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Effects of Classroom Seating Arrangements on Memory Recall

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The study examined the impact of classroom seating arrangements on memory recall and its subsequent implied effect on academic performance. The study sought to find out if there was a significant difference in performance of students who sat towards the front, middle and back positions in the classrooms. The experiment was conducted on sixty (60) Form-Two students of Kwegyir Aggrey Memorial School. Three conditions with 20 subjects were randomly assigned to each condition. The Brown-Petersons Auditory consonant Trigram was used and subjects under each condition were presented with nonsense trigrams to learn and recall either immediately or after performing a mathematical test. A difference in performance in the recall of words of students who sit in front of the class, middle and of students who sit at the back of the classroom was obtained and was realized from the results that seating arrangements have no effects on the performance of students. As against previous findings, no significant difference occurred between performance of students who sat in front, middle or at the back. This indicated that students perform the same irrespective of their seating position in class.

KEY WORDS: Seating arrangements, Memory recall, Academic Performance

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INTRODUCTION

BACKGROUND OF THE STUDY

Student satisfaction has been of pivotal concern to educators for many decades (Schwarzer,, 2008). Psychologists in all branches of the discipline contribute to our understanding of teaching, learning and education. Educational psychologists seek to understand and improve the teaching and learning process within the classroom and other educational setting (Schwarzer, 2008). They study topics such as intelligence and ability, testing student motivation, discipline and classroom management, curriculum planning and grading.

They also test general theories about how students learn most effectively and frequently engage in curriculum research and development. School psychologists work in elementary and secondary schools administering tests, making placement recommendations and counseling children with academic or emotional problems. At the heart of these two fields of psychology is the desire to develop effective ways and measures to optimize student performance academically, which happens to be the primary aim of this research work.

How important is memory to normal human function? One way to appreciate its importance is to imagine if we

were without it. We will not recognize anyone or anything as familiar. We would not be able to talk, read or write because we will remember nothing about language. There will be nothing like experience because it would have taught us nothing. Memory involves taking something we have observed, such as a written phone number, a person's name and converting it into a form we can store, retrieve and use. For a sound, image, or thought to return to mind when it is no longer present, it has to be represented in the mind-literally, re-presented, or re-presented again-this time without the original stimulus. Memory could refer to the mental function of retaining information about events, images and ideas after the original stimuli are no longer present (Westen, 2003). Baddeley (1996) defines memory as the active system that stores, organizes, alters, and recovers information. Although the English language uses a single word for memory, there are actually many different kinds. Most theoretical models of memory distinguish three main systems or types: sensory memory, short-term or working memory, and long-term memory. Within each of these categories are further divisions. Sensory memory holds information about a perceived stimulus for a fraction of a second and after the stimulus disappears, allowing a mental representation of it to remain in memory briefly for further processing (Sperling, 1960).

The short-term memory is also a memory store that holds a small amount of information in consciousness-such as a phone number-for roughly 20 to 30 seconds, unless the person makes a deliberate effort to maintain it longer by repeating it over and over (Waugh & Norman, 1965). Conrad (1964) suggested that short-term memory codes all information acoustically, that is according to sound. However, long-term memory may hold information for more than 30 seconds for as long as a lifetime. As a result of its diverse usage, the term memory is used almost invariably in psychology with source adjectives preceding it.

This research was conducted at the conscious level, which involves the existence of the part of memory known as the short-term storage. The short term memory or the working memory has a limited processing capacity such that insufficient capacity is available to deal simultaneously with all the information that subjects had to store. This sometimes leads to a phenomenon known as information overload where people are faced with more information or stimulation than they can comprehend.

Memory and learning are closely related, and the terms often describe roughly the same processes. The term learning is often used to refer to processes involved in the initial acquisition or encoding of information, whereas the term memory more often refers to later storage and retrieval of information. However, this distinction is not hard and fast. After all, information is learned only when it can be retrieved later, and retrieval cannot occur unless information was learned. Thus, psychologists often refer to the learning and memory process as a means of incorporating all facets of encoding, storage, and retrieval.

In trying to optimize academic excellence, one will have to make conscious effort to improve learning in students. Learning underpins the very existing of all cultures. Psychologists view learning as a means of adapting to the environment. Hilgard (1975) defined learning as a relatively permanent change in behavior resulting from experience. Psychologists who study memory are interested in how the brain stores knowledge, where this storage takes place, and how the brain later retrieves knowledge when we need it (Roediger, 2008). In contrast, psychologists who study learning are more interested in behavior and how behavior changes as a result of a person's experiences. It is thus impossible to think of humans or any animal being able to learn without this capacity (memory).

It is also impossible to conduct the research without laying emphasis on the two, since at one point or the other these theories come into play. Experiments by psychologists have identified motivation, intelligence, maturation, the physical condition of the learner, good physical working conditions amongst others to be factors that affect and can influence the rate and efficiency of the learning process. However, the current study seeks to research into whether the latter (a good physical working conditions) tends to affect the learning process. The physical workings conditions include fresh air, light, comfortable seating arrangement and surroundings which can be of great aid to learning effectively.

How desks in a classroom are arranged seem have a profound influence upon young children, and that is what this study seeks to investigate. There are various classroom seating arrangements that encompass learning objectives, desired (or undesired) outcome and even peer and other social implications. In Ghana, most schools and teachers favor the traditional form of row seating as it offers the teacher ease of movement around the classroom and affords the student a clear view of what is happening in front of them, as such the current study was conducted using this form of seating arrangement. Although it is ideal for classroom management in a regular school setting, for purposes of language learning, it is less than ideal. This arrangement is also thought to be too teacher-centered and not conducive for group or pair work in that it inhibits students from easily communicating. However, problem behavior and peer intimidation is less frequent and this promotes learning objectives and desired outcomes set by the teacher (Marzano, 2001). Different seating arrangements can foster academic and social success for students, while lessoning behavior problems and one of such arrangements is the cluster seating arrangement. Clusters consist of four or five desks pushed together so every desk is facing another one. The fifth desk, if needed, would be put on the end of the group of four.

