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Effects of Classroom Design and Atmosphere towards Affective Reactions and  
Memory of Content

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Honours Psychology Thesis  
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### **Abstract**

The purpose of the present study was to investigate how a classroom's design can alter an individual's memory of content and affective reactions towards the experience. 123 University of Western Ontario Undergraduate students who were part of a first year psychology participation pool listened to a video lecture on schizophrenia and then completed two paper and pencil questionnaires. The first was a multiple-choice assessment of participant memory for lecture material, and the second was a Likert scale on the perceived learning experience. The atmosphere of the classroom as well as the design of the desk arrangements was changed for different conditions as to determine which aspects of the classrooms design had a significant influence on recall for material and perceived learning experience. Previous studies have found that the environment in which learning takes place can have a great effect on student performance as well as on their affective reactions to the experience, teacher, material presented, and institution as a whole (Veltri, Banning, & Davies, 2006; Winterbottom & Wilkins, 2009). A significant interaction between atmosphere and desk design was found for specific affective reactions, which is consistent with recent research. Contrary to recent research, main effects for atmosphere and affective reactions were found for participants in sterile and row arrangements, compared to warm horseshoe arrangements previously noted in literature. The results suggest that classroom design is a crucial aspect for student performance as well as affective reactions, but that at the University level, small format lectures may not follow trends seen in other educational settings.

### **Acknowledgement and Dedication**

Sincere gratitude needs to be given to Dr. Mike Atkinson for reminding me never to be discouraged with my data and for letting me explore the world of educational research with someone who clearly has a passion for improving the lives of university students as well as a love for the discipline of psychology. Thank you for all you have done and having the patience to help me make this dream a reality.

My dream of completing a thesis that could change the educational world may have been a bit advantageous, but the reason from which this dream arose is still alive; university students, just like all students at any age, deserve the greatest education that they can possibly achieve. I want students to remember that their education is important and to push for what they deserve.

“Education is the most powerful weapon which you can use to change the world.”

- Nelson Mandela (n.d.)

## **Effects of Classroom Design and Atmosphere towards Affective Reactions and Memory of Content**

“Modern Canadian universities wrongly and seriously devalue the education of undergraduate students.” (Pocklington & Tupper, 2002, p. 6). This quote from Pocklington and Tupper’s (2002) controversial book *No Place to Learn*, implies that Canadian universities are failing their undergraduate populations from the best education they can receive. Their book argues that universities are not placing enough emphasis on developing classrooms, programs, and courses and that they are placing too much emphasis on graduate populations, research, and tenured professors. The main objective within an undergraduate education is to learn and to leave the institution with greater knowledge than when they entered. However, if universities are not actively creating spaces and programs that foster learning, this goal cannot be achieved.

### **Rationale for the Present Study**

Canadian universities have forgotten that learning can be fostered through more than research and highly knowledgeable professors. Non-verbal communication in the classroom is an important aspect of teaching as it conveys information to students about how the professor perceives the class and how they should feel in return (Sommer, 1974). Non-verbal communication can be defined as communication not involving words (Zukoski, Harvey, & Branch, 2009). It may be expressed through the professor’s attitude, posture, excitement for the material, and so forth, but can also be expressed through the physical environment to which the class takes place. Non-verbal communication from the environment can be expressed through the classroom design or layout as well as through the environments atmosphere (Simonds & Cooper, 2010; Sommer, 1974). It can be noted that Canadian universities do not place enough emphasis on designing classrooms that inspire learning. This is because traditional designs with few

distractions are thought to be the most effective both cost and education wise (Owens & Valesky, 2007, pp.186-221; Sommer, 1974). The universities' disregard for which types of environment are best for learning for undergraduate populations needs to be corrected.

Many university buildings resemble government buildings and prisons; largely made of concrete, with locked doors, little décor, and fluorescent lighting (See Figure 1). It is believed by some educational systems that human beings cannot be trusted in spaces that are welcoming and from a design perspective, beautiful, due to the fact that vandalism, theft, and general disrespect will ensue (Wollin & Montagne, 1981). Sterile environments are difficult to humanize and can result in depressive effects (Sommer, 1974). In a study by Wollin and Montagne (1981), a sterile classroom was compared to one that was amiable to determine if the student's from each of the introductory psychology classes' interactions and performance would differ when partaking in a class in both environments over the semester. Both classrooms were identical in structure but differed on aspects such as fluorescent lighting, seat comfort, wall decorations, and carpet type. The control room, or sterile classroom, was not altered at all; only the amiable classroom had alterations such as warm white lights rather than fluorescent ones made. They found that the classroom that was more amiable not only increased perceptions of the teacher and improved socialization, but also improved performance rates in the class. In a more recent study, an elementary school district's objective was to create physical changes in their schools that would express a sense of safety and welcoming to both children and adults alike. This was of great importance to them as they were interested in finding which aspects of an atmosphere are important in keeping it from being perceived as cold or unsafe. After conducting a survey with students, their parents, and school staff, the following were deemed to be important to maintain a welcoming and safe school building; identifiable main offices, well-maintained building, student



*Figure 1.* A typical sterile classroom seen in the Social Sciences Center at the University of Western Ontario displaying concrete walls, uncomfortable seating, fluorescent lighting, and a row desk arrangement.

work displayed, and well painted walls (Maxwell, 2000). The focus placed on atmospheres within Wollin and Montagne's (1981) study and Maxwell's (2000) study uncovers an area that universities need to work on. A positive and warm atmosphere has significant results on student's behaviors and perceptions when compared to that of a typical sterile university classroom and is perceived to be welcoming and safe (Wollin & Montagne, 1981). By changing the atmosphere of a classroom, universities could greatly improve their undergraduate populations experience and capacity for learning.

### **Focusing on Classroom Atmosphere**

There are certain aspects of a classrooms atmosphere that have a greater effect on affective reactions and learning than others. Music, lighting, and comfortable seating are aspects of a classroom environment that hold importance when creating a warm and welcoming environment that is intended to increase learning and affective reactions while reducing feelings of helplessness and unease (Veltri, Banning, & Davies, 2006).

In the current study, music, lighting, and seat comfort are the three features used for creating a classroom that is warm and welcoming. Lang (1996), as cited by Winterbottom and Wilkins (2009), notes that lighting, when diffuse and placed correctly so that glare is minimized, can help create a sense of comfort for both students and teachers which is important for the purpose of learning. Diffuse lighting is vital in a properly designed classroom as certain types of lighting, such as fluorescent, can cause distress and discomfort, which can result in a lack of interest and desire to engage in the material at hand (Winterbottom & Wilkins, 2009). Winterbottom and Wikins (2009) studied the effects of lighting in the classroom environment. They measured the glare of fluorescent lighting in ninety secondary classrooms across the United Kingdom. They did this as fluorescent lighting has been shown to cause headaches and impair visual performance. By measuring the glare off of furniture, whiteboards, windows, and the floor of different classrooms they recognized that harsh lighting and décor hinders task performance in secondary school aged children. These findings confirm previous research showing that atmospheres, which produce distress in university classrooms, can result in poor test performance and negative affective reactions (Sommer, 1974; Veltri, Banning, & Davies, 2006; Wollin & Montagne, 1981). University classrooms often use fluorescent lighting because of the lower cost associated with fluorescent light bulbs. Florescent bulbs use only one third of the amount of energy that an incandescent light bulb uses, they generate less heat, and tend to last longer (Lee, Ruppert, & Porter, 2012). Comfortable seating in classrooms can also improve attitudes and therefore affective reactions. It has been shown that uncomfortable seating can alter perceptions of experiences if the seating causes the discomfort or pain. Uncomfortable seating can be a negative distraction and therefore can be a very notable part of the experience (Veltri, Banning, & Davies, 2006).



Music may be one of the most important features that can be used to find differences between differing types of atmosphere. Music has the ability to alter an individual's likability towards an object, person, or experience. In May and Hamilton's (1980) study, likability ratings increased with music that was chosen for positive affect more than for music that was chosen for negative affect. Music affects our motivation and affect resulting in changes in our perceptual processes. Although likability is not a target variable in the current study, understanding that music has the ability to alter perceptions is very important, as much like affective reactions, likability is tied to perceptions and attitudes (May & Hamilton, 1980). It is possible then that a change in perceptual processes of liking will also occur when in the context of a classroom. It thus makes sense to hypothesize that a classroom that welcomes students with music chosen for its positive affect should increase affective reaction more than a classroom that has no music playing to welcome students.

Music also has calming and anti-anxiety properties, which should result in higher affective reaction than if, no music was played. This relationship between reducing anxiety and positive affect for the classroom and experience is based on information reported by Twiss, Seaver, and McCaffrey (2006). They found that that cardiovascular surgery patients heal faster in environments where there is less anxiety, which can be reduced by playing music during and after surgeries. Sixty adults over the age of 65 who would be undergoing cardiovascular surgery were assigned to one of two groups: a control group, and a group that was exposed to music during and after surgery. Each participant in the experimental condition was given the choice of listening to one of six CD's that contained different types of music that had all been previously shown to precipitate relaxation. The six CD's ranged from melodies from classical motion pictures to compilations of spontaneous piano improvisations with the melodies from classical

motion pictures being the most frequently picked CD by participants. It was the nurse on duty's job to play the same CD to each participant over the span of the study. The Spielberger STAI, a psychometric test to measure anxiety was given to each participant before surgery and three days after surgery. The two scores for each participant on the Spielberger STAI were compared to measure the differences in anxiety between the control and experimental groups. The length of intubation time, or healing time, was measured in minutes from when the participant left the operating room to when they were extubated in the ICU. Results from this study indicated that music reduced levels of anxiety and participants who listened to music were less anxious and were extubated faster than those who did not listen to music. Helping to reduce anxiety creates a non-threatening atmosphere, which should increase student's attitude towards their environment. It is also highly plausible that environments that have low anxiety improve academic performance. Harsh environments that cause unease and distress result in lower performance for students (Winterbottom & Wilkins, 2009). Therefore, using music before and after a lecture to make an environment non-threatening should also make individuals feel at ease, which can positively affect academic performance. Furthermore, music has been tied closely to mathematics due to its similarity in structure (equations and time signatures) and when paired together has been found to increase test performance as well as other cognitive areas (Vaughn, 2000). Music's multi-faceted ability to alter affective reactions as well as learning is an important aspect of the current study.

