Design elements in learning spaces

Section 2: Studio Classrooms Background and History Obeidat and Al-Share (2012) define studio-based learning as an apprenticeship and inquiry learning model that draws upon problem-based learning, although it has room for more pervasive student-centered approach. Weinstein (1979) described studio-based learning using the architect's learning studio, which is characterized by a shared learning environment whereby students tackle ambiguous problems using critique, proposition, and multimodal analysis. In the contemporary education system, studio-based teaching and learning are based on the need to deviate from the conventional lecture-based pedagogy towards a model where the instructor plays the role of a facilitator by issuing projects, students working in groups, activities that emphasize on cooperative and collaborative learning, and placing the responsibility to learn on students (Aydin, 2007). The concept of studio-based learning and instruction is increasingly becoming a topic of interest in contemporary education systems. Having a background of studio-based instruction and learning in education and architectural and art education can be instrumental in providing important insights regarding the goals and purposes of studio-based learning methods (Lackney, 1999).

Aydin (2007) asserts that architecture by tradition and nature has a huge potential to be applied as a model to be integrated and applied in learning. Surprisingly, studio-based learning is not a new paradigm in education; the use of studio-based learning model in the United States public education system can be traded back to the times of Horace Mann, an education reformer during the 19th century (Lackney, 1999). Although it was not formerly referred to as studio-based learning, a model similar to studio

learning had been tried out in the US public education system by Parker School in Quincy, Massachusetts, during the 1800s. This model advocated for a more student-centered learning approach to education and was later referred to as the Quincy System. Some of the core components of this model included learning through expression and doing while using arts, active learning, integrated curriculum, and student motivation and interest (Lackney, 1999). The system was also characterized by long-term projects and exhibitions.

In addition, the use of advisory systems and small classes enabled instructors to know their students relatively well. Moreover, teachers were compelled to regularly redesign and revise the curriculum in order to reflect the needs and interests of students as well promote student engagement. John Dewey, a renowned education theorist and reformer of the 20th century, played an integral role in exploring a number of issues associated with studio-based learning, and his ideas were instrumental in designing the learning curriculum adopted at Horace Mann High School in Gary, Indiana, during the early 1900s (Lackney, 1999). In this learning model, students were supposed to spend a minimum of one hour per day in the lecture theater lecturing other students, questioning presentations given by other students, participating in plays, reciting poetry, and viewing educational films. In addition, the Gary schools were adjacent to zoos, parks, and farms, which were instrumental in fostering activity-based learning.

Activity-based learning is a principal facet of the studio-based learning model in the sense that learning is facilitated by doing hand-on activities and experiments and that the student is perceived as an active learner rather

than a passive one (Graetz, 2013). According to Kahl (2005), the studio-based learning and instruction model owes its origin and development to the master-apprentice educational approach used by the learning systems of the middle ages. Specifically, Kahl (2005) cites the architectural schools of North America and Europe, which implemented this learning model using the concept of the " design studio", which referred to a place where students constructed their workspaces using modeling and drawing materials, books, and drafting materials, after which the students spent most of their learning time working on their own common design exercises. Hill (2008) argues that a studio classroom is a good pedagogy. Several studies have pointed out that interactive engagement, a core facet of studio classrooms, plays an integral role in facilitating intellectual development and meaningful learning. In addition, Hill (2008) affirms that group activities, cooperative learning, and active learning are the most efficient methods to facilitate student learning as well develop higher order thinking skills among learners.

Types of Teaching/Learning Styles that Occur in Studio Classrooms Herman (2013) considers studio-based teaching and learning as a pedagogic model that is based extensively on architecture and art and draws upon the ideas of constructionist education philosophy. Studio-based teaching and learning place emphasis on experimentation, problem-based and project work in a hands-on studio learning environment. Studio teaching cannot be equated to just another form of classroom activity or series of classroom projects. Graetz (2013) considers studio teaching and learning as an approach that guarantees active engagement of students with regard to their own learning.

Fundamentally, the instructor/facilitator is not the focus as in the case of traditional classrooms.