The classroom would have clusters scattered around, so each cluster would be far apart that the student chairs would not hit each other. In this situation, the teacher is free to walk around the room without bumping into student's desk or chairs and can work with the groups. The groups of students need to be thought about before setting up. The students need to be able to work together. There will have to be different levels of students at each group so that they can help each other learn and grow. Clusters are very common in situations where there is a lot of group learning and work. The desk put together makes it easy for all students in the cluster to see each other and to discuss. In this situation, the philosophy of the teacher is more collaborative learning. This lets the students have hands-on activities and learn by practicing. The teacher shares and gives guidance and helps the students. This arrangement also, allows for students to do individual work at their desks.

Another popular seating arrangement is known as the horseshoe or half circle. This arrangement has similar characteristics with the cluster seating arrangement. As the name implies, the horseshoe arrangement takes the form of a half circle usually with the facilitator at the middle. In some cases when the class size is large an additional semicircle is provided. The seating arrangement is done in a way that those in the inner circle do not block the view of those in the outer circle. The main advantage to this classroom organization is that the teacher can see all students at all times and this can aid in giving clear instructions, and it helps with classroom management or other potential problem behavior (Poulou, 2001).

The study arose as a result of observations made by the researcher in the course of his education as a student in both junior and senior high school. While learning in class the researcher noticed the tendency for students seating arrangements to cause students to perform better or worse academically depending on whether a student sits in front or at the back of the class. "Seating is a prime consideration, and it can do a great deal to either facilitate or hinder what goes on in your classroom" (Wald, 1996). A traditional classroom especially in Ghana often is set up with the desks in rows, the teacher's desk or table somewhere in front of the room, and student desks moved far apart. The desire to improve education has stimulated awareness for the necessity of improving learning environments (Douglas & Gifford, 2001). Research on the subject of classroom environment often takes the form of exploring how the physical and social classroom environment affects academic performance. Douglas and Gifford (2001) found that in studying classroom physical properties and assessment, the students and faculty members preferred classrooms equipped with an outdoor view, comfortable chairs and communal seating layouts. Research conducted by Wannarka and Ruhl (2009) provided evidence to support the idea that students display higher levels of appropriate behavior during individual tasks when they are seated in rows, with disruptive students benefiting the most.

It is obvious that seating arrangements can affect various facets of experience for the students as well as the teacher alike, thus the need to conduct the current experiment to test the hypothesis that seating arrangement will affect recall.

STATEMENT OF THE PROBLEM

This study is concerned with the manner in which seating positions affect memory recall and in turn its possible effect on academic performance of students. One of the more reliable findings about seating arrangements or in educational research is the relationship between seating position and classroom participation, which affects the overall academic performance of students. The study seeks to find out if students sitting towards the front, middle and center portions of the classrooms participate more than those sitting towards the back of the classroom. The issue here becomes eminent when seating arrangements in classrooms impact on students' ability to recall. Students offering a course should all have equal opportunities and accessibility to facilities and infrastructure so as to avoid bias in the educational program and also to offer each student equal chance to excel academically.

AIMS AND OBJECTIVES

At the end of the study, a difference in recall of words between those students who sit in the front, middle and of those who sit at the back of the classroom is to be established.

Also the direction of this difference if there is any will be identified. It will be of great importance to know if students seated in the front of the classroom, that is those close to the teacher will perform better than those seated at the back of the classroom that is those seated to the rear or further to the end of the classroom or even those seated in the middle.

It will then be interesting to know if boys seated in the front rows are going to perform better than girls who sit also in the front rows and the vice versa will also be considered in the experiment.

A further aim of this experiment is to give researchers a forum within which to discuss general claims about excellence of students that go beyond any particular individual or cultural settings.

RELEVANCE OF THE STUDY

There are many different viewpoints on excellence among educational psychologists. One particular glaring

fault line in the debate about how to promote excellence concerns whether excellence is something fostered in individuals-by enhancing their inherent mental abilities, their knowledge, or their personal efforts to excel-or whether excellence is a product of particular institutional practices. Unfortunately, these two perspectives are rarely addressed in a single volume, thus this experiment will allow those of us who emphasize transforming institutions. The aim of the study is to promote excellence in student performance, thus seeking to determine if seating arrangements or layout actually causes a student to perform exceedingly well or cause them to under-achieve academically.

This study is important for assisting schools and students to make the most of their educational opportunities.

LITERATURE REVIEW

THEORETICAL FRAMEWORK

The context-dependent memory states that there is a tendency for recall to be best when the environmental context present during attempts at retrieving is the same as the context when learning occurred (Gershman2016). There have been several experiments to confirm the effects of context on recall. Gershman (2016) has suggested that if teachers want to get optimal performance from their students, tests and finals should be given in the same classroom in which the class meetings took place. A study by Godden and Baddeley (1975) amply demonstrates this point. Their subjects were scuba divers who learned a list of forty works in one of two conditions: ashore or under water. The subjects then had to recall the list in one of two conditions. Half the subjects recalled the list in the learning environment (i.e., ashore or under water). The other half of the subjects recalled the list in the other environment. Results indicate that subjects who learned and recalled the words under water performed about 50% more than subjects who learned under water and recalled on dry land.

The findings of the study have practical implications. Instructions given to scuba divers should be given underwater as well as on dry land and if divers are making observations about what they see underwater, they should record them there and not wait until they get on dry land (Baddeley,1982). It should however, be noted that effects of context are not limited to physical environment's influence. The mood of the subject who is learning some material is also part of the context, and the probability of retrieval is enhanced if subjects can reestablish the same mood at recall time. This is sometimes referred to as the state-dependent learning. One important assumption of this theory involves the illustration of environmental context on memory recall. This theory helps to explain the reason why students find themselves making conscious effort to either sit in front or at the back of the class in an environmental context which will increase their performance when recall is required. It is evident from the above that contextual effects can exert a strong effect on the kind of encoding that is done, thus the environmental situation present or available to us during learning is of immense value especially during recall. In this, the location of a student in class, his closeness to the teaching board and interaction with the teacher or instructor could go a long way in affecting the student's performance. The current study recognizes the prospect of context affecting students in recall and tries to find out ways to employ to promote good and suitable contextual settings that will enhance optimum performance in schools.

