

# The Framework Model for the Implementation of Collaborative and Interactive Learning in the University Classroom

Mohammed Alhaji Mohammed<sup>1\*</sup>, Adel A. Abdou<sup>2</sup>

<sup>1</sup>Department of Architectural Engineering, King Fahd University of Petroleum and Minerals  
Dhahran, Saudi Arabia

<sup>2</sup>Department of Architectural Engineering, King Fahd University of Petroleum and Minerals  
Dhahran, Saudi Arabia

\*Corresponding author's email: mamkol [AT] yahoo.com

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**ABSTRACT**— *Today, colleges and universities recognize that, to employ and retain good students and highest level of academic staffing for the best student comprehension, the provision of contemporary and highly equipped instructional facilities is essential. This paper discusses the impact of the indoor environmental quality; the instructional technology; the physical set up of the university classroom; and the emerging teaching/learning pedagogies on students' performance. It is established that, these four factors have a significant effects on student learning outcome. The study also presents a comprehensive and critical review of literature on the nature of the university classroom for collaborative and interactive learning, with the aim of providing an enabling environment of higher learning in the universities. The research suggests that improving the three influential components i.e. the indoor environmental quality, the instructional technology and the physical set up will help in enhancing student performance and productivity. The study concluded by establishing a systematic framework model for the implementation of collaborative and interactive learning in the university classroom.*

**Keywords**— University Classroom; Collaborative and interactive learning; Instructional technology; Equipment; Learning styles; Physical set up; Learning outcome; Students; Environment.

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## 1. INTRODUCTION

A classroom is an environment intended for the teaching and learning activities in a safe atmosphere without any interruption or distraction. The exchange of information between learners and teacher in a classroom usually happens through the two basic media of vocal and visual communication. These communication processes require a learning environment facilitated with the right visual, acoustic, and thermal qualities for the effective exchange of knowledge and an enhanced level of comprehension. The University classroom should accommodate the basic modern technology and resources for easy pedagogical delivery, and offer a flexible layout that can reflect the specific learning styles of the teacher. Today, colleges and universities recognize that the precondition to employing and retaining good students and academic teams is the availability of modern and well-resourced instructional facilities. Furthermore, owing to the recent changes in learning styles as a consequence of emerging technology, an efficient modern university classroom, suitable to these changing styles, with a state-of-the-art educational facilities and a comfortable indoor environment is essential.

Moreover, there is an increase desire for a collaborative and interactive learning environment between university students and instructors, which demands the provision of suitable layouts to accommodate such instructional pedagogy. Despite rapid development in technology, which supports and enhances collaborative and interactive learning, it would appear that the bulk of classrooms in today's universities fail to reach these standards [26]. For these developments to reach the classrooms, a framework model for the implementation of a collaborative and interactive learning environment is required.

## 2. RESEARCH METHODOLOGY

In order to accomplish the study objectives, the following research methodology is implemented.

- a) A comprehensive literature review has been conducted to address the main issues with regard to the influential factors affecting collaborative and interactive learning in the university classroom.
- b) A thorough analysis of the collected literature has been conducted to ascertain the relationship between the influential factors, which affect student performance, and their achievement in the university classroom.
- c) Based on the analyses of the above two stages, a conclusion has been reached with the establishment of a model framework for the implementation of a collaborative and interactive learning environment.

### 3. INFLUENTIAL FACTORS AFFECTING STUDENT LEARNING IN THE UNIVERSITY CLASSROOM

#### 3.1 Classroom Indoor Environmental Quality (IEQ)

##### 3.1.1 Lighting Quality

Lighting is, and always has been, an important factor in the design and operation of educational spaces. As electric power costs declined and designers began to take advantage of the increased flexibility provided by electric lighting, daylighting took a secondary role [4]. “A major challenge is to provide classroom lighting that will increase teacher control, reduce glare, improve lighting and optimize visual comfort whilst minimizing the lighting power and energy use to their lowest possible levels” [33]. Hes chong Mahone Group [17; 18] found and validated respectively a compelling statistical correlation between the amount of daylight in the elementary school classroom and the performance of students on standardized math and reading tests. The studies of the classrooms also showed that the position of windows and the resulting lighting quality in the classrooms are a key issue in learning, and can have both positive and negative impacts on student performance. Another study conducted by the New Building Institute, [31] also expands and validates previous research carried out by Hes chong Mahone Group [17].