### **The Importance of Classroom Desk Design**

University classrooms that are used for lecture style classes are often designed in a traditional manner where the professor is located at the front of the room with all of the students in front of them at individual, small sized desks, arranged in rows (See Figure 1). Often this

design is thought to be best for learning simply because it has been used for the longest period of time. However, the students who perform best in classrooms like this are ones that have a direct line of sight to the professor. Performance is best for those located in the center column or in the first row (Sommer, 1969). Although this information was brought to attention over 40 years ago it is still important and valid. This is because 40 years ago, there was not very much diversity in how desks were set up within the university classroom. Due to the fact that this research was conducted at a time where multiple classrooms could be tested and students would not be surprised by the seating arrangement, the results that Sommer (1969) presents should be reliable as well as applicable. He states that the majority of the class is not receiving as great of an education because distractors that do not help in the learning process are visible for those students not in the first row or center column. It also allows students to isolate themselves and separate themselves from the material being presented (Miller, Erickson, & Yust, 2001; Sommer, 1969; Wannarka & Ruhl, 2008). Individual seating arrangements can isolate students and inhibit social relationships, which are of value to the undergraduate population and necessary for learning.

Sociopetal seating arrangements encourage interaction by design. Such seating arrangements group students close together ensuring that all members of the class feel included and a part of the experience (Douglass & Gifford, 2010). The importance of inclusion and personal value is, in some individuals' views, forgotten by universities. Placing student desks in groups allows all students to be part of a sociopetal setting where they can either choose to interact or focus on the topic at hand depending on what works best for their individual learning style. This gives them the chance to tailor their education to themselves. Much like groups, designing the classroom so that the desks form a horseshoe (i.e., the typical case-study

classroom) allows for each student to have a direct line of sight to the professor, at least one individual to interact with if desired, and still have the ability to keep attention on the topic of interest (Albertson & Selwood, 1998; Douglas & Gifford, 2010; Sommer, 1969; Wannarka & Ruhl, 2008). Horseshoe desk arrangements should promote learning better than groups and rows as it incorporates two principles that effect learning ability. The horseshoe arrangement reduces distractions while giving students the best seating arrangement for the task at hand; small lecture formats, as it incorporates optimal visibility of the material being presented as well as a sense of community (Wannarka & Ruhl, 2008). The design of a classroom is an important to ensuring that students can both achieve academic excellence and enjoy the experience.

Research looking at different types of seating arrangements in university classrooms has been performed with a focus on computer laboratory designs. Computer laboratories have been focused on as data can be collected easier due to the fact that for a computer to be utilized, a student must be logged on, and therefore the use of the computer and desk space can be recorded. An Australian university utilized their computer laboratories to determine if there was a specific seating arrangement that students preferred. Spenneman, Atkinson, and Cornforth (2007) arranged five different computer laboratories into different seating arrangements and monitored which labs were most commonly used as well as which desk spaces within those labs were more commonly used. They determined which spaces and seats were most preferred by the frequency to which they were utilized over two school semesters (Spennemann, Atkinson, & Cornforth, 2007). They were able to determine that preference for computer laboratories was not due to seating arrangement but due to proximity to the entrance of the building. They also determined that students selected seats within computer laboratories based on their proximity to the door or windows within the room. These findings are extremely interesting for the current

study, as students do not show a preference for seating design but one for convenience. Although the current study will not be interested in convenience, it proposes that seating arrangement may effect affective reactions, if participants find their seat and location to be inconvenient to get to as well as to leave from.

### **Expanding Current Research on Classroom Design**

Research on improving human abilities to learn has been recognized as an important and multifaceted area of psychology. It should not be a surprise then to why studying learning and affective reactions at the university is important. The ability to learn at the university level is a privilege to which much of the population does not get to experience and is being semi-neglected due to focus on other aspects of the university (Pocklington & Tupper, 2002). Not only is learning an extraordinarily important aspect of university life, students perceptions of these academic institutions does not seem to be a focus either. There has been very little research on small classroom design at the university level, especially in the last twenty to thirty years. This indicates a major gap in the literature that needs to be attended to seeing as university students learning habits and affective reactions are very different from those at the primary and secondary school level.

The physical environment of a classroom can affect test performance and attitudes toward the teacher, classroom, and experience as a whole. Wollin and Montagne (1981) found that both test performance and perceptual evaluations of the class and professor increased significantly over the semester. Their focus on the physical environment as a whole needs to be teased apart to determine if the atmosphere of the classroom is the effector, if the seating arrangement is more important, or if both must function together to create an environment that fosters learning. By teasing apart which aspects of a classroom are most important for altering students' memory of

content and affective reactions, the current study will expand Wollin and Montagne's (1981) study.

### **The Current Study**

The current study focuses on the best way that a classroom can be designed for undergraduate university students so that it optimizes learning as well as students affective reactions. This was completed by manipulating a classrooms atmosphere so that it would be either warm (dimmed lighting, music with positive affect, and comfortable seating) or sterile (bright lights, no music, and average seating) as well as manipulating the seating arrangement so that the desks would be arranged in one of three designs: rows, groups, or a horseshoe. Distractors, such as seat comfort will also be investigated in the current study. Participants were asked to listen to a university level lecture and complete a memory test based on the lectures content to measure memory of content and were also required to fill out an attitude questionnaire based on their experience as a whole to measure affective reaction. This study is a 2 (atmosphere: warm versus sterile) x 3 (seating arrangement; rows, groups, or horseshoe), which consists of six conditions in total; warm and rows; warm and groups, warm and horseshoe, sterile and rows, sterile and groups, and sterile and horseshoe.

The general hypothesis for this study is that classrooms, which welcome students and helps them better attend to information would benefit their memory for content and affective reactions toward the experience. The dependent variables of this study are memory for content and affective reactions. Memory for content should be most superior when students seating was arranged in a horseshoe rather than in groups or rows. As previously explained, desk arrangements should be created for a specific purpose, which in the case of the present study is for a small lecture format. Therefore, a desk arrangement that reduces distractions and creates a

sense of community should produce the highest performance scores for memory of content. Memory of content should be superior when students were in a classroom that was warm and welcoming rather than one that was sterile and cold. The study by Winterbottom and Wilkins (2009) where sterile lighting was found to produce negative reactions from the student participants has promoted the above hypothesis. An interaction for memory of content is hypothesized for students in a classroom with a horseshoe seating arrangement and a warm atmosphere. It is also predicted that when students are in a classroom with a sterile atmosphere and desks are arranged into rows, affective reactions will be the lowest. Affective reactions are hypothesized to be the highest when students are placed in a classroom that had a warm atmosphere. It has been found that uncomfortable chairs, poor aesthetics and lighting create feelings of helplessness and unease in the classroom (Veltri, Banning, & Davies, 2006). Affective reactions are also hypothesized to be the lowest when student's seats were arranged into rows. This prediction is based on Albertson and Selwood's (1998) study where they researched different designs of computer laboratories to find the best design based on teaching method, approach, and cost. They found that the most popular design, as rated by students, was with computers and desks around the perimeter of the room while the least popular was a traditional arrangement of rows.

## **Method**

### **Participants**

A sample of 123 University of Western Ontario students participated in this study of the effects of different types of classroom seating arrangements and atmospheres on academic performance and affective reactions. Participants' ages ranged from 17 to 24 ( $M = 18.46$ ,  $SD = 0.97$ ). Participants were required to be enrolled as an undergraduate student as well as being

enrolled in a first year psychology undergraduate course to participate in the study. Participants were recruited through the psychology research participation pool and were randomly assigned to different conditions and tested as one group. The six conditions each consisted of 12 participants and were run twice with different participants. The six conditions were warm atmosphere and row design, warm atmosphere and group design, warm atmosphere and horseshoe design, sterile atmosphere and row design, sterile atmosphere and group design, and sterile atmosphere and horseshoe design. The participants received 1 course credit for their participation in the study and the study should take less than an hour to complete.

### **Materials**

To test the influence of different types of seating design and atmospheres on academic performance and affective reactions, an identical 40 minute video lecture on Schizophrenia by Dr. Mike Atkinson, an introductory psychology professor at the University of Western Ontario, was presented to each condition where they were either in a warm or sterile environment and the desks were arranged in one of the following arrangements; rows, groups, or in a horseshoe. The topic of Schizophrenia was chosen because the participants would not yet have had an expansive knowledge of the disorder as their first year psychology class would not have explored the topic in depth at this point in the school year. Next, participants completed a 25 item multiple-choice assessment of their memory for the information presented in the lecture. An example item of medium difficulty from the multiple-choice assessment is: “As mentioned in lecture, genetics can cause a predisposition to Schizophrenia. What is the name of the protein that is partially responsible for this?” (See Appendix A for a complete list of questions). The multiple-choice assessment measured the participant’s memory for the information presented in the lecture on Schizophrenia. Directly after finishing the multiple choice assessment, participants completed a



15 item, 7 point Likert style questionnaire on their affective reactions to the experience as a whole. Each questionnaire item was created to assess either the classroom, teacher, or lecture material and was assessed separately for results. An example item from the affective reactions questionnaire is: “The classroom was pleasant.” where the rating of 1 indicated *not at all*, and the rating of 7 indicated *extremely* (See Appendix A). Comfortable as well as uncomfortable seating were brought in to alter the classrooms atmosphere. To control for lighting differences, the classroom was originally equipped with fluorescent lighting which was suitable for sterile conditions as well as an overhead projector which was turned on in replacement of the fluorescent lighting to create dimmed lighting for the warm conditions. A collection of songs by the band Cold Play were played during warm conditions while the participants entered as well as while filling out the questionnaires. The songs were chosen based off of a pre-test assessing individuals perceptions of how positive they found different songs to be.