Selection attention is used to refer to the fact that we usually focus our attention on one or a few tasks or events rather than on many. At any given moment, our awareness encompasses only a tiny proportion of the stimuli impinging on their sensory systems. Presumably, we process information about things that we are not paying attention to, differently from information about things that we are focusing on. To explain this, Broadbent (1958) proposed a filter theory of attention, which states that the amount of information that can be attended to at any given time is limited. Therefore if the amount of information available at any given time exceeds capacity, an attention filter is used to let some information through and block the rest. The filter is based on some physical aspect of the attended message, the location of the source or its typical pitch or loudness. This suggests that closeness of students to teachers depending on their seating arrangements makes them benefit from attending to instructions from teachers or might hinder their attention in class. Broadbent (1958) went on to say that this does not mean that people can never pay attention to two messages at once, believing instead that what is limited is the amount of information we can process at any given time. Two messages that contain little information can be processed simultaneously. In contrast, message that present a great deal of information quickly take up more mental capacity, fewer can be attended to at once. The filter thus serves to protect us from "information overload" by shutting out messages whenever there is too much information to process all at once.

Human memory is very important and critical for our survival. Fortunately the memory system is also very efficient that it hardly fails, but the same mechanisms that generally foster adaptation can regularly cause memory failures. When one's memory fails it can result in very frustrating and sometimes serious situations. Inconveniences may range from forgetting the date of birth of your friend to disastrous consequences as forgetting the appropriate answer to a question in an examination. Schacter (1999) spent his life studying

memory, and found that human memory systems evolved through natural selection, A prime culprit in memory failure is interference, the intrusion of similar memories on one another, as when students confuse two theories they learned around the same time (Weasten, 2003).

Insight into forgetting comes from a classic experiment in which college students learned lists of nonsense syllables. After studying, students in one group slept for eight hours and were then tested for memory of the lists. A second group remained awake for eight hours and went about business as usual. When members of the second group were tested, they remembered less than the group that slept. This is based on the fact that new learning can interfere with previous learning. It is not clear if new memories alter existing memory traces or if they make it harder to 'locate' (retrieve) earlier memories. In either case there is no doubt that interference is a major cause of forgetting (Neath, 1998). In the current study subjects performed best when they had to recall immediately after hearing the nonsense trigrams than when they had to perform other mathematical calculations. It was obvious from the study that interference seemed to occur when students had to perform other activities before recalling the initial stimulus presented to them.

REVIEW OF RELATED LITERATURES

Several researchers have investigated classroom seating arrangements and its effects on student performance in to. In one of such studies, Wannarka and Ruhl (2008) researched into seating arrangements that promote positive academic and behavioral outcomes. They postulated that seating arrangements are important classroom setting events because they have the potential to help prevent problem behaviors that decrease student attention and diminish available instructional time. The purpose of this synthesis of empirical literature was to determine which arrangements of desks best facilitate positive academic and behavioral outcomes for primary through secondary high school students with a range of characteristics. Eight studies that investigated at least two of three common arrangements (i.e., rows, groups or semi-circles) were considered (Wannarka & Ruhl, 2008). Results indicated that teachers should let the nature of the task dictate seating arrangements. Evidence supports the idea that students display higher levels of appropriate behavior during individual tasks when they are seated in rows, with disruptive students benefiting the most. Their experiment was majorly interested in finding a suitable classroom seating arrangements that could facilitate academic performance and this is consistent with the current study.

Gary (1972) also conducted a research into Seating Arrangement and its Effect on Interaction, Performance, and Behavior. They believed that Classroom proxemics, particularly seating arrangements, is intuitively thought to affect the performance, attitudes, and behavior patterns of students. A study of 84 sixth-grade students, based on different classroom seating arrangements for a six-week period, tested this hypothesis. Both students and teachers submitted evaluation forms each week to express their attitudes about seating positions, student-teacher interaction, student participation in class, and other factors relating to behavior and discipline. Results indicated that seating arrangements do affect classroom behavior and that there is a relationship between pretested IQ scores and reactions to the various seating arrangements. The results do not suggest solid causation but can be interpreted as indications worthy of future studies. The study utilized self-report in obtaining data from participants, which can be very subjective as participants may turn to be bias in reporting information to either support or refute hypothesis.

Yet in another study carried out by Marx, Fuhrer; and Hartig (1999) investigated the relationship between classroom seating arrangements and the question asking of fourth-graders. Data were collected during 53 lessons spread over eight weeks. Children were assigned to sit in a semicircle and then in a row-and-column seating arrangement for two weeks each. This rotation was repeated. Both children's questions and the teacher's verbal reactions were recorded using an observational system based on Kearsley's question taxonomy. The results showed that children asked more questions in the semicircle than in the row-and-column arrangement, and that the pattern of question characteristics was stable over time. The findings also revealed that, within the row-and-column arrangement, there was an action-zone in which children asked morequestions per lesson. The results are interpreted in terms of Steinzor's postulation that social interaction is encouraged when individuals are able to establish face-to-face contact.

Beyer and Langenfeld (2000) researched into the topic Gender Differences in the Recall of Performance Feedback, their study tested whether gender differences in recall of performance feedback exist. Participants were 88 female and 68 male undergraduate students enrolled in introductory psychology courses at the University of Wisconsin-Parkside. They were presented with eight comments each (evaluative feedback) for both an English paper and a computer program. Participants were asked to imagine that either they or another student had written the paper or the program. The feedback for one of the two performance domains was mostly positive, the other mostly negative. After reading the performance feedback, participants were asked to guess the letter grade the professor had assigned to the paper or program and to rate the comments. Participants were then given a three-minute surprise recall test of the performance feedback for both domains.

Participants were once again given a form listing each of the eight English paper and eight computer program

comments. They were asked to rate the three comments that were most influential in determining the grade the professor has assigned the paper or program. The women estimated that the English paper had received higher grades than men did when the feedback was positive, but they estimated lower grades than men did when the feedback was negative. Thus, females reacted in a more polarized fashion to the performance feedback, indicating that they were somewhat more affected by the evaluative feedback than males. However, this effect was not found for the computer program. Upon careful examination of the experiment it was observed that a bias in the selection of participants may have a strong impact on the results. The researcher selected more females than males in the study and this has a greater probability of confounding results, thus in the current study the researcher made conscious efforts to select equal number of males and females in each group.