In this regard, it is arguable that studio classrooms make use of student-centered teaching and learning, which has the main objective of ensuring that students are active learners. Instructors only play the role of a mentor or guide and provide help when necessary while ensuring that they avoid playing a lead role in the learning process. Despite the fact that studio classes may incorporate lectures, most studio classes do not involve lecturing and lectures are only used to respond to specific queries and needs of students (Rydeen, 2003). Under traditional teaching and learning styles, instructors are charged with the responsibility of directing the learning process whereas students only assume a receptive role. According to Weinstein (1979), studio classrooms were designed to address the limitations of traditional teaching and learning methodologies through using group work and hands-on activities and ensuring that learners are actively engaged in their own learning.

Studio classrooms consider learners as the focus of the learning process. According to Obeidat and Al-Share (2012), studio classrooms ensure that learners participate actively in discovering learning processes on their own. Teaching often incorporates a number of hands-on activities in order to ensure successful learning. In addition, studio classrooms also adopt unique learning styles that offer students both task-conscious and learning-conscious methodologies, which make studio classes a better environment for learning. Hill (2007) asserts that learning in studio classrooms occurs in the form of active learning, wherein students are involved in problem-solving

activities, answering questions, formulating questions of their own, brainstorming during classes, discussions, and debating among themselves.

Hill (2007) also points out studio classes are characterized by cooperative learning, wherein students solve projects and problems by working in teams under conditions that guarantee individual accountability and positive interdependence. Inductive learning and teaching are also characteristic of studio classes where facilitators provide learners with challenges and they learn in the course of solving these challenges. Some of the inductive methods deployed in studio classes include just-in-time teaching, discovery learning, project-based learning, problem-based learning, case-based instruction, and inquiry-based learning (Aydin, 2007). Studio-based learning incorporates the aspects of student-centered learning and has been affirmed to be more effective than the conventional teacher-focused approach to learning (Taylor, 2009). Action-based learning in studio classrooms entails students working and learning together through tackling real problems and reflecting on their actions (Graetz, 2013; Lackney, 1999).

Experiential learning is also a significant characteristic of studio classrooms, which entails learning by reflection on doing. Experiential learning is contrasted with didactic/rote learning (Kahl, 2005). Users of Studio Classrooms and their Needs Since its inception, studio-based teaching and learning have reported substantial successes in a number of disciplines requiring activity-based learning. Studio-based teaching and learning have been deployed in a number of disciplines, especially fine arts and architecture, whereby students do not only learn by doing, but also through peer critique of their work (Vredevoogd, 2012). Some potential users of

studio classrooms include art, design, architecture, and such science departments/majors as engineering and computer-related disciplines (Aydin, 2007). With regard to fine arts, it is apparent that it cannot be taught by just giving instructional lectures; rather, it requires hands-on student engagement in various activities attributed to the course such as painting, sculptural work, and drawing among others, which cannot be done in a regular classroom.

This poses the need to have a special studio that can be used to accommodate fine and visual arts students. A core requirement of fine arts studios is that the class size should be relatively small in order to ensure that students receive maximum attention (Obeidat & Al-Share, 2012). Aydin (2007) also points out that the studio should be well-equipped in terms of materials to ensure that students have the freedom of choosing activities for their own projects. With regard to architecture, studio education plays a central role in student learning. Some of the important needs of architecture students learning in a studio environment include: organizing their work into semester-long projects that are complex and open-ended; the student's design should be subjected to rapid and multiple iterations; frequent critiquing through both formal and informal avenues from their peers, the faculty, and visiting experts; the faculty should play an integral role in helping students to impose suitable constraints on their appropriate design with the primary objective of helping students come up with a satisfactory design solution; and the availability of a variety of design media (Demirbas and Demirkan, 2000). Other potential needs of architectural design students learning in a studio environment include open-ended and complex problems,

collaboration among students, focus on reflection, and collaborative problem definition.