### **Procedure**

Participants were tested in groups of twelve in one classroom in the Social Sciences Building at the University of Western Ontario. Participants were randomly assigned to groups as well as conditions. The classroom in which the study took place in was set up so that it was one of the three possible seating arrangements (rows, groups, or a horseshoe) and so that the atmosphere was either warm or sterile before the participants were welcomed into the room (See Figure 2). Participant’s attention was not directed towards the design of the classroom or its atmosphere. When the participants were welcomed into the classroom they were directed towards a specific seat that had been set up for the intended seating arrangement. Once at their seats, the participants received a letter of information as well as provided informed consent



*Figure 2.* Photographs showing the six different conditions used within the study. All photos on the left exhibit sterile atmospheres with the right column exhibiting a warm atmosphere. The first row displays group desk arrangements, the second row showing row desk arrangements, and the third row displaying a horseshoe desk arrangement.

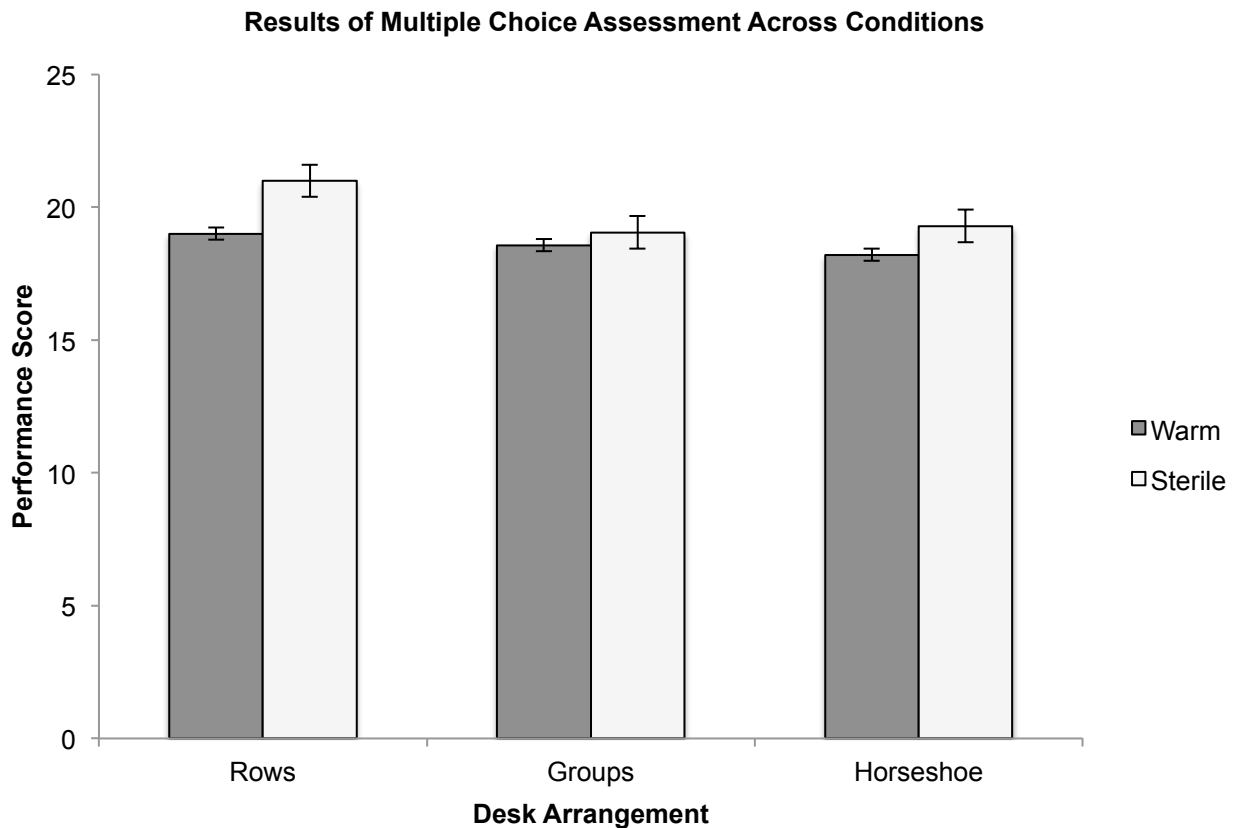
(See Appendix B). After collection of consent, the experimenters explained that the participants would be watching a 30 minute lecture on Schizophrenia. It was explained that at the completion of the lecture they would be asked to fill out two questionnaires about the material they were just presented with (See Appendix A). The experimenters then played the previously recorded lecture to the participants. When the lecture was complete, the experimenters handed out an assessment package and told the participants that they would collect them when finished. The package contained both the multiple-choice assessment as well as the affective reactions questionnaire. Each participant was given 20 minutes to complete the assessment package and was asked to hand in their test when finished. Upon completion of the study, the participants were fully debriefed to explain the purpose of the study (See Appendix C). The entire study took less than one hour to complete.

## Results

A 2 (Atmosphere: warm vs. sterile) x 3 (Desk Design: row vs. group vs. horseshoe) analysis of variance was conducted to test the effects of classroom design on memory of content as well as on students' affective reactions.

### Memory of Content

The highest memory of content scores were reported by participants whose classroom was sterile and arranged in rows ( $M = 21.00$ ,  $SD = 2.27$ ), followed by a sterile atmosphere and horseshoe arrangement ( $M = 19.29$ ,  $SD = 2.72$ ), sterile atmosphere and group arrangement ( $M = 19.05$ ,  $SD = 2.50$ ), warm atmosphere and row arrangement ( $M = 19.00$ ,  $SD = 3.09$ ), warm atmosphere and group arrangement ( $M = 18.57$ ,  $SD = 3.40$ ), and finally a warm atmosphere and horseshoe arrangement ( $M = 18.21$ ,  $SD = 3.90$ ). Levene's test for equality of variance was not significant so equal variances can be assumed,  $F(5, 117) = 0.11$ , *ns* (See Figure 3).



*Figure 3.* The effects of Atmosphere and Desk Arrangement on Memory of Content expressed through performance scores on a multiple-choice assessment. The total marks available would be 25. Error bars represent standard errors.

There was no significant interaction observed between atmosphere and desk design for memory of content,  $F(2, 117) = 1.78$ , *ns*,  $\eta^2 = .029$ , power is .366, suggesting that the hypothesis that students' memory of content is dependent on both a classrooms atmosphere and the classrooms seating design is incorrect. There was a significant main effect observed between warm ( $M = 18.59$ ,  $SE = 0.45$ ) and sterile ( $M = 19.78$ ,  $SE = 0.32$ ) atmospheres on memory of content scores,  $F(1, 117) = 4.75$ ,  $p < .05$ ,  $\eta^2 = .039$ , power is .580, suggesting that the sterile atmosphere differed significantly from the warm atmosphere such that participants who performed in a sterile environment had higher scores on memory of content. This supports the hypothesis that different atmosphere types would affect memory of content scores differently.

There was no significant main effect observed between row ( $M = 20.10, SE = 0.45$ ), group ( $M = 18.81, SE = 0.45$ ), and horseshoe ( $M = 18.78, SE = 0.53$ ) desk designs on memory of content scores,  $F(2, 117) = 2.22, ns, \eta^2 = .037$ , power is .445. Dissimilar to hypotheses, these findings suggest that memory of content is not effected by a classrooms desk design. The lack of a significant interaction does not discount the significant main affect for atmosphere and memory of content but helps make the distinction clearer as to what aspects of the learning environment are important for higher student performance. Through analyzing the data, it can be noted that atmosphere has an effect on memory of content by itself, but that desk design does not.

### **Affective Reactions**

The affective reactions questionnaire consisted of 15 questions, which were statistically ran separately, as each question was created to assess different affective reactions. The first seven questions refer to the classroom, followed by four referring to the teacher, and finishing with four about the lecture content. The highest affective reactions score on the first question; The classroom was interesting, was reported by participants from a sterile atmosphere with a row arrangement ( $M = 4.50, SD = 1.50$ ), followed by those from a warm atmosphere and a row arrangement ( $M = 4.22, SD = 1.80$ ), warm atmosphere and horseshoe arrangement ( $M = 4.16, SD = 1.50$ ), sterile atmosphere and group arrangement ( $M = 4.09, SD = 1.02$ ), warm atmosphere and group arrangement ( $M = 4.00, SD = 1.41$ ), and finally a sterile atmosphere and horseshoe arrangement ( $M = 3.29, SD = 1.52$ ). The highest affective reactions score on the second question; The classroom was comfortable, was reported by participants from a warm atmosphere and row arrangement ( $M = 4.94, SD = 1.21$ ), followed by those from a warm atmosphere and horseshoe arrangement ( $M = 4.89, SD = 1.15$ ), sterile atmosphere and row arrangement ( $M = 4.86, SD = 1.28$ ), warm atmosphere and group arrangement ( $M = 4.76, SD = 1.48$ ), sterile atmosphere and