##### 3.1.2 Acoustic Quality

Acoustic comfort in the classroom remains a crucial factor in development activities, particularly those that require a high level of students’ attentiveness [22]. The effects of classroom acoustics on learning outcomes are well established, reliable and substantial, demonstrating that high-quality classroom acoustics are fundamental to student achieving outstanding results [36]. It has been established that, a high level of background noise and reverberation in the classroom, adversely affects the learning setting, especially for young children, who need optimal situations for hearing and understanding [41]. Moreover, the design of an environment, which enables enhanced, appropriate and accurate hearing, is vital for students’ comprehension. Earthman, [9] cited many studies linking the acoustic environment in a classroom to academic achievement, thus relating levels of classroom noise and reverberation to reading and spelling ability, behaviour, attention, space concentration, and student comprehension. The ability to clearly hear and comprehend what is being taught is a prerequisite for effective learning. The impairment of this ability through unwanted noise will decrease student performance. Benjamin et al [3] confirm that exterior and interior noise sources are among the major contributors of acoustic discomfort in the classroom.

##### 3.1.3 Thermal comfort

The relationship between thermal comfort and student performance in classroom has been established in the literature. Ed Young, et al. [10], study links classroom indoor thermal comfort to student educational outcome. The efficiency of student performance in classroom is largely dependent on the nature of the thermal environment, as a comfortable thermal environment leads to an outstanding student performance [9]. Temperature, humidity and air movement all affect the thermal environment in classroom. An increase in temperature in any workplace tends to decrease worker efficiency and consequently increase work related accidents [9].

##### 3.1.4 Indoor Air Quality

The effect of poor indoor air quality on student performance remains one of the continuous questions in educational facilities research. Many studies have linked poor indoor air quality to illnesses leading to student absence in school and a direct reduction in the person’s capacity to perform specific mental assignments which require concentration, calculation or memory [12]. Some research established the lack of acceptable evidence linking poor air quality in classrooms to low student performance [29]. However, Wargocki, and Wyon, [44] in their studies agreed EPA [12] that, poor indoor air quality, can lead to absenteeism due to the effect of chemicals in circulation which affect asthma and increase respiratory dust. Ed Young, et al. [10] established the existence of the relationship between the indoor air quality and student health and achievement, asserting that Poor indoor air quality causes respiratory infections, worsens allergies, and causes drowsiness and a shorter attention span. Furthermore, Shaughnessy et al. [37] confirmed these associations in their studies linking classroom ventilation rates to student performance in math standardized test scores, stressing the need for further studies with a larger sample size and a broader assessment of the indoor environment. With the above affirmations there is therefore enough evidence linking indoor air quality to student performance in the classroom.

#### 3.2 Classroom Physical Set-up and Geometrical Configuration

The physical set-ups in educational facilities have a great impact on student comfort, achievements and the general classroom communication process. The effectiveness in communication in the classroom, which is partially a function of seating arrangements, is vital to the success of both the student and teacher [27]. Ed Young, et al. [10] in their studies ascertained that students had higher achievement scores in the newer facilities compared to their scores in the older ones. The study outcome confirms that, the newer the facilities the higher the scores in reading, mathematics, and composition classes. The improvement in facility conditions leads to improved student achievement and scores, just as stimulating set-

ups promote positive attitudes in students [10]. The suitability or otherwise of furniture and the seating arrangement largely depends on the learning styles employed in the classroom.

Moreover, the size of the classroom is also an essential factor to be considered in school design as this will have an effect on the educational outcome. The study by Public Agenda indicated that 70% of the teachers surveyed believed that a small class size is more important to student performance than a smaller school size [36]. Classroom sizes are usually determined by the expected seating capacity, for example computer classrooms generally require 2.8-3.7 square meters per student, also the provision of a sufficient space for an instruction area to accommodate the instructor's workstation; the environmental controls; the projector; screen; white board and a technology storage space is also essential [11].

