

☐ ☐ ☐ ☐

C. Part C. Your predilection for classroom seating pattern and why

1. What is your predilection for seating pattern (U-shape or rows-and-columns) in science classroom class? State the reason for your preference.

_____

_____

2. In which seating pattern were you able to complete your task better, U-shape or rows-and-columns? State the reason.

_____

_____