group arrangement ( $M = 4.18$ ,  $SD = 0.91$ ), and finally by those from a sterile atmosphere and horseshoe arrangement ( $M = 3.76$ ,  $SD = 1.51$ ). The highest affective reactions score on the third question; The classroom was pleasant, was reported by two groups of participants, the warm atmosphere and row arrangement ( $M = 5.00$ ,  $SD = 1.24$ ) as well as the warm atmosphere and horseshoe arrangement ( $M = 5.00$ ,  $SD = 1.20$ ), followed by a warm atmosphere and row arrangement ( $M = 4.90$ ,  $SD = 1.38$ ), sterile atmosphere and row arrangement ( $M = 4.68$ ,  $SD = 1.00$ ), sterile atmosphere and horseshoe arrangement ( $M = 4.62$ ,  $SD = 1.29$ ), and finally a sterile atmosphere and group arrangement ( $M = 4.32$ ,  $SD = 0.84$ ). The highest affective reactions score on the fourth question; The classroom was distracting, was reported by participants from a warm atmosphere and row arrangement ( $M = 2.83$ ,  $SD = 1.38$ ), followed by a warm atmosphere and group arrangement ( $M = 2.76$ ,  $SD = 1.22$ ), a sterile atmosphere and row arrangement ( $M = 2.59$ ,  $SD = 1.44$ ), a warm atmosphere and horseshoe arrangement ( $M = 2.53$ ,  $SD = 1.12$ ), a sterile atmosphere and horseshoe arrangement ( $M = 2.33$ ,  $SD = 0.97$ ), and finally a sterile atmosphere and row arrangement ( $M = 2.00$ ,  $SD = 1.16$ ). The highest affective reactions score on the fifth question; The classroom was generic, was reported by participants in a sterile atmosphere and row arrangement ( $M = 5.14$ ,  $SD = 0.91$ ), followed by those in a warm atmosphere and group arrangement ( $M = 4.71$ ,  $SD = 1.38$ ), a warm atmosphere and row arrangement ( $M = 4.56$ ,  $SD = 1.47$ ), a warm atmosphere and horseshoe arrangement ( $M = 4.53$ ,  $SD = 1.74$ ), a sterile atmosphere and horseshoe arrangement ( $M = 4.48$ ,  $SD = 1.60$ ), and finally by participants in a sterile atmosphere and group arrangement ( $M = 4.45$ ,  $SD = 1.57$ ). The highest affective reactions score on the sixth question; The classroom was conducive for lecture, was reported by participants from a sterile atmosphere and row arrangement ( $M = 5.27$ ,  $SD = 1.12$ ), followed by those from a warm atmosphere and horseshoe arrangement ( $M = 5.00$ ,  $SD = 1.20$ ), a warm

atmosphere and row arrangement ( $M = 4.67$ ,  $SD = 1.46$ ), a sterile atmosphere and group arrangement ( $M = 4.09$ ,  $SD = 1.34$ ), a sterile atmosphere and horseshoe arrangement ( $M = 4.05$ ,  $SD = 1.32$ ), and finally those from a warm atmosphere and group arrangement ( $M = 4.00$ ,  $SD = 1.30$ ). Lastly, the highest affective reactions scores from question seven; The classroom made me want to learn more, was reported by participants from a sterile atmosphere and row arrangement ( $M = 4.64$ ,  $SD = 1.50$ ), followed by those from a warm atmosphere and horseshoe arrangement ( $M = 4.00$ ,  $SD = 1.37$ ) as well as from a warm atmosphere and row arrangement ( $M = 4.00$ ,  $SD = 1.28$ ), a warm atmosphere and group arrangement ( $M = 3.48$ ,  $SD = 1.69$ ), a sterile atmosphere and group arrangement ( $M = 3.41$ ,  $SD = 1.30$ ), and finally from a sterile atmosphere and horseshoe arrangement ( $M = 3.24$ ,  $SD = 1.55$ ). Levene's test for equality of variance was not significant so equal variances can be assumed for questions 1 through 7.

Questions 8 through 11 refer to affective reactions involving the teacher. The highest affective reactions scores from question 8; The teacher was knowledgeable, was reported by participants from a sterile atmosphere and row arrangement ( $M = 6.45$ ,  $SD = 0.67$ ), followed by those from a warm atmosphere and group arrangement ( $M = 6.38$ ,  $SD = 1.07$ ), a sterile atmosphere and group arrangement ( $M = 6.27$ ,  $SD = 0.63$ ), a warm atmosphere and horseshoe arrangement ( $M = 6.26$ ,  $SD = 0.93$ ), a warm atmosphere and row arrangement ( $M = 6.22$ ,  $SD = 0.65$ ), and finally by those from a sterile atmosphere and horseshoe arrangement ( $M = 6.14$ ,  $SD = 0.79$ ). The highest affective reactions score on the ninth question; The teacher was interesting, was reported by participants from a sterile atmosphere and row arrangement ( $M = 6.18$ ,  $SD = 1.10$ ), followed by those from a warm atmosphere and horseshoe arrangement ( $M = 5.89$ ,  $SD = 1.00$ ), a warm atmosphere and group arrangement ( $M = 5.86$ ,  $SD = 1.11$ ), a sterile atmosphere and group arrangement ( $M = 5.64$ ,  $SD = 0.95$ ), a sterile atmosphere and horseshoe arrangement

( $M = 5.57$ ,  $SD = 1.25$ ), and finally by those from a warm atmosphere and row arrangement ( $M = 5.39$ ,  $SD = 1.58$ ). The highest affective reaction score on the tenth question; The teacher made me want to learn more, was reported by participants from a sterile atmosphere and row arrangement ( $M = 5.95$ ,  $SD = 1.09$ ), a warm atmosphere and horseshoe arrangement ( $M = 5.63$ ,  $SD = 0.90$ ), a warm atmosphere and group arrangement ( $M = 5.24$ ,  $SD = 1.64$ ), a sterile atmosphere and horseshoe arrangement ( $M = 5.19$ ,  $SD = 1.21$ ), a warm atmosphere and row arrangement ( $M = 5.11$ ,  $SD = 1.45$ ), and finally those from a sterile atmosphere and group arrangement ( $M = 5.09$ ,  $SD = 1.38$ ). The highest affective reactions score from the final question referring to the teacher, question 11; The teacher was generic, was reported by participants from a warm atmosphere and group arrangement ( $M = 4.10$ ,  $SD = 1.90$ ), followed by those from a sterile atmosphere and horseshoe arrangement ( $M = 3.90$ ,  $SD = 1.67$ ), a warm atmosphere and row arrangement ( $M = 3.67$ ,  $SD = 1.61$ ), a sterile atmosphere and row arrangement ( $M = 3.59$ ,  $SD = 1.18$ ) as well as a sterile atmosphere and group arrangement ( $M = 3.59$ ,  $SD = 1.10$ ), and finally by those from a warm atmosphere and horseshoe arrangement ( $M = 3.32$ ,  $SD = 1.46$ ). Levene's test for equality of variance was not significant so equal variances can be assumed for questions 8 through 11.

Questions 12 through 15 refer to affective reactions involving the lecture content. The highest affective reactions score from the twelfth question; The lecture was interesting, was reported by participants from a sterile atmosphere and row arrangement ( $M = 5.82$ ,  $SD = 1.10$ ), followed by those from a warm atmosphere and group arrangement ( $M = 5.62$ ,  $SD = 1.16$ ), a warm atmosphere and horseshoe arrangement ( $M = 5.58$ ,  $SD = 0.84$ ), a sterile atmosphere and group arrangement ( $M = 5.14$ ,  $SD = 1.32$ ), a warm atmosphere and row arrangement ( $M = 4.89$ ,  $SD = 1.37$ ), and finally from a sterile atmosphere and horseshoe arrangement ( $M = 4.86$ ,  $SD =$



1.24). The highest affective reactions score from the thirteenth question; The lecture made me want to learn more, was reported by participants from a sterile atmosphere and row arrangement ( $M = 5.64, SD = 1.22$ ), followed by those from a warm atmosphere and horseshoe arrangement ( $M = 5.42, SD = 1.12$ ), a warm atmosphere and group arrangement ( $M = 5.00, SD = 1.23$ ), a warm atmosphere and row arrangement ( $M = 4.72, SD = 1.13$ ), a sterile atmosphere and group arrangement ( $M = 4.68, SD = 1.39$ ), and finally by those in a sterile atmosphere and horseshoe arrangement ( $M = 4.52, SD = 1.33$ ). The highest affective reactions score from the fourteenth question; The lecture was generic, was reported by participants from a warm atmosphere and row arrangement ( $M = 4.28, SD = 1.36$ ), followed by those from a sterile atmosphere and horseshoe arrangement ( $M = 4.05, SD = 1.43$ ), a sterile atmosphere and row arrangement ( $M = 4.00, SD = 1.38$ ), a sterile atmosphere and group arrangement ( $M = 3.95, SD = 1.00$ ), a warm atmosphere and group arrangement ( $M = 3.81, SD = 1.50$ ), and finally by those from a warm atmosphere and horseshoe arrangement ( $M = 3.79, SD = 1.55$ ). The highest affective reactions score from the final question referring to the lecture content, question 15; The lecture was difficult to follow, was reported by participants from a sterile atmosphere and horseshoe arrangement ( $M = 2.57, SD = 1.63$ ), followed by those from a warm atmosphere and group arrangement ( $M = 2.33, SD = 1.16$ ), a warm atmosphere and row arrangement ( $M = 2.22, SD = 0.88$ ), a warm atmosphere and horseshoe arrangement ( $M = 2.05, SD = 1.39$ ), a sterile atmosphere and group arrangement ( $M = 1.91, SD = 1.38$ ), and finally by those from a sterile atmosphere and row arrangement ( $M = 1.77, SD = 0.97$ ). Levene's test for equality of variance was not significant so equal variances can be assumed for questions 8 through 11.