### **3.3 The Impact of Information and Communication Technology (ICT) in the Classroom**

Information and Communication Technology (ICT) varies from lower to higher technology with the potential of enhancing learning practices through many approaches and which impact on the students learning and instructors teaching. The establishment of enough space for computers and supporting facilities (e.g. printers, network connections and large monitors), initiates the instructor's reorganization process. This will result in a re-assessment of classroom activities and an enhanced efficiency in the learning experience [15]. The incorporation of information and communication technology in the classroom system began more than two decades ago, with the application of new technology, such as email, Internet, the World Wide Web and video-conferences. These applications have generated fresh communication possibilities for the teaching and learning process of such things as emails and video-conferences [19]. Today, ICT potential involves the teaching of technical and cognitive skills to access, utilize, develop, create, and communicate information effectively with ICT tools. Learners in classrooms express this expertise by applying technology decisively to solve problems, analyse and exchange information, develop ideas, create models, and control devices [1].

### **3.4 Classroom Seating Arrangement Styles**

The nature of the classroom seating arrangement is one of the core characteristics to be considered in designing the classroom for collaborative and interactive learning. Franklin, [14], studied the "L" shaped classroom which may offer the flexibility beneficial to the multidimensional elementary classroom of the future. Emmons and Wilkinson [11] classified classroom design into three models including the "demo" for passive audience presentation; the "lab" for practical work; and the classroom that combines elements of the two. The need for student collaboration and interaction during the learning process is one of the most important considerations in adopting a particular seating arrangement in the classroom. The typical characteristics of the collaborative and interactive classroom include visual contact amongst students, an ease in forming small groups, and flexible and reconfigurable furniture.

## **4. REQUIREMENTS OF THE UNIVERSITY CLASSROOM**

The classroom ratio of 20 to 25 students is considered best for collaborative and interactive learning, and it also reduces student rowdiness. According to the study conducted by Kokkelenberg, et al [20], student scores decrease significantly as class size increases until class sizes of twenty, are reached and more slowly, still markedly through larger class sizes. Hence, a small, easy to control, classroom size is necessary to achieve the required pedagogical outcome. Due to the large number of facilities/equipment required to support interactivity in the collaborative classroom, an expanded instructor space for the use of an interactive display is required. Apart from the instructor's chair, the instructor's space also houses the Information and Communication Technology (ICT) corner, which constitutes the gadgets required to set-up interactivity; internet accessories; multimedia equipment; and other remote collaborative tools. The provision of a raised access floor in a collaborative and interactive classroom provides a void for cables, ducts and other under floor services. The floor panels can be raised with appropriate lifting devices to accommodate the installation of extra services when necessary [2]. This provides opportunity for the reorganization of furniture in the classroom without any distraction to suit the particular collaborative situation.

Furthermore, as different pedagogical techniques require different types of learning space, it is not cost effective to provide different classrooms for different pedagogical requirements, flexible, adjustable and movable furniture has to be provided in the collaborative and interactive classroom. A survey has shown that almost half of the instructors prefer the movable seating arrangement [32]. The mobility of the furniture provides a means for the student to manoeuvre the furniture as required for the pedagogical style operating in the classroom at any point in time.

## **5. COLLABORATIVE AND INTERACTIVE LEARNING PEDAGOGY**

The importance of the Learning and teaching style in the university classroom instructional delivery cannot be overemphasized. A Learning style is a unique and habitual mode of acquiring knowledge, skills and attitudes by study or experience [38]. Prior to the discussion on collaborative and interactive learning, it is relevant to acknowledge the existence of other learning and teaching styles that are also applicable in the collaborative settings. There are many well defined learning styles prominent in the literature; Kolb [21] come up with four sets of learning styles, Muir [30] cited eleven learning styles as shown in Table 1., Teaching styles according to Conti as cited in McCoy, [28] refer to any

consistent instruction practices employed by a teacher irrespective of the situation or the content being taught. They are divided into two, including the teacher-centred approach and learner-centred approach. Teacher-centred approach is the one in which the teacher is active throughout the session, the students remain passive listeners and learner-centred approach is the opposite when the students are actively involved. These teaching and learning styles need to be considered when designing, upgrading and enhancing any classroom in order to avoid both instruction and assimilation conflict that will decrease performance. Table 1 shows various learning styles descriptions and models.