Architecture studios also need a peaceful and calm environment to foster creativity (Demirbas & Demirkan, 2000). With regard to science majors and other technical-based disciplines, Lackney (1999) points out that studio classrooms combine both lab activities and lecture in one physical space and play an integral role in helping students learn via continuous observation, experiment, and reasoning. Students commence wit an observation of the physical phenomena, after which they come up with their own ideas that result in discussions, further experimentation, and new observations in order to construct and refine their scientific understanding of the subject matter. In this regard, science students in a studio learning environment need to perform experiments, observe the demonstrations, actively take part in classroom discussions, share data and information, work in relatively small groups, and be able to switch between these activities while at the same seat. Safety is also a major requirement for science-based studio classrooms.

Overall, Lackney (1999) points out that studio classes for all disciplines should be aesthetically appealing, which entails adequate lighting, warming and welcoming colors, sound insulation, and comfortable chairs and tables. Section 3: Elements of design Several studies have pointed out the design of the classroom has a significant impact on student learning, and the same has been replicated for the case of the studio classroom design. Studies by Obeidat and Al-Share (2012) and Vredevoogd (2012) have revealed that aspects such as color, classroom layout, flexibility, and lighting have a significant effect on the learner's temperament as well as one's ability to be

productive. According to Tom, Voss, and Scheetz (2008), the design of the classroom affects the students' behavior, concentration, and learning. In this regard, Tom, Voss, and Scheetz (2008) assert that the physical layout of a learning studio is somewhat analogous to a map that directs the learning process; as a result, the physical layout of the learning studio should reflect the needs of the students.

The overall atmosphere in the studio classroom determines the level of student interaction and sense of community, which are core requirements of an effective studio-based learning environment. For instance, Weinstein (1979) points out that a disorganized learning studio makes it hard for the facilitator to reach the students as well as makes it hard for the students to interact and reach the required materials. In this regard, Webber, Marini, and Abraham (2000) point out that there should be a balance between the elements of design in a learning studio, which include lighting, color, temperature, privacy, and layout (flexibility of furniture). In addition, it is imperative for these elements of design to take into consideration the specific studio classroom type. Lighting Hill (2007) emphasizes that lighting is an important variable relating to the physical climate of the learning studio.

In the typical classroom, lighting is often uniform and too general; this is contrasted with a learning studio, which incorporates both zoned lighting options to be used when required and direct lighting options. However, Hill (2007) asserts that different learning studios require different lighting requirements. For instance, the visual arts studios require adequate natural light through windows to facilitate the most ideal view for leaning and

inspiration. In addition, visual arts studios need windows to facilitate observation and allow the instructor to teach art concepts such as perspective, depth, and form. Empirical research has also pointed out that both artificial and natural lighting has an effect on the alertness, wellbeing, mood, and health of people.

In addition, studies have suggested that the temperature and intensity of color of artificial lighting have an impact on a number of physiological processes such as blood pressure and pulse rate variability (Graetz, 2013). Besides the psychological and physiological impacts of varying types of lighting, a research by Weinstein (1979) points out that particular lighting conditions affect an individual's performance. For instance, artificial lighting has been shown to have positive impacts on task performance, accuracy, and working speed. In the context of the studio learning environment, it is imperative to note that the impact of lighting on learning depends on the situation, the specific learning environment, and the task at hand. According to Webber, Marini, and Abraham (2000), the lighting of the learning studio has an effect on the achievement of students. Lighting should be comfortable and create a conducive environment for learning.

Overall, it is imperative for lighting to be adequate in a learning studio depending on the particular needs of that studio classroom. In addition, the type of lighting adopted should depend on the purpose of the learning studio (Herman, 2013). For instance, fine art studios may require natural day light to facilitate effective learning; photography and cinematography studios may require darkening of the learning studios. In addition, learning studios with visual displays should be darkened by using blinds, which can be adjusted

according to the amount of light required. According to Demirbas and Demirkan (2000), students' performance in the studio learning environment is the best when the classroom has a diffused and uniform daylight.

Obeidat and Al-Share (2012) have also concluded that lighting is a significant variable that affects the ability of the brain to focus. A learning studio that is brightly lit guarantees higher performance than dimly lit learning studios. Poor lighting is not damaging to the eye; however, it has a negative effect on how learners collect information and how they perform their tasks (Aydin, 2007). Lighting also affects visual clarity of the learning environment, which is significant in the studio classroom. In this regard, Aydin (2007) asserts that dim lighting hinders learning since it makes it difficult for learners to undertake experiments. Herman (2013) points out that poor lighting in laboratories results in students performing experiments wrongly.