A significant interaction between atmosphere and desk design for question 6; The classroom was conducive for a lecture, was found to be significant,  $F(2, 117) = 3.77, p < .05, \eta^2$

= .060, power is 0.678, which suggests that a students affective reactions towards a classrooms conductivity depends on both the classrooms atmosphere as well as the seating arrangement (See Figure 4). To determine which conditions differed significantly, Tukeys HSD was conducted. None of the warm atmosphere conditions with row, group, or horseshoe arrangements differed significantly on their affective reaction rating. However, sterile atmospheres with row arrangements differed significantly from both sterile group arrangements,  $q(6, 117) = 4.28, p < .05$ , as well as sterile horseshoe arrangements,  $q(6, 117) = 4.34, p < .05$ . Participants in the sterile row arrangements did differ significantly from those in warm group arrangements,  $q(6, 117) = 4.56, p < .05$ . Significant interactions between atmosphere and desk design were also found in two other affective reactions questionnaire items; question 12; The lecture was interesting,  $F(2, 117) = 5.69, p < .01, \eta^2 = .089$ , power is 0.855 (See Figure 5) , and question 13; The lecture made me want to learn more,  $F(2, 117) = 5.49, p < .01, \eta^2 = .086$ , power is 0.843 (See Figure 6). To compare means, Tukey's HSD was conducted for both questionnaire items. None of the means for either questionnaire item 12 or 13 differed significantly. Therefore, it is consistent with the researchers' hypotheses that affective reaction ratings depend on the classrooms atmosphere and desk arrangement. Main effects should be interpreted with caution due to the interactions found.

There was only one significant main effect observed between warm ( $M = 4.86, SE = 0.17$ ) and sterile ( $M = 4.28, SE = 0.16$ ) atmospheres on affective reaction scores for questionnaire item 2,  $F(1, 117) = 6.72, p < .05, \eta^2 = .054$ , power is .730, suggesting that the sterile atmosphere differed significantly from the warm atmosphere. This supports the hypothesis that different atmosphere types would affect affective reactions differently. Significant main effects were found for row ( $M = 5.00, SE = 0.21$ ), group ( $M = 4.05, SE = 0.20$ ), and horseshoe

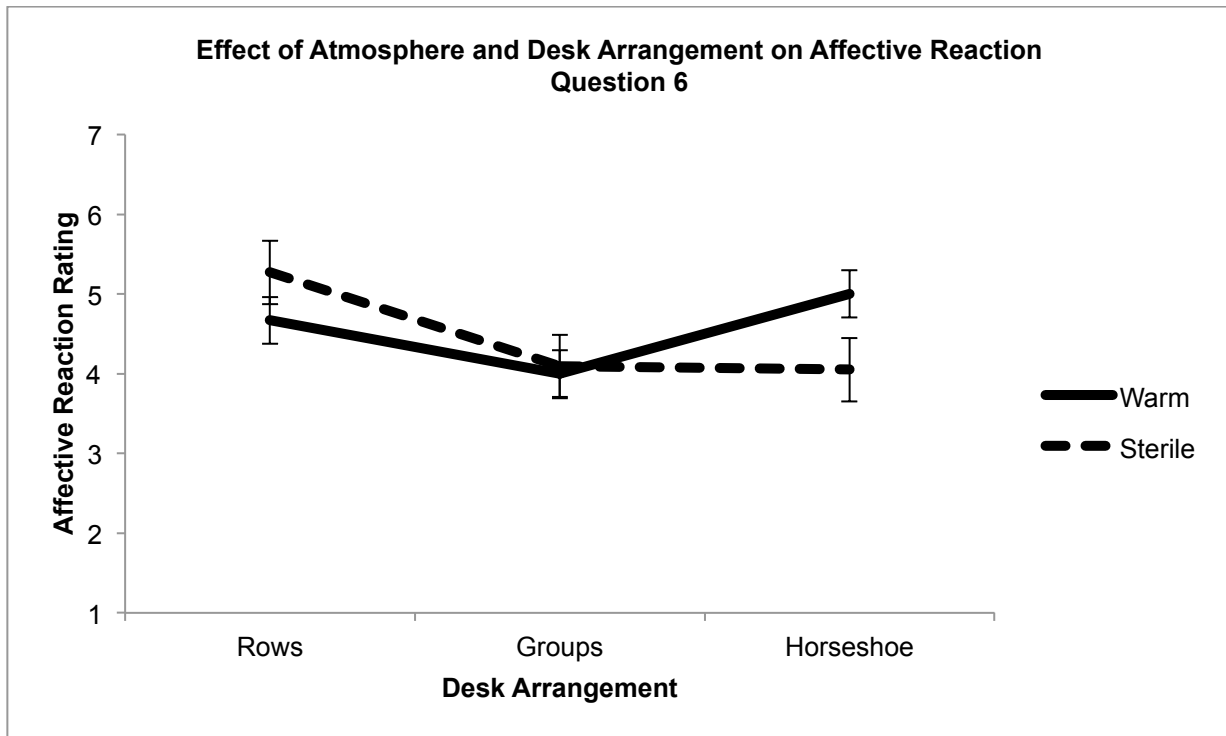


Figure 4. The effects of Atmosphere and Desk Arrangement on Affective Reactions Question 6; The classroom was conducive for a lecture. Error bars represent standard errors.

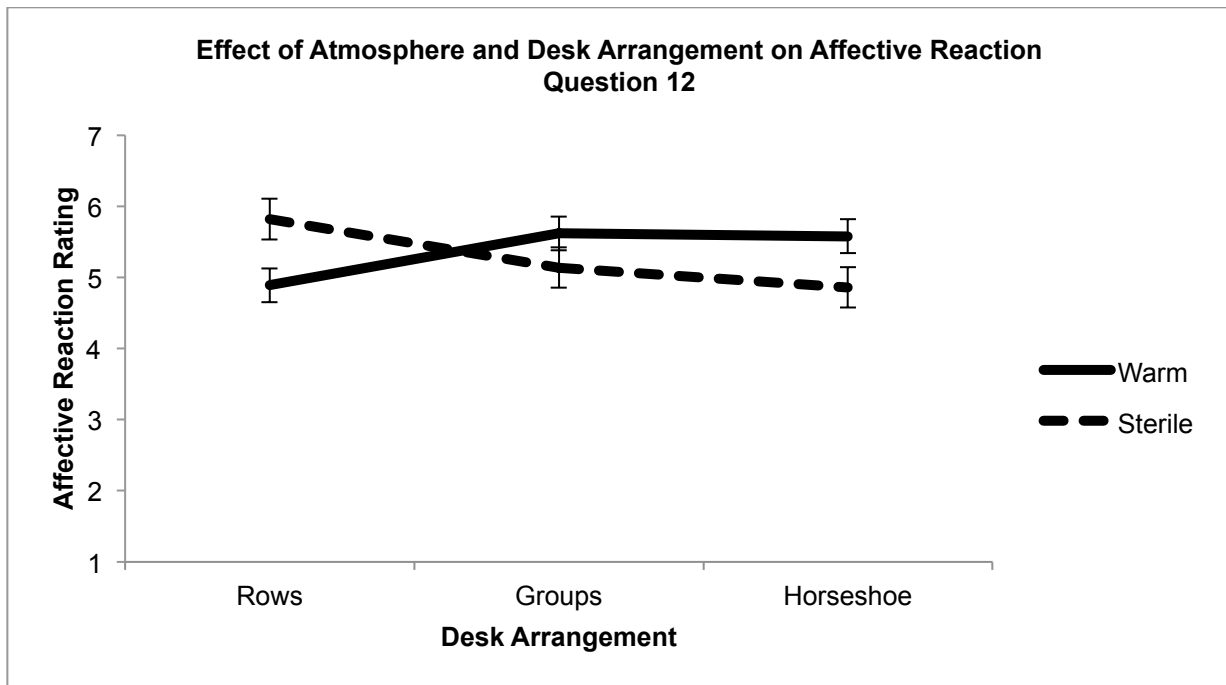


Figure 5. The effects of Atmosphere and Desk Arrangement on Affective Reactions Question 12; The lecture was interesting. Error bars represent standard errors.

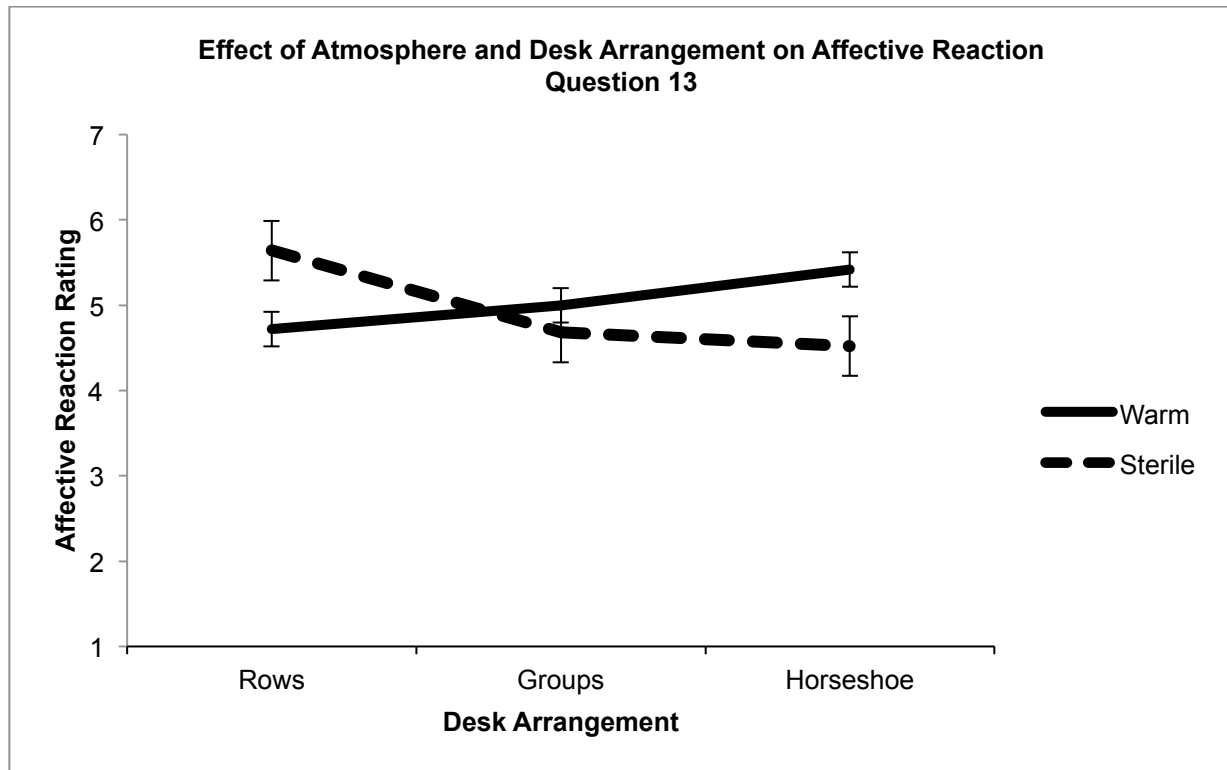


Figure 6. The effects of Atmosphere and Desk Arrangement on Affective Reactions Question 13; The lecture made me want to learn more. Error bars represent standard errors.