Collaborative learning provides an environment which stimulates and augments the learning process through the introduction of interactive settings and by creating a pragmatic atmosphere, into the classroom which enriches the effectiveness of the system. Such an environment will assist in sustaining the student interest by providing a more pragmatic learning habitation [8]. Collaboration learning is an active process and a coordinated effort by which learners pursue joint objectives, solve problems, and build a common understanding of a particular issue [25]. The medium of collaborative learning provides students with opportunities to analyse, synthesize, and evaluate ideas cooperatively [16]. Owing to the benefits attached in engaging team learners collaboratively in problem-solving activities, students need to interact socially and develop the essential intellectual structures to acquire their own knowledge. Collaborative learning usually enhances social skills and facilitates student participation in their social structure, whilst conveying the relevance of learning. Moreover, it also permits more student-centred educational processes, requires less discipline and is more stimulating [39]. The encouragement of collaborative learning in the university classroom should move beyond the student level, and involve course teachers who should be well-informed. Hence, teachers have to be supported and inspired in adopting and implementing the transformation, from an isolated teaching model, to a collaborative learning one.

Moreover, the success of collaborative learning depends considerably on the availability of the suitable instructional, physical, and social conditions. Simply grouping people and requesting them to execute tasks or solve problems does not necessarily encourage the kind of interaction that increases the learning possibility, rather collaboration should be understood in a wider sense [26]. In order to be effective and successful in problem solving, it is essential that knowledge is constantly shared and constructed in teams [24]. Empirical studies indicated that collaborative learning is often more effective than individual learning, depending on the quality of interactions during collaboration [7].

Furthermore, the study conducted by Leidner, and Fuller, [23] found that students working collaboratively in groups have a greater interest in materials and perceive themselves to learn more than students working individually. The students in a collaborative group are responsible for an equal work distribution to ensure the adequate contribution of each member leading towards achieving the required goal and effective assessment of all components. Hence, students as comment on each other’s work or ideas, they are also assessing their own understanding within a new context [34]. The collaborative and Interactive learning environment should be equipped with all the necessary tools that can allow for remote interactivity including Tele-collaboration, video-conferencing, Smart-Board, software tools, and internet facilities etc. to enable physical engagement of various formats of synchronous-collaborative classes [43].

**Table 1: Learning styles Descriptions and Models**

S/N	Learning styles	Description/Comments	Models/Inventor
1.	Diverging learning style	Feeling and Watching, Work in group (brainstorming)	The four Kolb learning styles [5]
2.	Assimilating learning style	Watching and Thinking Reading, Lectures, and Exploring analytical models. Less focus on people	
3.	Converging learning style	Doing and Thinking Less concern with people Prefer technical task Experiment, simulate and practical applications.	
4.	Accommodating learning style	Doing and Feeling Hands-on learners Rely on others for information Works in teams trying different ways.	
5.	Visual (spatial) learning style	Seeing and Reading in observation. Pictures, diagrams, demonstrations, display, hand-outs, and films.	The VAK learning styles model [5]
6.	Auditory learning style	Listening and Speaking	
7.	Kinesthetic learning	Touching and Doing Physical experience	
8.	Sensing and intuitive perception	Sensors are practical and inductors are imaginative. Sensors like facts & observations, and inductors like concept & interpretation.	

9.	Visual and verbal input	Visual learners get info from visual images. Pictures, diagrams, graphs, schematics & demonstrations. Verbal learners get info from verbal material, written & spoken words, and math formulas. A lecture is verbal while experiment is visual.	The dichotomous learning style dimensions of this model [13].
10.	Inductive and deductive organization	Inductive learners use observation, experiment & numerical Science instructions are deductive. Deductive is more conscience & orderly than inductive	
11.	Active and reflective processing	Active learners learn by doing & work well in group Reflective learners use to think and work alone or in pairs. Most lecture classes do very little for the two	
12.	Sequential and global understanding	Sequential learners absorb information and acquire understanding of material in small connected chunk. Global learners take in information in seemingly unconnected fragments and achieve understanding in large holistic leaps.	
13.	Activitists (Do)	These are ‘hands-on’ learners Immerse themselves fully in new experiences Enjoy here and now Open minded, enthusiastic, flexible Acts first, consider consequences later Seek to centre activity around themselves	Honey and Mumford Model learning [40].
14.	Reflectors (Review)	These are ‘tell me’ learners Stand back and observe Cautious, take a back seat Collect and analyse data about experience and events, slow to reach conclusions Use information from past, present and immediate observations to maintain a big picture perspective.	
15.	Theorists (Conclude)	These are ‘convince me’ learners Think through problems in a logical manner, value rationality and objectivity Assimilate disparate facts into coherent theories Disciplined, aiming to fit things into rational order Keen on basic assumptions, principles, theories, models and systems thinking	
16.	Pragmatists (Plan)	These are ‘show me’ learners and want a demonstration. Keen to put ideas, theories and techniques into practice Search new ideas and experiment Act quickly and confidently on ideas, gets straight to the point Are impatient with endless discussion.	
17.	Concrete Sequential Learner	Direct hands on activities Active (tactile) methods Use Workbooks, diagrams, flowchart and demonstrations for instruction. Computer assisted instructions	Anthony Gregorc learning styles on brain [35].
18.	Concrete Random Learner	Prefer trial & error approach. Independent study, computer games, simulations, multimedia & software.	
19.	Abstract Sequential Learner	Verbal, logical & analytical approach. Like written, verbal & visual instruction. Lectures, reading, outlines, conducting Internet searches, email, list serves, and audiotapes.	
20.	Abstract Random Learner	Responds to visual instruction. Group discussion & face to face meetings Uncomfortable with distance education Instructional methods: video clips, group discussion, videoconferencing, television, case studies, chat-rooms, and guest speakers.	Other Models
21.	Verbal (Linguistic)	Involves both written and spoken words Public speaking, debating, politics, writing & journalism.	
22.	Logic (mathematical)	Use logic & reasoning, as in sciences, mathematics, accounting, detective work, law & computer programming.	
23.	Social (interpersonal)	Prefer to learn in group Communicate both verbally & non verbally well	
24.	Solitary (intrapersonal)	Prefer to work alone & use self-study More private & independent	