Off-task behavior is also linked to poor lighting; in this regard, learning studios should have softer natural light in order to reduce the possibility of students being distracted (Hill, 2007). Rydeen (2003) asserts that the best lighting for a learning studio that guarantees optimal learning and productivity should be soft, as natural as possible, and adequately bright for visual clarity. Extremely dim lighting can result in difficulties with visual experimentation because of a lack of visual clarity and brain focus. Similarly, extremely bright light can result in off-task behavior (Taylor, 2009). Color According to the color theory, colors tend to have psychological effects on the human body (Graetz, 2013).

For instance, red has been established to increase appetite and aggression, which is a poor combination for any learning environment (Graetz, 2013). According to Weinstein (1979), yellow has been established to increase adrenaline levels, which Weinstein (1979) considers detrimental to any form of learning. Blue has been established to calm the brain, which is desirable for any form of learning (Graetz, 2013). Nevertheless, blue is also linked to sadness and coldness and tends to lengthen the sense of time; this can make the classroom environment torturous for learners. Graetz (2013) points out that students tend to favor warm colors, which makes learners alert and increase their brain activity.

This is instrumental in enhancing learning and student achievement, which is contrary to cool colors. In this regard, learning studios should balance cool and warm colors with subdued and bright colors to create a pleasing effect in the learning environment. According to Graetz (2013), yellow, orange, and red tend to increase and stimulate brain activity. Violet, blue, and green result in relaxation (Graetz, 2013). In this regard, the studio classroom can be designed to match either a relaxed or active learning style using colors. Kahl (2005) also points out that color plays an integral role in inspiring creativity, which is a core requirement in artistic and design projects.

Besides the aesthetical value of color in the learning environment, color can be used from a functional perspective to enhance the learning process in the studio classroom by relieving the eye fatigue, increasing accuracy and productivity, and facilitating a way of finding and supporting the development process (Aydin, 2007). Neutral colors such as grey, white, and beige are detrimental to learning in the studio classroom. Whereas beige and

soft whites can have a calming effect, they are extremely monotonous and do not stimulate student activity. In addition, too much white in the learning studio can be intimidating and create an institutional feel, which is detrimental to learning in the studio classroom where students expect freedom while learning and performing their tasks (Herman, 2013). Temperature Temperature is also an important element of design with respect to the physical climate of a studio classroom. Studies have affirmed that the temperature of the classroom has a significant effect on the level of student achievement.

Obeidat and Al-Share (2012) recommend that the classroom temperature should range from moderate to cool. This is because warm learning environments result in students being sleepy, disruptive, and bored and increase inattention. In addition, when studio classrooms are warm, student distraction stems from the discomfort of high temperatures, resulting in low levels of concentration when performing their tasks. Obeidat and Al-Share (2012) also assert that warmer classroom temperatures make learners feel lazy and tired, which is contrary to cool temperatures that make learners more alert. However, it is imperative to make sure that the temperature of the learning studio is not overly cold.

Therefore, the temperature should be adjusted to a level where students are comfortable, so that they can focus and concentrate on their projects (Kahl, 2005). Enhanced air ventilation and lower temperatures in the learning studio have been established to have a positive impact on learning. Temperature in the studio classroom can be regulated by installing fans, having adequate windows to allow ventilation, and scheduling classes that

make use heat-generating equipment in the morning among others. The goal is to ensure that students are as comfortable as possible (Hill, 2007). Privacy and Layout of the Classroom According to Hill (2008), classroom layout plays a vital role influencing how students behave, concentrate, and learn. In studio classrooms, freedom is imperative, and this can be achieved by adopting a classroom layout that allows flexibility of furniture, movement in the learning studio, and guarantees student privacy.