In another study done by Richardson (2009) gender effects on recall was once again tested. The purpose of this study was to discover if there is a significant effect for the sex of a participant on the types of gender associated images recalled from a slide show. Data were collected from 28 undergraduate students from a midsized university in Northwest Missouri. All students were enrolled in a Cognitive Psychology class at the same university. Each participant was given a piece of paper with 20 lines for recall and one line for their gender. A Power Point show of 20 slides with people or objects on them, one slide with the word “start” and one slide with the word “stop” on them were shown to the participants.

The people or objects were chosen based upon lists provided by male and female students enrolled in a research methods lab class. Each participant received a paper with 20 lines for recall and one line for their gender. They were instructed to pay attention to the Power Point show because they would be later asked to recall as many slides as possible. A Power Point slide show was shown to the participants. Each slide was consecutively shown for three seconds a piece. After the 20 slides were shown a slide instructed participants to begin recalling. They were given one minute to recall as many slides as possible. After one minute was up another slide instructed them to stop. A factorial mixed-design ANOVA was calculated comparing the number of gender associated images recalled by male or female participants. It was thought that there would be a strong significance of the gender of the participant as to which gender based images were remembered. Neither the gender of the participant nor the gender associated with the image had a great significant effect on the recall. Some of the limitations on this study were the amount of participants, the amount of slides shown, and the order in which the slides were presented. In reading the participant`s recall sheets, it was noticed by the researcher that many of the participants recalled the first three slides in the exact order that they were presented.

Further studies on Gender, Culture and Geography: A Comparison of Seating Arrangements in the United States and Taiwan was again conducted by Cline and Puhl (2002). Their study described and compared seating preferences among Taiwanese and American respondents. Using a questionnaire method, seating preferences were obtained for 75 male and 100 female college students from the United States, and for 29 male and 54 female teachers of English in Taiwan. Responses were obtained for all possible combinations of sex of interaction partner, location (task or social), and six interpersonal activities. Results were summarized in the form of proportions of respondents choosing each of four possible angles of interaction: corner, opposite, diagonal, and side seating. Comparisons were made using Chi Square tests for independence.

In general, results showed that Taiwanese respondents, when compared to Americans, are more likely to prefer side seating and less likely to prefer corner seating. Culture, sex of respondents, and sex of interaction partner interact in influencing preferences. In the United States, seating preferences function to unite males with females and to separate same-sex partners, while the opposite is true in Taiwan. Results are interpreted in terms of implications for intercultural communication.

Sri Lanka is a resource-poor country in the South-East Asian region with good health indices (Jayaratne& Fernando, 2010). Ergonomics of children in educational environments is still novel in the region. An important ergonomic issue of the classroom is the seating arrangement. Essential aspects of seating include location of the chair and desk in relation to the blackboard and features of the chair and desk. A school-based descriptive cross sectional study was carried out in a district of Sri Lanka to ascertain the distribution of selected ergonomic factors related to seating arrangements in the classroom of school-going early adolescents and to assess their relationship to musculoskeletal pain.

A sample of 1607 school children of Grade 6, 7 and 8 were selected using stratified multi-stage cluster sampling method. There were 52.1% (N=838) females and 47.9% (N=769) males. Many ergonomic aspects related to classroom seating arrangements are not conducive for children. Children were seated with a mean distance of 398.04 cm (SD=132.09) to the blackboard.

Nearly 23% of children had to turn more than 45~degrees to see the blackboard. A prevalence of 80% mismatch was found between body dimensions of children and measurements of furniture. Musculoskeletal pain may have resulted from efforts to maintain stability while seated in incompatible furniture. Nearly 36% children complained of recurrent musculoskeletal pain. Musculoskeletal pain may have resulted from efforts to maintain stability while seated in incompatible furniture. Mismatched seat depth – buttock-popliteal length posed

1.59 times risk recurrent musculoskeletal pain. Despite, children perceived a good chair comfort. Use of backrest lowered the risk of recurrent pain. Results shows that program planners can utilize such evidence to provide simple ergonomic solutions at national and school level.

The physical, social and academic components that make up the classroom are tightly related (Burgess & Kaya, 2007). Although the effects of physical classroom factors on students' participation and performance have been clearly stated, there is little empirical work investigating college students' perceptions of classroom seating layouts. The goal of this study was to examine whether male and female students' perceptions of seating layout differed in order to identify areas for future research. The research used both qualitative and quantitative methodologies. Focus groups, one comprised of college students and one of college faculty from different disciplines, were assembled. Results were content analyzed to determine salient attributes related to classroom layouts for construction of a written survey. The survey was then used for data collection at a large public university in the United States.

Four distinct seating layouts were generated using AutoCAD software. The shape, size, orientation of the space and number of chairs in each layout were kept constant. The final survey consisted of 60 statements (15 Likert-type items applied to each of four classroom layouts) pertaining to students' attitudes about seating layout. The scale ranged from 1 (strongly disagree) to 5 (strongly agree). Results indicated that female students turn to be more concerned about the classroom seating layout which they seem to feel may affect their performance but is not so with male students.

Another study examined whether gender influenced college students' attitudes regarding classroom-seating layout. Seating layouts included rows of tablet-arm chairs, U-shaped, clusters, and rows of tables with individual chairs. The sample consisted of 912 college students. Factor analysis yielded two dimensions: "Feeling at Ease" and "Social Interaction." Results of the factorial ANOVA revealed that females had greater feeling at ease in rows of tablet-arm chairs and in clusters, while males felt more at ease in u-shaped and rows of tables with individual chairs. Regardless of layout, males were less likely to interact with classmates than females. Topics for future research are included.

Students reported that the best classrooms were clean, orderly, outfitted with necessary physical facilities and had ample room. Douglas and Gifford (2001) found, in studying classroom physical properties and assessment, that students and faculty preferred classrooms equipped with an outdoor view, comfortable chairs and communal seating layouts.