( $M = 4.50$ ,  $SE = 0.21$ ) desk designs on affective reaction questionnaire item 6,  $F(2, 117) = 5.28$ ,  $p < .01$ ,  $\eta^2 = .083$ , power is .828, as well as for row ( $M = 4.35$ ,  $SE = 0.23$ ), group ( $M = 3.44$ ,  $SE = 0.23$ ), and horseshoe ( $M = 3.60$ ,  $SE = 0.24$ ) desk designs on affective reaction questionnaire item 7,  $F(2, 117) = 4.08$ ,  $p < .05$ ,  $\eta^2 = .065$ , power is .715. These results suggest that at least one desk design's mean differs significantly from another desk design's mean for both affective reaction questionnaire items. To determine which desk designs significantly differed, Tukey's HSD test was conducted. It found for questionnaire item 6 as well as questionnaire item 7 that row arrangements differed significantly from group arrangements,  $q(3, 117) = 4.74$ ,  $p < .01$ , and  $q(3, 117) = 4.01$ ,  $p < .05$ , respectively.

Through analyzing the data, it can be noted that both atmosphere and desk design have an effect on affective reactions by themselves. It can also be noted that an interaction between

atmosphere and desk design supports the hypothesis that the effects of atmosphere and desk design depend on affective reactions.

### **Discussion**

The motivation for the present study hinges on Pocklington and Tupper's (2002) claim that universities within Canada are devaluing undergraduate students' educations by placing too much concern on graduate studies and tenured professors. Although this statement may be premature, research for university classrooms that promote lecture based learning have been far and few between in the past twenty years. Teasing apart literature on the important aspects of university classrooms to promote learning and positive attitudes, the atmosphere of a classroom as well as its desk arrangement proved to be of great importance (Veltri, Banning, & Davies, 2006; Winterbottom & Wilkins, 2009). Through manipulating the atmospheres 'temperature' (warm versus sterile), as well as the arrangement of students within the classroom, encouraging results would help determine which of the broad aspects of a classroom are of the greatest importance for first year students in a lecture based learning environment.

### **Memory of Content**

It was hypothesized that memory of content would be the highest for those individuals who were part of a horseshoe arrangement because all of the students would have a direct line of sight to the presentation which has been shown by Sommer (1969). However, students produced the greatest performance scores, on average, when they were arranged in rows. Although these results were not significant, their grades differed by at least four percent, which to most undergraduate students can move them from a B average to an A. Sommer's (1969) early research on classroom desk arrangements and the negative effects of row desk designs has been challenged by the present findings. Within a small lecture format, the negative effects previously

mentioned by Sommer (1969) may not be present. Sommer (1969) states that row desk arrangements produce distractions and impede a student's direct line of sight to the teacher. However, due to the small size of the classroom used in this study, a student would only have a maximum of two students in front of them, which based upon the current results, is not enough to impede performance scores. It is possible that Sommer's (1969) results still hold merit, but the classroom size and capacity for these results to be present needs to be determined to strengthen their findings.

The atmosphere of a classroom was also hypothesized to have an effect on a student's memory of content such that classrooms that were warm and welcoming would produce high performance scores. This hypothesis was not supported with a main effect for atmosphere on memory of content such that a classroom with a sterile atmosphere significantly affected student's performance scores for memory of content. Winterbottom and Wilkins (2009) produced results from students in sterile secondary school classroom. Their conclusion that fluorescent lighting greatly devalues performance capabilities may not have been as applicable for this study due to the lack of reflective surfaces within a classroom that produce distracting visual impairments and headaches that can cause poor performance.

The hypothesized interaction of atmosphere and desk arrangement on memory of content was not found suggesting that although atmosphere and desk arrangement have individual effects on performance scores, when paired together, there is no significant effect on students' performance scores for memory of content. Although this differs from much of the research that has been discussed so far, students arranged in a horseshoe produce higher performance scores than those arranged in groups, which is consistent with hypotheses.

### **Affective Reactions**

Items on the affective reactions questionnaire were designed so that ratings would indicate whether or not students felt that the classroom was an environment that promoted learning. It was hypothesized that students in row desk arrangements would rate a classroom as having the weakest ability to promote student learning. Based off of the results, students participating in group arrangements produced the lowest ratings on questions assessing the classrooms ability to promote learning. These results should not have been unexpected as students perceptions of group arrangements tend to only out rate other desk arrangements when group work is necessary (Douglas & Gifford, 2010). It is, however, unusual that students in horseshoe arrangements did not rate the classroom higher than those students in row arrangements as students' perceptions of classrooms in past research show more positive regard when students feel that they have a sense of both individuality and a community present (Albertson & Selwood, 1998; Douglas & Gifford, 2010). It is possible that much like for memory of content, the size and capacity of the classroom are important characteristics for student perceptions.

Similarly to the hypotheses for memory of content, it was predicted that students would have more positive reactions to a classroom that had a warm atmosphere compared to that of a sterile one. This was true for students who were part of group and horseshoe arrangements, but false for those students who participated in row arrangements. These findings are intriguing as they point out the oddity of the row arrangement participants and the diverging results between these findings and past research. It is possible that the participants' lack of experience with different classroom designs made the horseshoe and group arrangements too distinct from their perceptions about learning as students do not experience many alternate classroom designs until their third or fourth years when classes are smaller (M. Atkinson, personal communication, March 3, 2014). Due to their inexperience, the participants may have expressed their perceptions

of beneficial classroom environments based on what they know; row arrangements. It is highly possible that familiarity outweighed the effects of atmosphere experienced in this study such that all row arrangements were rated as more effective when part of a sterile atmosphere rather than in a warm atmosphere.

Both classroom atmosphere and desk arrangement effected students' affective reactions on three of the affective reaction questionnaire items (See Figure 4, 5, 6). These significant interactions measuring classroom conduciveness and student interest help explain the results previously mentioned. Parallel with previous data, students' perceptions and attitudes towards the classroom, teacher, and material can easily be influenced by the non-verbal communication of a classroom; atmosphere and desk arrangement (Veltri et al. 2006). A classroom that has a sterile atmosphere and a row arrangement produces the highest ratings on both classroom conduciveness as well as students interest, contradictory to previous literature (Wollin & Montagne, 1981). Gislason (2010) completed a case study on open concept high schools and interviewed students to measure their affective reactions. Students noted that they were frequently distracted from their work by the noise, traffic, and social nature of the school. Gislason (2010) determined that students who lack strong intrinsic motivation, such as many of the low socioeconomic status students at the school, preferred learning environments where socialization can be monitored but stays away from traditional layouts. The students that participated in the present study, compared to Gislason's (2010), were enrolled in a first year psychology class with the majority being enrolled in their first year of university. Similar to students with low intrinsic motivation, first year students at university are given the task of learning how to study in ways that frequently differ from those learned in high school. Seeing as most students take the entire first year, if not longer, to become accustomed to university



learning, their motivation for learning may have been present, but may have been at a lesser grade than those in higher years of university (Fenty, 1997). If we regard the participants within both the present study as well as in Gislason's (2010) study as similar, our findings do not contradict previous literature. However, the hypotheses made may have been too ambitious for the study. As previously mentioned, participants gave the highest affective reaction ratings for a sterile row arrangement, which is similar to classrooms at the high school level (Gislason, 2010). Closely following those results was the classroom that was warm and a horseshoe arrangement, parallel to previous literature and our predictions (Albertson & Selwood, 1998; Wollin & Montagne, 1981). Due to the fact that our hypotheses would have been confirmed if row arrangements were absent from the study, it can be stated that affective reactions are not only influenced by atmosphere and desk arrangement, but that upper year students who have gained intrinsic motivation and studying abilities at the university level, may still require universities to tailor learning environments so that they promote learning and not distress.

This study was based upon the principle that universities are weakening their students' undergraduate educations by neglecting learning environments. Pocklington and Tupper's (2002) compelling book made claims that too much focus is being placed on graduate students and tenured professors while the undergraduate students are forgotten to a large extent. In determining what makes a learning environment beneficial for not only fostering learning but also improving student's attitudes and perceptions, studies that promoted warm environments and sociopetal seating arrangements were of the greatest population (Douglas & Gifford, 2010; Simmonds & Cooper, 2010; Sommer 1974). Warm atmospheres and sociopetal seating arrangements were suggested as multitudes of studies have found these aspects of an environment to reduce distress as well as distraction (Lang, 1996; Veltri et al., 2006; Wollin &

Montagne, 1981). The discontinuity in the present research compared to that of past literature might be a result of several shortcomings in the procedure and participants used.