## **6. FRAMEWORK MODEL FOR IMPLEMENTING COLLABORATIVE AND INTERACTIVE LEARNING IN UNIVERSITY CLASSROOM**

The success, or otherwise, of any collaborative and interactive learning process in the university classroom depends largely on the quality of the implementation method. The strategies to be employed in setting out any collaborative layout should be in line with the learning style adopted in the classroom. The framework model for the implementation of collaborative and interactive learning in the university classroom has been developed as follows:

### **6.1 Identify the collaborative learning style to be adopted in the classroom**

The identification of a particular learning style to be adopted in pedagogical delivery is the first step for the implementation of collaborative learning in the classroom. Many learning styles exist in the literature as presented in Table 1. The identification and subsequent selection of the learning style is done based on the requirement of the course and the material to be taught as some courses require the pragmatic approach in which activities will be demonstrated practically in the classroom, other styles are logical in nature and require reasoning and thorough discussion among students and their instructor. Therefore, care should be taken when deciding on which type of learning style is to be applied in the collaborative and interactive classroom.

### **6.2 Determine the requirements for the selected collaborative learning style**

Depending on the nature of pedagogical delivery required by the selected collaborative learning style, there is a possibility of providing the wrong requirement for the selected learning style. Selected learning styles for collaborative and interactive learning should be premeditated and understood clearly prior to assigning any requirement for its proper delivery, e.g. some learning styles require voting equipment in form of clickers, while others require flipchart etc.

### **6.3 Determine the classroom size required to accommodate the requirements above**

The consideration of the classroom size in relation to the learning style requirement is very important. The various facilities, the equipment and materials used in instructional delivery to suit a particular group of learning styles should be well accommodated by the size of classroom. This is to avoid wastage by supplying facilities that cannot be accommodated in the space provided. As different learning styles require different types of learning space, it is not cost effective to provide different classrooms for various pedagogical requirements. The simplest solution is to have flexible facilities (Furniture and Equipment) that can be transformed in the same classroom to suit the requirement of any collaborative learning/teaching styles to be adopted in the classroom.

### **6.4 Consideration of indoor environmental quality for such learning setting or layout**

A comfortable learning environment is a prerequisite in improving student achievement in the collaborative classroom. The comfort factors in the classroom include; lighting, acoustics, thermal and indoor air quality. Many studies have confirmed the positive effect of a comfortable classroom on students understanding and achievements [17; 18; 31]. The research linking acoustics to learning outcomes in the classroom is reliable and credible, as high-quality acoustics are fundamental to good academic performance [36]. Moreover, accurate hearing is crucial to the students' ability to absorb information. The ability to clearly hear and understand what is being verbally communicated is a prerequisite for effective learning. When this ability is impaired through unwanted noise, it will decrease students' performance. [9]. Poor indoor air quality in the learning environment can cause illness leading to absenteeism in school, and result in acute health symptoms which often decrease the students' performance [12]. Hence, the indoor environmental quality has a great impact on learning outcomes and should be considered when setting up the collaborative and interactive learning environment.