There is a huge body of literature, which supports the assumption, that seating arrangements does actually turn to affect recall and performance of students. This study was to extract a latent space structure of classrooms from students seating preferences, and to determine whether classroom division on the basis of latent space structure is useful in predicting actual seating behaviors. The actual seating positions of 151 female junior college students were observed in classrooms once a week for one semester; then students were asked to estimate their seating preference among 49 seating positions in an imaginary classroom. Students did have different preferences for seating positions. A factor analysis suggested that classroom seating space should be divided into four zones: rear, front, center, and sides. A multiple discriminant analysis suggested that the seating positions that students actually took reflected a four-zone structure. Classroom division based on the four-zone structure proved useful in understanding students' seating behaviors. Their experiment seemed quite subjective at a point where students were asked to estimate their seating preference among 49 seating positions. The experiment was biased in that it seemed to consider a large number of females to the neglect of the males. These observations however did not hinder the researcher's confirmation that classroom seating arrangements actually turned to affect student performance in memory recall, but were all considered in the current research.

HYPOTHESES

Students who sit in front of the class will perform better than students who sit in the middle or at the back of the class.
Female students will perform better than male students in recalling.
Female students who sit at the back of the class will perform better than male students who sit in front, middle or at the back of the class.

OPERATIONAL DEFINITION

Front rows: first two rows closest to the teacher and to the black board
Back rows: last two rows towards the rear of the class and closest to the end of the class Nonsense trigrams: three-letter units lacking apparent meaning

METHODOLOGY

POPULATION

Students of Kwegyir Aggrey Memorial School located at Mallam a suburb of Accra represented the population. Several reasons contributed to the settling on students of this school as the population. This was in large due to the nature of the research question, potential cost of

transportation to the said school and also due to convenience. Kwegyir Aggrey memorial school has a little over seven hundred students, twelve classrooms with a maximum of sixty students in a particular classroom. It is from this population that participants for the study were sampled.

SAMPLE AND SELECTION

Random sampling technique was utilized to select a class with sixty pupils to serve as participants out of the total population to represent the sample. This number was made up of thirty males and thirty females. Randomization technique was used to assign participants to the various seating positions were each subject had an equal chance of belonging to any of three independent groups. Equal number of boys and girls was also utilized in the research to control for sex variable that might affect the study. Participants were randomly assigned to three groups, which were identified as:

Group 1 – front seat subjects
Group 2 – middle seat subjects
Group 3 – back seat subjects

MATERIALS AND EQUIPMENTS

During the experiment, the researcher employed several instruments to facilitate the research. Such apparatus utilized included Pens, pencils for recording results, Stop clocks which aided in keeping track of time to control for the time interval where participants are asked to do something else other than rehearsing the stimulus. Calculators, Computers and statistical software (SPSS V.20) were used in analyzing of data amassed from the study. Also a number of A4 sheets were required in presenting test to participants.

One major apparatus used in the research was the Brown-Petersons Auditory consonant Trigrams. In the Brown-Peterson test participants were presented with a trigram (three letters), then presented with a triple-digit number and asked to count backwards by 3's. After varying lengths of time 3, 9, 18 and 36 seconds, participants were then asked to recall the original trigram. The counting backwards task was used as a distraction to keep participants from rehearsing the trigram. Brown and Peterson found that the more time passes after the original viewing of trigram, the worse recall becomes. This he used to illustrate the decay of short-term memory-it fades with time.

SCORING

A score sheet was prepared to score the responses. For each correct trigram recalled the participant obtains a score of 3 and a trigram not recalled attracted a score of 0. The test involved 20 trigrams making the highest score a participant could obtain 60 and the lowest score 0. Participants who could recall one, two, alphabets out of the three obtained a score of one or two respectively. However, the researcher also sort to find out if students distorted the positions of the trigrams, thus a correct trigram recalled is checked to find out if it was recalled in their correct positions. Recall of the correct position of a trigram attracted a score of three making students obtain a score of 6 for recalling a trigram and in its correct position with a total score on the test to be 120. For each student under each condition, a computation of the "Probability of recall" of items in the different positions was determined.

DESIGN AND PROCEDURE

The design adopted for the study was a factorial design. This is so because the study consisted of two independent variables 'Gender', with two levels (males or females), and 'Seating Arrangement' in class with assumed three levels (front, middle and back). The dependent variable being measured was performance in recall.

At the school, introduction of researcher and the assistants was facilitated with an introductory letter from the Psychology Department, University of Ghana, Legon. Limit of confidentiality was discussed to participants in that data obtained from the research was solely for research purpose, thus, no confidential information was going to be disclosed unless prior consent from the participant is obtained. This was followed by briefing of participants about the research and what was expected of them, all in turn to create rapport between participants and the researcher. There were three groups depicting seating arrangements (those seating in the front rows, the middle rows and those seating at the back rows of the class). Answer sheets were then distributed to the participants where they provided information about themselves including their names, gender, class, their seating position in class, occupation of parent and the highest level of guardian's education. Under the three seating conditions subjects were presented with consonant trigrams and all they had to do was to listen, memorize and to recall immediately after hearing the trigram. The test however, involved twenty sets of different consonant trigrams with varying time limits when it came to recalling. During the first five sets of trigrams participants recalled immediately after hearing the trigram by writing their response on the answer sheets provided to them by the researcher. In subsequent trigrams participants were presented with a nonsense trigram and digit number they had to count backwards by 3's for varying time limits before writing down the trigram

presented to them earlier on the answer sheet. Participants had a time limit of which to complete each task on the test. Help from research assistants and the class teacher was sought to control student behavior and prevent cheating by students. After the presentation of all trigrams to participants, answer sheets were collected from participants.

STATISTICAL ANALYSIS OF DATA

In analyzing of the data, both One-Way and Two-Way ANOVA tests were utilized. One-WAY ANOVA was used to analyze two of the hypotheses, which included hypothesis one and two whiles the Two-Way ANOVA was employed to analyze the third hypothesis. This test was adopted because the study involved three groups of students who were randomly and independently selected from their respective population. The three groups are independent of each other; it was thus assumed that the population distributions from which the students were randomly selected are in normal form. It was thus further assumed that the population variances are homogeneous. Also from the given data, the level of measurement on the dependent variable (performance in memory recall) was at least interval. Therefore, the most appropriate statistical test to use to test the research hypotheses was One-Way and Two-Way Analysis of Variance. The computed values were referred to ANOVA tables at the .05 level of significance for decisions to be taken as to whether observed results was to be retained or rejected.

RESULTS

The results are shown with reference to the tables below. Table 1 shows the mean and standard deviations of performance by seating arrangements and gender.