### **Limitations**

The time constraints in completing this study as an undergraduate honors thesis barred the possibility of a longitudinal study that followed students for an entire semester. The present study was based on Wollin and Montagne's (1981) longitudinal study where students' perceptions and performance in a university level class was observed in either a sterile or warm atmosphere. Although interesting results were found for affective reactions, test scores in the present study were extremely high and produced very little variability compared to those found in longitudinal studies. There may have been a ceiling effect which could have been eradicated had the study proceeded identically to the participants other university classes including midterms and final exams to measure performance results. Internet administered posttests for the material presented in lecture were not available as an alternative to longitudinal testing as participants' identities were withheld during the study for ethical reasons.

There was also an oddity in the participant population that was not originally thought to be of a concern. The number of first year or very young students in relation to other academic years and ages at university was not controlled for in the study resulting in 87 out of 123 participants being under the age of 19. Fenty's (1997) paper on first year university students makes a valid claim that many first year student's experience high levels of stress and, as a whole, have more drop out rates than other years. As previously mentioned, not taking into account the way in which first year students learn is a mistake that needs to be controlled for. However unfortunate this effect was, literature on learning environments focuses heavily on primary and secondary school aged children or on university students completing group work (Doppelt & Schunn, 2008;

Maxwell, 2000; Weinstein & Woolfolk, 1981). The lack of recent literature on undergraduate lecture format learning environments does not excuse the limitation being discussed, but helps expand the present studies importance for filling the research gap. It is also possible that within this research gap, undergraduate students are still to large a population and that lower year (first and second) and upper year (third and upwards) university students need to be seen as two distinct populations when referring to learning environments at the university level.

Although first year learning styles may explain the oddity seen with row arrangement results, other possible explanations might be related to a minimal distinction between the warm and sterile atmospheres as well as the delivery style of the lecture material. The distinction may simply not have been enough to generate noticeable differences. Wollin and Montagne (1981) created two distinct classrooms that differed in floor material, wall color, overall arrangement, and decorations (paintings, pictures, and color schemes). Compared to the clear difference experienced in Wollin and Montagne's (1981) classrooms, the differences in the atmosphere's used in the present study are hardly different (See Figure 2). Simply changing key aspects of a room to alter an atmosphere may not have been a big enough change, calling into action the power of interior designers, studies on optimal colors for learning, and finding classrooms that are effective for learning that diverge from the typical classroom. Interestingly, the style in which the lecture material was delivered to the participants could also explain the results. Studies such as Wollin and Montagne (1981) as well as Spennemann, Atkinson, and Cornforth (2007) delivered lecture material directly from a professor to students live. In the current study, a video lecture of a current first year psychology professor was used as to control for teacher enthusiasm effects. Although the benefit of controlling for enthusiasm effects was necessary, it is possible that watching a video rather than interacting with a live professor enacts different learning

processes, alters attentional capabilities, and influences intrinsic motivation. A study by Figlio, Rush, and Yin (2010) suggests that live-lecture learning does produce greater performance scores compared to that of online instruction, especially with students who are male, Hispanic, or low achievers. Similarly, the research was completed with introductory course material at a major research university, consistent with the present study. The debate between live-lecture versus online instruction is one that still requires further experimentation before conclusions can be made.

### **Implications and Future Research**

If the results from the present study are accurate, previous research on classroom design has been challenged and should be confirmed through future studies. Lower year university students are displaying different results than upper year university students and high school aged students. This difference between students of different experience levels has divulged an area within learning that could use more attention. Both the interactions and main effects found support previous research that states that classrooms have non-verbal communication abilities and that it can alter student's performance as well as affective reactions. It is the direction to which our results point that differs from research and suggests that authors such as Pocklington and Tupper (2002) may be incorrect in their harsh view of Canadian universities. Strong feelings of neglect for undergraduate populations may not be accurate as our research points to the upper year students being the neglected population, not the entire undergraduate population. This study cannot make the claim that universities are creating positive learning environments for all of their students, but for those in their first few years, the small, traditional lecture format has been confirmed as the most effective learning environment. Based on this data, universities should consider creating different learning environments for students of different experience levels.

Based off of these implications, studies should be focusing in on three main areas: time lines, participants, and atmosphere design. To not only confirm the present findings but also to see greater effects, this study should be completed for a minimum of one semester to present students with multiple testing opportunities, different lecture materials, and time for the effects to be seen. The young participants previous experience in learning at the university level also skewed the results, contradicting the hypotheses made. To provide a better test of our hypotheses two options seem appropriate. The first option would be to have a more diverse population with varying levels of university learning experience so that different learning styles could be accounted for. The second option would be to only use participants who have at least two years of university learning experience, isolating social learning styles that have been fostered through experience. Finally, and possibly most importantly, the difference between warm and sterile atmospheres needs to be made much more distinct so that students can clearly identify the atmospheric type, as a more subtle difference did not create many effects in the present study.

### **Conclusion**

The current study challenges some aspects of previous literature on the topic of classroom design. The purpose of this study was to tease apart the relationships between students' learning experience and which aspects have the greatest effect on the students as a whole. The results of this study clearly defined that specific aspects of classrooms, such as its atmosphere and desk arrangement, do have an effect on student's academic performance and affective reactions to the experience as a whole. In conclusion, the findings of this study not only contradicted previous findings, but brought to light aspects of university learning experiences that require further attention. These results are helpful for educational research because not only did they confirm that education relies upon more than just efficient teachers, it reiterates the

notion that all students are individuals who cannot achieve optimal results with generic experiences. Future research is required to confirm and extend these findings.

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## Appendix A

**Effects of Classroom Design and Atmosphere towards Attitudes and Memory of Content****Assessment Package**

**Age:**

**Gender:**

**Condition Group:**

**Instructions:** Please fill out your age and gender on this cover page of this assessment package. The condition number has been filled in by the researcher and refers to which condition you are participating in for data collection. Once this page has been filled out please complete the Multiple Choice Assessment and the Attitude Questionnaire on the pages that follow. Instructions for each are below.

*Multiple Choice Assessment:* Please read each question below and choose the best answer out of the four possibilities. Please highlight the answer as shown below in question 1. After completing this assessment please begin the Attitude Questionnaire, which follows.

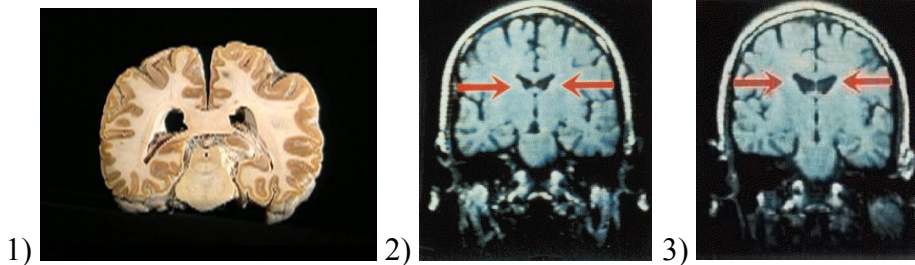
*Attitude Questionnaire:* Please read each statement and rate your attitude towards it. The scale is a 7 point Likert Scale ranging from *1 Not at all* to *7 Extremely*. Once completed, please make sure all information in both Assessments is complete and raise your hand. The researcher will come and debrief the study with you.

**Multiple Choice Assessment**

1. I am an undergraduate student taking Psychology 1000.
  - a) Yes
  - b) No
  - c) Maybe
  - d) I am not sure
2. When breaking up the word Schizophrenia, the “phrenum” aspect of the word means:
  - a) Split
  - b) Dual
  - c) Split mind
  - d) Mind
3. Schizophrenia is the splitting of:
  - a) Personalities
  - b) Mental processes
  - c) Identity
  - d) The Brain
4. When talking about Canadians that have Schizophrenia, it can be said that the incidence rate is:
  - a) 1-2 %
  - b) 1 %
  - c) 500,000
  - d) 1,000,000
5. Throughout the World, about \_\_\_\_\_ have Schizophrenia
  - a) 2 %
  - b) 3 %
  - c) 0.5 %
  - d) 1%
6. The DSM – IV states that to be diagnosed with Schizophrenia there are four distinct characteristics. Which is one of the following is NOT one of these characteristics:
  - a) Social or occupational dysfunction
  - b) 6 months duration
  - c) Decline in G score
  - d) Cognitive or perceptual distortion
7. Within the family of Schizophrenia, there are four subtypes according to the DSM – IV. Which of the following is ONE of the four?
  - a) Schizoid
  - b) Differentiated
  - c) Paranoid
  - d) Unique
8. Within the family of Schizophrenia, there are four subtypes according to the DSM-IV. Which of the following refers to incoherent speech, odd affect, delusions and/or hallucinations?
  - a) Schizoid
  - b) Disorganized
  - c) Paranoid

- d) Unique
9. When referring to the 'Type' within Schizophrenia, which pair matches up?
- a) Type I – negative symptoms; Type II – positive symptoms
  - b) Type I – positive symptoms; Type II – negative symptoms
  - c) Type I – positive symptoms; Type II – less positive symptoms
  - d) Type I – negative symptoms; Type II – more negative symptoms
10. In Schizophrenia, delusions and hallucinations are part of,
- a) Negative symptoms
  - b) Unique subtype
  - c) Positive symptoms
  - d) Paranoid subtype
11. In Schizophrenia, flat affect is a part of,
- a) Negative symptoms
  - b) Unique subtype
  - c) Positive symptoms
  - d) Paranoid subtype
12. Due to Schizophrenias adverse affects, people may withdraw from social interactions and have poor self-care. This is considered to be a part of which of the following:
- a) Self
  - b) Feeling
  - c) Thought
  - d) Action
13. Martha began to believe that secret cult meetings were going on even when evidence was produced showing that there were no such meetings. Which aspect of the circular process described in lecture is being affected?
- a) Feelings
  - b) Actions
  - c) Thoughts
  - d) Behaviour
14. Which of the following is Martha (from question 12) suffering from?
- a) Hallucinations
  - b) Delusions
  - c) Insomnia
  - d) Dissociation
15. Hallucinations are:
- a) False sensory perceptions
  - b) Scary dreams
  - c) True sensory perceptions
  - d) None of the above
16. When referring to those with Schizophrenia, their thought processes tend to be slightly to greatly disturbed. They may suffer from Formal Thought Disorders where there is a break down in the form or pattern of logical thinking. Examples of this break down can be seen through:
- a) Paralogic
  - b) Over inclusion
  - c) Bluffing