### **6.5 Analyse and establish the required geometrical configuration for the collaborative learning style**

The adopted learning styles, facilities and equipment requirements, together with the consideration for comfort and classroom size should be examined carefully in order to establish the required geometric configuration for the collaborative learning style in the classroom. The type and nature of furniture and equipment has to be analysed thoroughly to provide a proper arrangement suitable for the adopted learning style. Classroom seating arrangement remains the core consideration in designing any collaborative learning environment. This is due to the fact that different collaborative learning styles require a varying level of student interaction, and as such, different seating arrangements must be suited to their pedagogical activities.

### **6.6 The allocation of required pedagogical tools, equipment and materials for each collaborative group**

Collaboration in the university classroom requires the grouping of students which will largely depend on the type and nature of the pedagogical activities required in the classroom. These groups will at times require some tools, equipment and materials that will help in understanding a particular aspect of the course requirement. Tools such as software and equipment such as clickers, and materials and rough papers should be provided for each group in the classroom before students enter to participate in the collaborative session.

### **6.7 Grouping of students to suit the adopted collaborative style**

The grouping of students in the collaborative classroom to carry out any assigned task is one of the important characteristics in setting the collaborative classroom layout. The responsibility of selecting the students lies with the instructor. The instructor will know the performance of every person in the classroom and can facilitate that excellent students and academically poorer ones will be mixed in each group. Thus, the main aim of collaboration is to provide the required avenue in which students will learn from each other. Group students are responsible for distributing any assigned task fairly amongst them ensuring that each member contributes adequately. A student with leadership abilities should be included in each group to provide the best outcome.

### **6.8 Commencement of Collaborative and interactive learning activities**

When all the necessary arrangements in terms of space, furniture, equipment, materials, comfort and grouping are in place, the collaborative and interactive learning may begin. These processes should be monitored and supervised by the teacher who will then remain as facilitator throughout the session and the required collaborative learning style will then be delivered with very few problems.

### **6.9 Review the Effectiveness of the Developed collaborative learning style and its Implementation**

The outcome of the collaborative learning activities will be reviewed after one or two lectures, which assess its effectiveness in relation to the provided strategies. The assessment result will enable any fault that has been identified to be corrected. This will strengthen the entire methodology and will result in delivering a better collaborative learning outcome.

### **6.10 Recommend solutions to the documented problems and implement the reorganized strategy in the next meeting**

Solutions will be recommended to deal with the problems identified in the process of the entire collaborative and interactive framework model implementation. Based on these recommendations, the reorganized framework model will be reapplied again in subsequent lecture meetings. Thus, a perfect framework model for implementing collaborative and interactive learning will have been achieved. Figure 1 illustrates the logical steps in the collaborative and interactive framework model.