By inspecting the data above, it is deduced that students who sit in front of the class performed better than students who sat in the middle or at the back, whiles students in the middle group performed better than students who sat at the back of the class. Also, the mean and standard deviation table above indicates that female students who sat in front of the class performed better than male students who sat in front, middle or at the back of the class. However, the Analysis of Variance would be the most appropriate statistical test to test our hypotheses and thus summarize the results of the analysis below in Table 2. It is only after subjecting the data to inferential statistical tests, that we can determine if the hypotheses tested have been supported or not, thus necessitating the use of One-Way and Two-Way ANOVAs analysis from which results have been summarized in subsequent tables.

The results recorded in Table 2 show that the effect gender on memory recall was not significant (F=0.523, p= 0.473). At the 0.05 level of significance, no significant difference existed between gender of participants and memory recall from the One-Way ANOVA Analysis in the table above. Table 2 reports that no significant difference exists between males and females in memory recall, as a result the above results clearly indicate that the hypothesis that female students will perform better than male students in recalling was not supported.

Table 3, also did not observe any significant difference in seating position of students and their performance on memory recall (F=1.328, p= 0.273). Results obtained from table 3 above, suggests that the first hypothesis, which states that students who sit in front of the class will perform, better than students who sit in the middle or at the class was not supported. At the 0.05 level of significance no significant difference exists between student seating position in class and the student performance in recall.

The two-way Analysis of Variance in the table 4, apart from showing no statistically significant difference in the results obtained for the main effects which were seating arrangements and gender, revealed another finding, thus observing no significant interaction between Gender and Seating position in class (F=2.390, p= 0.101). The Absence of significant difference among the various seating groups negates the first hypothesis, whiles the second and third hypotheses are repudiated by the absence of significant difference in performance based on Gender.

DISCUSSION

The study set out to find out the effects of classroom seating arrangements on memory recall, to find out whether the seating position in class will affect their ability to recall and their subsequent performance in class. The study also set out to determine if gender is a factor or affected recall. Results indicated that seating arrangements does not affect memory recall. Similarly gender also did not affect performance of students in recall. There was no significant difference in observed and the critical values at the 0.05 level of significance. In undertaking the study, the researcher expected to find a difference in gender and also observe the effects of seating arrangements on memory recall, but according to the results the researcher's hypotheses were all disproved. Three hypotheses were formulated and tested.

Hypothesis one stated that, students who sit in front of the class will perform better in recalling than students who sit at the back or middle of the class. This was to say that seating arrangements was going to affect recall. The results of the study refuted this hypothesis even though mean scores showed some differences between performances of the various seating positions of

Table 1: Means and Standard Deviation of Scores on Recall on the Brown-Peterson Nonsense Trigram Test.

Seating position of participant	Gender of participants	Mean	Standard deviation	Number (N)
Front	Male	106.00	13.400	10
	Female	107.60	9.732	10
	Total	101.80	12.858	20
Middle	Male	105.00	6.733	10
	Female	96.50	20.506	10
	Total	100.75	15.481	20
Back	Male	91.80	18.371	10
	Female	97.30	15.980	10
	Total	94.55	16.994	20
Total	Male	97.60	14.349	30
	Female	100.47	16.296	30
	Total	99.03	15.291	60

Table 2: A Summary Table of One-Way Anova of Scores on Recall on Gender.

	Sum of Squares	Df	Mean Square	F	Siq.
Between Groups	123.267	1	123.267	.523	.473
Within Groups	13672.667	58	235.736		
Total	13795.933	59			

Not significant at the 0.05 level of significance

Table 3: A Summary Table of One-Way Anova of Scores on Recall on Seating Position.

	Sum of Squares	Df	Mean Square	F	Siq.
Between Groups	614.033	2	307.017	1.328	.273
Within Groups	13181.900	57	231.261		
Total	13795.933	59			

Not significant at 0.05 level of significance

Table 4: A Summary Table of The 2-Way Anova of Scores on Recall on The Brown-Peterson Nonsense Trigram Test

Source	Type III Sum of Squares	df	Mean Square	F	Siq.
Corrected Model	1799.333[a]	5	359.867	1.620	.170
Intercept	588456.067	1	588456.067	2.649E3	.000
Seating position	614.033	2	307.017	1.382	.260
Gender	123.267	1	123.267	.555	.460
seating position * gender	1062.033	2	531.017	2.390	.101
Error	11996.600	54	222.159		
Total	602252.000	60			
Corrected Total	13795.933	59			

a. R Squared = .130 (Adjusted R Squared = .050)

students. While observing results of the mean scores from table 1, it was realized that students who sat in front really performed well in recalling with a mean score of 101.80 and a standard deviation if 12.86, followed by students in the middle who had a mean score of 100.75 with standard deviation of 15.40 whiles students with the lowest performance was recorded by students at the back with a mean score of 94.55 and standard deviation of 16.99. These differences that we were observing in the mean scores suggest differences in performance between the positions students sat in class and their performance, thus clearly showing seating arrangement does affect student performance in recall. If this is true, then the first hypothesis which stated that students in front of the class will perform better than students who sit in the middle or at the back of the class would be confirmed. However, it will be absolutely wrong to interpret the data as it presently stands until it has been subjected to hypothesis testing, using an appropriate statistical test. This is so because; the differences that we are observing between the various group means could have arisen due to error in sampling or some systematic error that occurred during the collection of data. Subsequent results from table 3 after analyzing the data with One-Way ANOVA, indicates that the first hypothesis be rejected. This is manifested in the insignificant difference in performance by students in front from the others. Table 3, which utilized One-Way ANOVA to analyze the effect of seating arrangement on recall, realized an F value of 1.328 which is larger than the significant value of 0.273 at the 0.05 level of significance, thus rejecting the first hypothesis.