- d) Both A and B
17. Predisposition and stress are considered to be causes of:
- Bluffing
  - Schizophrenia
  - Dissociative Identity Disorder
  - Bipolar
18. When discussing predisposition, which of the following three are contributors?
- Genetics, Biochemical, and Medicine
  - Genetics, Stress, and Biochemical
  - Genetics, Biochemical, and Neurological
  - Genetics, Stress, and Neurological
19. As mentioned in lecture, genetics can cause a predisposition to Schizophrenia. What is the name of the protein that is partially responsible for this?
- DISK 1
  - DISC 1
  - RISK 1
  - RISC 1
20. The concordance rate of Schizophrenia for a fraternal twins when one has Schizophrenia is:
- 9 %
  - 13 %
  - 17 %
  - 48 %
21. It has been noted that the neurotransmitter dopamine is related to attention. Drugs that stimulate dopamine can induce hallucinations and delusions. What is the name of this theory?
- Neurotransmitter Theory
  - Dopamine Increase Theory
  - Dopamine Theory
  - Hallucination and Delusion Theory
22. It has been noted that drugs that stimulate dopamine can induce hallucinations and delusions. Based off of this information, what action would be most effective for antipsychotic drugs?
- Increase dopamine activity
  - Decrease dopamine activity
  - Decrease serotonin activity
  - Increase serotonin activity
23. According to the pictures below, which belongs to an individual with Schizophrenia?



- a) 1
  - b) 2 and 3
  - c) 1 and 3
  - d) 1 and 2
24. Individuals will have a much higher incidence of Schizophrenia when they have a low social economic status (SES). How many times greater is it to have Schizophrenia at a low SES than a high SES.
- a) 5 times
  - b) 8 times
  - c) 9 times
  - d) 12 times
25. When looking at individuals who suffer from Schizophrenia, it is often found that there is \_\_\_\_\_ conflict with their parents and that discharged patients are \_\_\_\_\_ likely to relapse if family members were critical, hostile, and negative. Please choose the best answer to fill in the blanks in their respective order.
- a) more; less
  - b) more; more
  - c) less; less
  - d) less; more
26. What was the lecture based on that this assessment is testing?
- a) Schizophrenia
  - b) Dissociative Identity Disorder
  - c) Concordance Rates
  - d) General Psychology

**Answers:**

- 1. A
- 2. D
- 3. B
- 4. C
- 5. D
- 6. C
- 7. C
- 8. B
- 9. B
- 10. C
- 11. A
- 12. D
- 13. C
- 14. B
- 15. A
- 16. D
- 17. B
- 18. C
- 19. B
- 20. C

- 21. C
- 22. B
- 23. C
- 24. C
- 25. B
- 26. A

**Affective Reactions Questionnaire**

1.	The classroom was interesting						
1	2	3	4	5	6	7	
Not at all						Extremely	
2.	The classroom was comfortable						
1	2	3	4	5	6	7	
Not at all						Extremely	
3.	The classroom was pleasant						
1	2	3	4	5	6	7	
Not at all						Extremely	
4.	The classroom was distracting						
1	2	3	4	5	6	7	
Not at all						Extremely	
5.	The classroom was generic						
1	2	3	4	5	6	7	
Not at all						Extremely	
6.	The classroom was conducive for a lecture						
1	2	3	4	5	6	7	
Not at all						Extremely	
7.	The classroom made me want to learn more						
1	2	3	4	5	6	7	
Not at all						Extremely	
8.	The teacher was knowledgeable						
1	2	3	4	5	6	7	
Not at all						Extremely	
9.	The teacher was interesting						
1	2	3	4	5	6	7	
Not at all						Extremely	
10.	The teacher made me want to learn more						
1	2	3	4	5	6	7	
Not at all						Extremely	
11.	The teacher was generic						
1	2	3	4	5	6	7	
Not at all						Extremely	
12.	The lecture was interesting						
1	2	3	4	5	6	7	
Not at all						Extremely	
13.	The lecture made me want to learn more						
1	2	3	4	5	6	7	
Not at all						Extremely	
14.	The lecture was generic						
1	2	3	4	5	6	7	
Not at all						Extremely	
15.	The lecture was difficult to follow						
1	2	3	4	5	6	7	
Not at all						Extremely	



## Appendix B

**Letter of Information and Informed Consent****Effects of Classroom Design and Atmosphere towards Attitudes and Memory of Content**

You are invited to participate in a study that examines how the design of a classroom and its atmosphere can affect attitudes and memory. We are interested to see how different aspects of a rooms design and atmosphere can influence cognitive functioning.

There are no known risks associated with participation in this study. If you consent to participate, the study will involve watching a videoed lecture that is half an hour long and completing two assessments; one Multiple Choice and one questionnaire. The lecture will be on Schizophrenia, a psychological disorder, in the format of a video. This study will take place on Western University's campus. You will be asked to complete the multiple-choice assessment to the best of your ability and to follow the instructions given to you. You will also be asked to rate your experience of the study in a questionnaire. You will be rating your experience using a 7-point Likert Scale. We anticipate this will take no longer than 1 hour to complete and you will receive 1 participant pool credit for your time.

Your participation in this study is completely voluntary and you are welcome to cease participation at any time, for any reason, without loss of the participation pool credit or impact your academic progress in your program. You are also welcome to omit any responses to any specific questions throughout the process with no penalties. All assessments and questionnaires are labeled generically and there will be no identifiers on data collected. The only information that will be requested will be your age and gender. This assures that this study is completely anonymous and confidential. Confidentiality is ensured, as all data from this study will be presented in aggregated form only.

At the completion of this study you will be fully debriefed and given a Debriefing Form for your own usage. You may pose any questions to the researcher concerning the study or your participation. If you wish to get in contact with the principal investigators of this study to find out more about this research or to address any concerns about your participation, please contact Brittney Bonnick, Honors Psychology Undergraduate Student ([bbonnick@uwo.ca](mailto:bbonnick@uwo.ca)) or Mike Atkinson, Ph.D ([atkinson@uwo.ca](mailto:atkinson@uwo.ca)).

If you have any questions about the conduct of this study, or your rights as a research participant, you may contact the Office of Research Ethics at Western University, 519-661-3036, or [ethics@uwo.ca](mailto:ethics@uwo.ca).

**Effects of Design towards Attitudes and STM Study**

I have read the Letter of Information, have had the nature of the study explained to me, and I agree to participate. All questions have been answered to my satisfaction.

Participant Information:

\_\_\_\_\_  
(Print name clearly)

\_\_\_\_\_  
(Signature)

\_\_\_\_\_  
(Today's date)

Researcher Information:

Brittney Bonnick  
(Print name clearly)

\_\_\_\_\_  
(Signature)

\_\_\_\_\_  
(Today's date)

## Appendix C

**Debriefing Form****Effects of Classroom Design and Atmosphere towards Attitudes and Memory on Content**

Albertson and Selwood (1998) researched different designs of computer laboratories to find the best design based on teaching method, approach, and cost. They found that the most popular design was with computers and desks around the perimeter of the room while the least popular was a traditional desk arrangement of rows. This research paired with that from Wollin and Montagne (1981) which shows that sterile environments are poor for learning, indicates a pocket of educational research that needs to be studied.

The purpose of the current study was to look into the effects of classroom design and atmosphere on student's memory and attitudes towards the experience. Therefore, the goal of the present research was to determine if an interaction between types of classroom design and different amounts of atmosphere in a classroom existed. We expect that participants who had a non-traditional classroom design with a warm atmosphere will have the highest scores on memory tests and have the greatest attitude toward their experience and that those participants who had traditional classroom design with a sterile atmosphere would have the poorest attitude towards the experience and the lowest score on their memory tests. This is due to the notion of sterility inducing less ownership and respect towards an environment and the events that occur within it. It is also hypothesized that the participants who have a higher score on their memory tests will have a more positive experience.

In this study participants were asked to listen to a lecture on Schizophrenia in either a sterile or warm atmosphere. Different conditions had differing classroom designs; traditional desk organization, grouping organization, and circular desk design. After the lecture was completed a multiple-choice assessment based on the material from the lecture was completed. The purpose of this task was to determine if the different atmospheres and different classroom designs affected the student's memory on the information that was just presented and if this altered the participant's attitude toward the experience as a whole. By comparing the results of this research, future students and teachers alike will be able to maximize the amount of learning within the classroom based on atmosphere and classroom design.

Your responses and participation are much appreciated. Without your involvement, it would not be possible to conduct this research. Thank you.

If you have any further questions about this research please contact Brittney Bonnick at [bbonnick@uwo.ca](mailto:bbonnick@uwo.ca) or Mike Atkinson at [atkinson@uwo.ca](mailto:atkinson@uwo.ca). Thank you for helping us with this project--your time is much appreciated.

If you have questions about your rights as a research participant, you should contact the Director of the Office of Research Ethics at [ethics@uwo.ca](mailto:ethics@uwo.ca) or 519-661-3036.

**References:**

- Albertson, T. & Selwood, S. (1998). Rows, isles or peninsulas? An analysis of computer laboratory layouts in schools. *New Zealand Journal of Applied Computing and Information Technology*, 2(1), 82-89.
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