## **7. DISCUSSION**

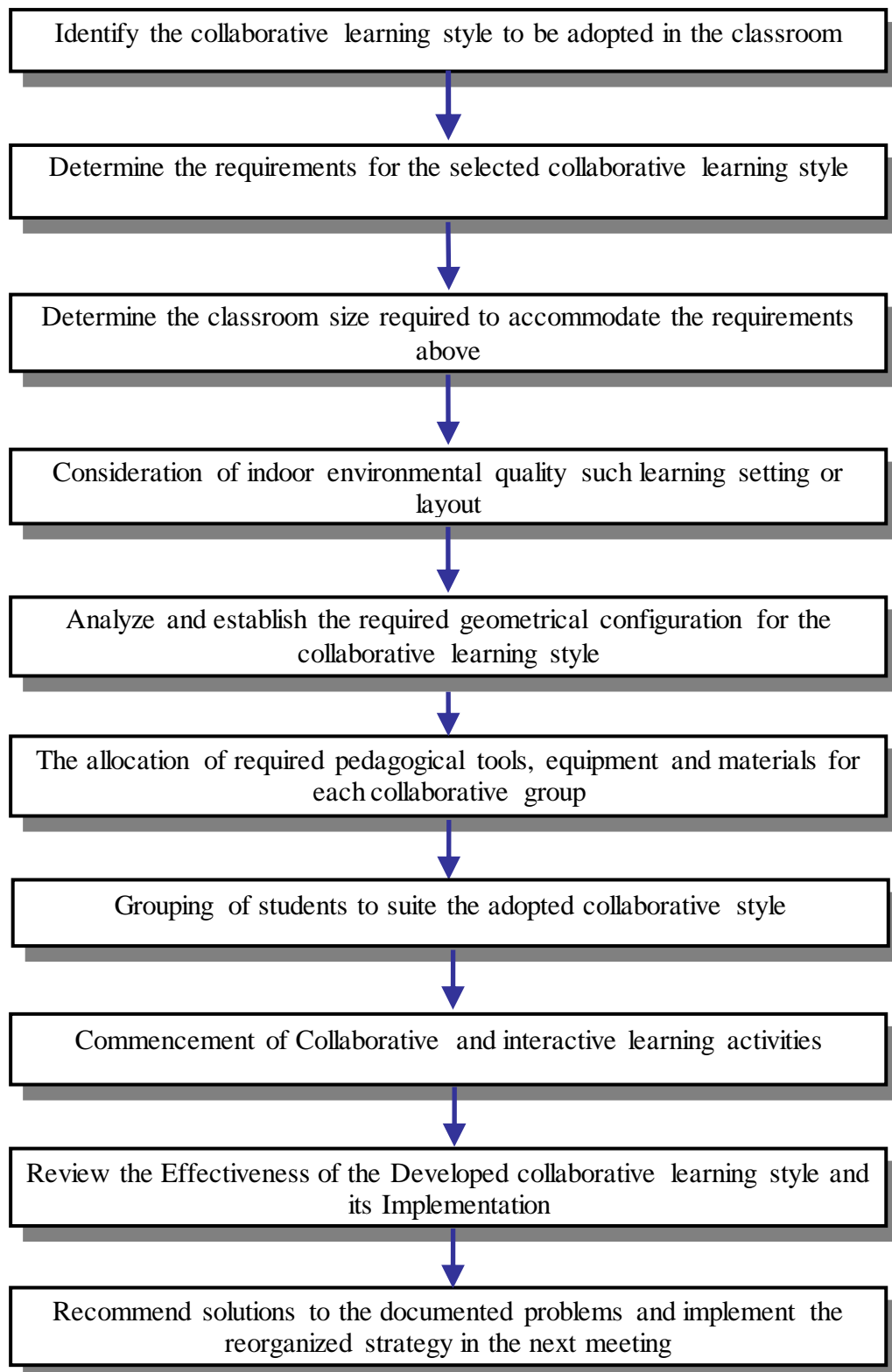
Classroom comfort is the key to achieving optimum student performance. The need to ascertain the major considerations that are significant in student achievement in the university classroom can never be overemphasized. The quality of the indoor environment, the physical set up of the classroom, the instructional equipment and technology, and an emerging teaching and learning pedagogy are the major factors affecting student performance in the university classroom. Figure 2 below illustrates the Relationship between various influential components of the university classroom.

The indoor environmental quality including; thermal comfort, lighting, acoustics and indoor air quality has to be balanced with the student comfort requirement in order to create the enabling environment for educational activities that will eventually improve student learning and performance. This can be achieved by studying the existing indoor environmental conditions with the aim of assessing measures of improvements.

The physical set up of the classroom including; geometric configuration, classroom size, furniture layout, and equipment have a great impact on student learning and learning styles [6]. There is a need for the provision of required interior geometric configuration and furniture layout which is also dependent on the collaborative and interactive teaching/learning styles engaged by the students and teachers in the classroom. Many styles of teaching/learning used in the university classroom have been identified; it is impossible to have a single geometrical configuration to suit all the existing learning styles. There is the need for the provision of flexible and reconfigurable furniture in the classroom in order to suit any collaborative learning style that may be implemented. Furthermore, there is no common teaching/learning style suitable for all universities; every university will have a different approach to collaborative and interactive learning depending on the nature of the course in which that particular style needs to be used. Hence, the teaching/learning style is a major factor that will dictate the type of geometrical configuration to be adopted in collaborative classrooms.