This finding contradicts previous studies of Wannarka and Ruhl (2008) who postulated that seating arrangements are important classroom setting events because they have the potential to help prevent problem behaviors that decrease student's attention and diminish available instructional time. The finding also contradicts the work of Rubin and Gary (1972) who conducted a research into Seating Arrangement and its Effect on Interaction, Performance, and Behavior. Their results indicated that seating arrangements do affect classroom behaviour and that there is a relationship between pretested IQ scores and reactions to the various seating arrangements. Result from the work of Marx, Fuhrer; and Hartig(1999) indicates that children asked more questions in the semicircle than in the row-and-column arrangement, which shows the effects of classroom seating arrangement on student question asking of fourth-graders. This finding however contradicts findings of the current study which did not find any effect of the type of seating arrangements and memory recall. This in part might be due to the absence of control groups to aid in comparisons in the current study. Also the current study should have included other seating arrangements types, like the horseshoe and semicircle arrangement to find out if differences occur between them. Other limitations that may have led to refuting of the hypothesis are mentioned in the limitation section.

For a second time from the means in table 1, several differences in performance between genders in respect to memory recall were observed. In the front rows, females performed better than males with means of 107.60 and 96.00 respectively. In the middle rows however, males performed better than females with means of 105.00 and 96.50 respectively. Lastly in the back seats females once again did perform better than male's 97.better than males 97.30 and 91.80 respectively on means. This should have been a basis to confirm the second hypothesis, which stated that females will perform better than males in recalling, but no! The data had to be statistically analyzed with a statistical test where in this case the One-Way ANOVA was utilized. Results from this analysis in table 2 postulates that hypothesis two be rejected even with the many differences observed in performance based on gender. One would expect that after observing such differences in performance based on their means, the hypothesis should be supported. Yet again, this was not so as the analysis of One-Way ANOVA from table 2 indicated an F- ratio with value of 0.523, which is above the significant value of 0.473 at 0.05 significant levels, thus did not find any significant difference in their performances.

This depicts that although we are witnessing all these differences in performance based on gender, these differences are not significant enough to say that the scores obtained is due to gender differences. Thus whatever affects student's performance, either positively or negatively, affects both boys and girls. Here again, the finding contradicts Cline and Puhl (2002) in their study on gender, culture and geography. One major critique against their work, which might subsequently explain the cause of the contradiction, is the biases of the researchers in their sample selection. Using a questionnaire method, Cline and Puhl (2002) obtained seating preferences for 75 male and 100 female college students from the United States, and for 29 male and 54 female teachers of English in Taiwan, indicating a bias in favor of females. However a study by Richardson (2009) on gender effects on recall corroborates results from the current study. In his study neither the gender of the participant nor the gender associated with the image presented to participants had a great significant effect on the recall. Current studies show that gender differences in the performance of tasks is gradually fading with females performing almost equally as male, in that there are more similarities between males and females in cognitive performances than differences (Hyde, 2005). In some cases women perform better than males on certain tasks. Rejection of the hypothesis postulates that other factors other than gender differences turn to affect recall; hence future researches should identify these factors and not compare gender differences because there was not much of a difference.

Subsequently, the researcher not being able to determine a significant difference between the main effects (seating arrangements and gender) on memory recall, sort to find out if there could possibly be a significant difference on the interaction between gender and seating arrangements thus formulating a third hypothesis. This stated that female students who sit at the back of the class will perform better than male students who sit in front, middle or at the back of the class. From the mean scores, females in front had a score of 107.60, which was higher than males in front with a mean score of 96.00, also higher than males in the middle and at the back with mean scores of 105.00 and 91.80 respectively. The Two-Way ANOVA statistical analysis was used to investigate the effects and here again no significant difference was observed. A significance of 0.101 was observed which is also higher than the set level of significance (p=0.05), thus here again the hypothesis was refuted. A Study conducted of Dalrymple (2009) supported the results. Dalrymple (2009) in a similar study, found no significant effect in the interaction between sound and gender in recall. After an observation of the various tables, it was noticed that seating arrangements alone affects memory recall than gender with significant levels of 0.273 and 0.473 respectively even though the hypotheses were refuted.

Furthermore, the combinational effect of seating arrangement and gender was more significant in affecting recall than the main affect alone. The combinational effect observed a significance of 0.101, which is lower than the significance levels of the main effects with 0.473 for gender, and 0.273 for seating arrangements. Simply put, insignificantly these observed insignificant scores vary around themselves. However, he most important finding from the results showed no significance difference between the combination of gender and seating arrangement on memory recalls.

SUMMARY AND CONCLUSION

The study set out to find out if seating arrangements contributed to the many reasons why students do not perform well in recalling what they are thought in class. Student academic performance is affected by several factors and this research was conducted to investigate if seating arrangement also played a role in this. A well-conducted experiment invariably takes gender into concentration in current researches, which is no exception in this study. Also a combinational effect of both gender and seating arrangements was also examined.

Analysis of result showed differences in performance based on seating arrangements and memory recall but these differences were not significant enough to support the hypothesis, thus refuting the first hypothesis. The finale analysis also showed that the second hypothesis be refuted stating that gender does not affect memory recall, likewise the third hypothesis, thus even though gender and seating arrangements may affect memory recall, the differences were not that significant to support the hypothesis.

At the end of the study it was observed that the three hypotheses upon which the study was conducted were all refuted, thus how desks in a classroom are arranged will not have a profound influence upon student performance. In other words the success in performances of students in the classroom does not depend on their seating positions in class, either at the front, behind or at the back of the classroom. In light of this teachers and instructors should desist or not waste instructional time in identifying seating positions for each student and concentrate on other areas that have been found to really affect student performance because the current study as seen above refutes the hypothesis that seating arrangements affect recall.

LIMITATIONS

Despite the success of the research, it was however not devoid of several impediments. It was observed that, though students agreed to take the experiment, some of them lacked the motivation, and this was manifested in the way they gave up the memory search when they became stuck in recalling. Participants of high motivation made frantic efforts to recall by scratching their heads and banging the table in order to score well on all the items in the list. A study showed that learning and memory recall is better for highly motivated subjects than less motivated (Haber, 1966).

Another factor, which might have led to the observed results, was evaluation apprehension. It was observed that some of the subjects were not at relaxed or at ease but rather were apprehensive and nervous even though they were assured of confidentiality of results and that the experiment was to test subject responses on the items in the test and not on intelligence. Some were suspicious and wanted to know what the experiment was really about so they could put on their best performance. Others made frantic efforts to cheat by writing the trigrams on the table or avoided to participate in the mathematical task of counting the mentioned number backwards in threes.

The study ate into the break time periods of students and this may have affected their attention in learning and recalling of the items. Other students around served as distracters to research participants. A good number of students did not have possession of some information and had difficulty providing them when instructed to. This made retrieving information such as their parent's occupation and their highest level of education from them very difficult and has been to a disadvantage to the study.

Control groups on which comparisons could be made

were also missing in the study. One other limitation encountered whiles undertaking the experiment involved time and expenses. It would have been of immense benefit if different types of seating arrangements like the horseshoe, theater, or cluster form of seating arrangements were considered in the study.

Finally, it was realized from the study that most of the previous works done on the research topic was mostly conducted outside the current social context. What this means is that once the research was conducted in different countries who share different belief systems and cultures, differences were going to be recorded in previous and current results. Diversity in culture enables one culture to value seating arrangement as important to student performance whiles those in another culture do not. As sociologist Robertson (1987) has noted: Americans eat oysters but not snails, French eat snails but not locusts, The Zulus eat locusts but not fish, The Jews eat fish but not pork, The Hindus eat pork but not beef, The Russians eat beef but not snakes, The Chinese eat snakes but not people, The Jale of New Guinea find people delicious. This illustrates the extent to which culture may affect researches carried out in different countries. In trying to correct this limitation researchers should make an effort to operationally define significant aspects of the study in the context of the society where the study is being carried out.

DIRECTIONS FOR FUTURE RESEARCH

The research in its small way has refuted results of researches conducted on seating arrangements and its effects on memory recall. This is shown in the lack of significance between seating arrangements and performance on recall as such future research can concentrate on reasons why and how the present hypotheses were refuted.

To begin with, extraneous variables that might have affected the study including sample selection, sample size motivation and attention should be adequately controlled. A greater sample size and literate-illiterate comparisons are recommended for future research.

If the researcher were to conduct the study again, much effort would be made to create control groups so scores could be compared as against the experimental group. It would also be of immense help if different communities, schools, classes are studied so as to aid a valid conclusion. Also, as mentioned in the limitation section, future researchers could consider different types of seating arrangements like the horseshoe, theater, or cluster form of seating arrangements to broaden the scope of the study.

Future researchers who might be interested in conducting this experiment again should consider administering the test to participants individually so as to curb the many extraneous variables that may affect studying in groups. Cheating of students and distractions from other students may all be avoided by doing this. This will provide a close observation of subjects and time record will also be properly kept.

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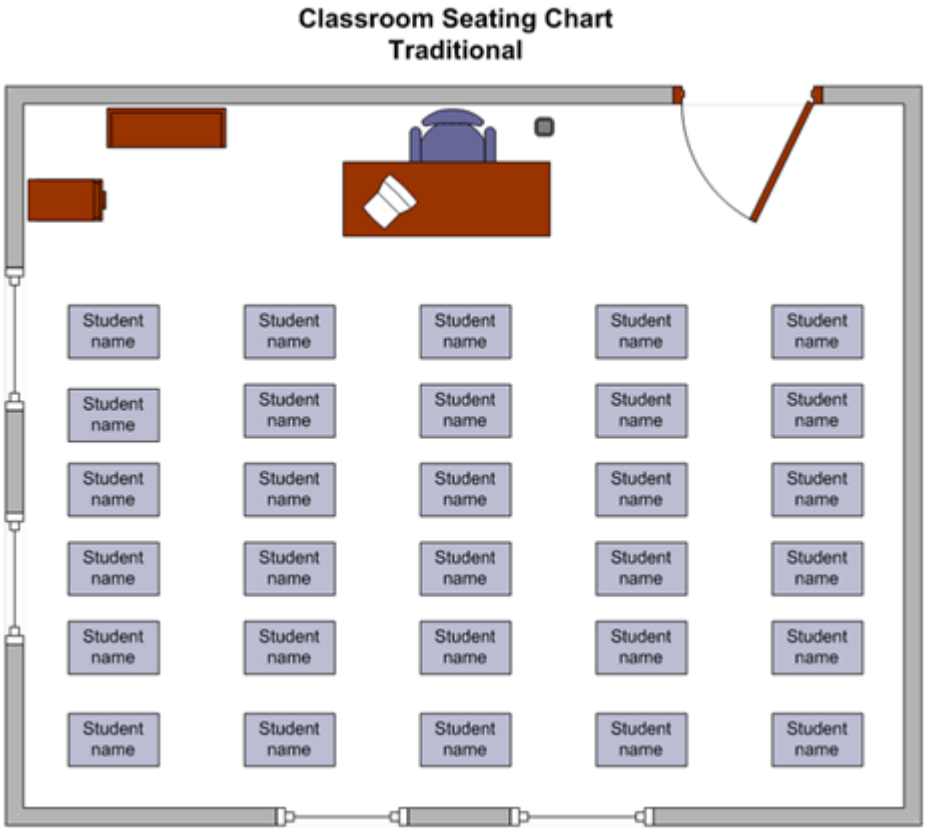
APPENDIX 1

NAME:……..
GENDER:……
CLASS:…….
FRONT: **MIDDLE ROW:** **BACK ROW:**
OCCUPATION OF PARENT:……...
HIGHEST LEVEL OF GUARDIANS EDUCATION:……..

STIMULUS	STARTING NUMBER	DELAY(SEC)	NUMBER CORRECT	CORRECT SEQUENCE	CORRECT POSITION
XTN	-	0			
TQJ	-	0			
LNP	-	0			
SJH	-	0			
KPW	-	0			
NKR	94	36			
FBM	109	18			
KXQ	53	9			
GQS	86	18			
DLX	117	36			
BFM	48	9			
ZGK	105	36			
WGP	62	18			
ZDL	112	9			
RLB	96	18			
QDH	45	9			
GWB	147	36			
CSJ	59	18			
FMH	177	36			
HFZ	49	9			

NUBMER CORRECT **1ST twolast two**
0 Delay _ **total corr. Seq :** _
9 Delay _ **total corr. Pos:** _
18 Delay _ _ **persev. Single:** _
36 Delay _ _ **persev. Double:** _

APPENDIX 2
PHOTOGRAPHIC DATA



A typical row and column design of a classroom layout, also known as the traditional classroom seating. This is the most popular seating arrangement in Ghana and was adopted in conducting the current study.