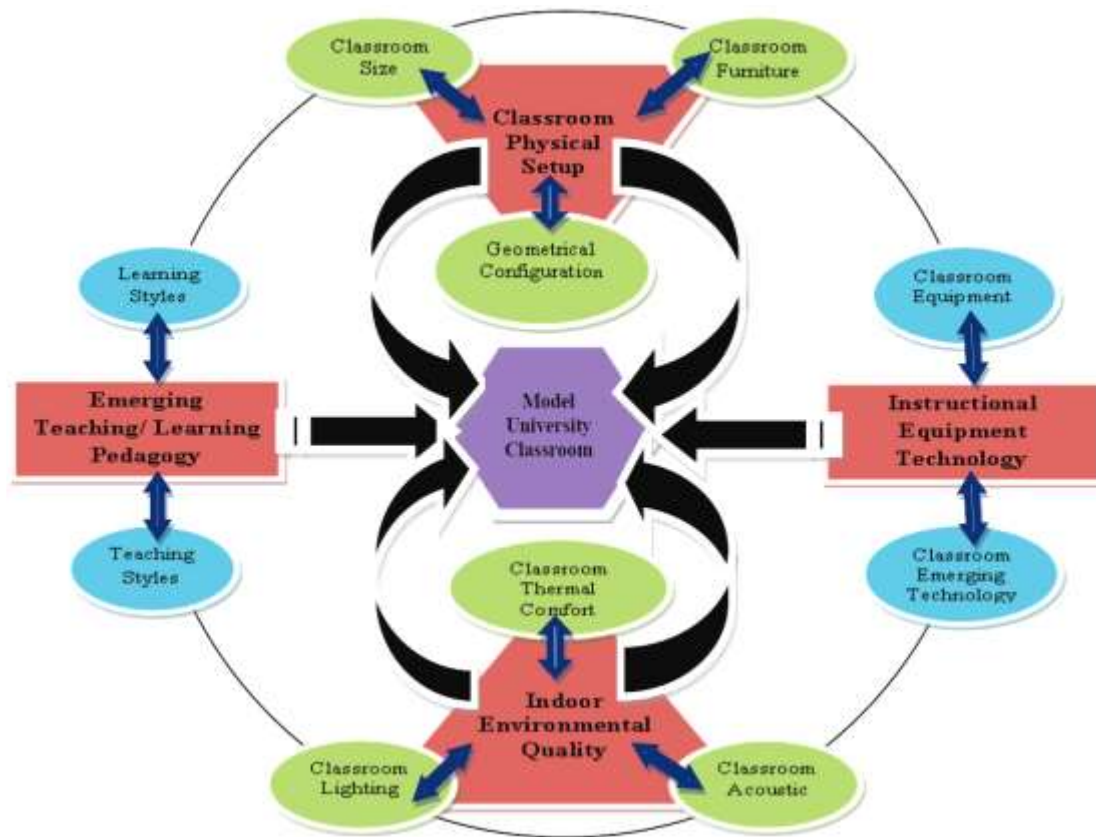
The frequent technological developments in the world create the challenge of providing modern instructional technology which can deliver the required flexibility in all activities in the collaborative and interactive classroom. The university classrooms requires Internet access for research, distribution of multimedia curriculum online, access to digital libraries, distance education courses and remote collaborative tools like videos, live video broadcast, desktop videoconferencing and 3D modelling [15]. Moreover, multimedia tools like tele-education systems guarantee wider access to education and support for lifelong learning, due to the power of live instruction in focussing student attention

more efficiently than static materials [45]. Hence, this system allows teachers and students in different locations to participate in classroom teaching through the multimedia communication systems.



**Figure 1:** Framework Model for Implementing Collaborative and Interactive Learning in the University Classroom





**Figure 2:** The relationship between various influential components of the university classroom

## 8. CONCLUSION

This study of the framework model for the implementation of Collaborative and Interactive Learning in the university classroom analyses the university classroom and ascertains the major influential factors affecting student performance in this environment. The study confirms that, the physical setup of the classroom; the indoor environmental quality, the instructional equipment and technology, and the emerging teaching/learning pedagogies are the four major influential factors affecting student performance and their learning and also the teaching styles in the classroom. It has been demonstrated that, there is the need for the provision of flexible and reconfigurable furniture in the classroom which will accommodate any collaborative learning style implemented. The study has established a model framework for implementing collaborative and interactive learning. This paper is part of a larger study of collaborative and interactive learning in the university classroom.

## 9. RECOMMENDATIONS

More research is required to establish suitable and flexible furniture that can be reconfigured to suit any collaborative learning style that will be adopted in the university classroom.

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