The layout of the classroom also has an impact on student engagement in the sense that it determines the level of interaction among students and how students interact with teachers (Tom, Voss, & Scheetz, 2008). A key feature of studio learning spaces is that they should have flexible furniture to facilitate interactive and collaborative work among learners and instructors. Obeidat and Al-Share (2012) assert that flexibility in the learning space is a critical success factor for learning. The physical layout of the classroom must facilitate individual project work, group work, and discussions among students and facilitators. Rydeen (2013) asserts that furniture fllexibility is a core requirement for project-based learning and that furnishings should reflect the needs of the students in the studio classroom.

Case Studies 1. Physical Layout: Impact of Studio Space on Learning and Teaching Institutions of higher learning are increasingly recognizing that traditional classroom layouts do not foster active and collaborative learning; as a result, several universities are converting these traditional learning spaces into studio spaces. Empirical research has been instrumental in pointing out positive impacts that the studio classroom space has on learning when integrated into the active learning pedagogy. However,

research has not differentiated the impact of the pedagogy from the impact of the physical studio space in fostering learning (Taylor, 2009). Taylor (2009) reviewed two case studies with the primary objective of assessing the role of the physical layout of the studio learning spaces in facilitating student learning. Specifically, Taylor (2009) assesses how studio features such as moveable chairs and tables, conventional white board, muted green and blue color scheme, and corporate-like furnishings affect learning processes in studio learning environments.

From the case study, the findings suggest that the studio learning space can help instructors launch the active learning pedagogy and result in positive impacts on learning associated with that pedagogy. The instructors and most of the learners involved in the case study reported a direct impact of the studio space itself and not just the impact of the pedagogical approach. Students reported high levels of classroom sessions enjoyment and facilitators were inspired to devise new active pedagogical methods. In addition, the physical space of the learning increased student-to-student communication, which is attributed to the physical layout such as moveable chairs and not the active learning pedagogy. Taylor (2009) attributes these positive impacts on learning to the comfort and flexibility of the studio learning space. In this regard, the findings by Taylor (2009) suggest that designers of the studio learning space should incorporate moveable and flexible furniture; comfortable chairs; interactive whiteboard; plenty of free space not occupied by furniture; small tables; and room shapes that lack a front.

2. Impact of Privacy on Learning in Studio Classrooms Demikran & Demirbas (2000) undertook a case study to analyze differences between the actual conditions and the desired conditions of a design studio learning space in the Department of Interior Architecture and Environmental Design at Bilkent University. Despite the fact that privacy is an individual concept, Demikran & Demirbas (2000) assert that the environment that a person is in is also linked to the aspect of privacy. In this regard, the case study sought to identify privacy regulations in the studio learning space; identify privacy needs or variables; and compare the preferences of learners with regard to privacy. The findings of the case study revealed that because of different personal characteristics, different learners had different definitions of privacy.

In addition, almost all students surveyed maintained that privacy was a core requirement for them when working and learning in the studio. More than 50 percent of the respondents said that they preferred working at their own tables in order to ensure privacy. In addition, most students said that they preferred to be alone when working on their projects. The case study findings also pointed out that the manner in which the tables were arranged and the perception of privacy affected the satisfaction of learners in a studio learning space. From these findings, it is apparent that the perceptions of privacy and isolation have a significant impact on the manner in which students behave and learn in studio learning spaces.

In this regard, it is imperative for designers of studio classrooms to ensure that the design elements of the classroom such as furniture arrangement and physical layout guarantee privacy while ensuring that it does not hinder

collaboration and interaction among students and between facilitators and students. 3. Impact of Lighting of Studio Classrooms on LearningSeveral studies have examined the impact of the classroom environment on learning. Lighting has received a significant interest, particularly with regard to how it affects the learning process. Herman (2013) undertook a case study research to evaluate the effect of classroom variables on student satisfaction with their learning environment and learning process. Herman measured the extent to which the variables of the physical classroom environment such as lighting affected the level of their satisfaction with the learning environment.

From the case findings, Herman reported that physical variables of the classroom, especially lighting, had substantial impacts on the manner in which students perceived the facilitator's organization, the level of enjoyment with the class session, their perceived degree of learning, and their overall sense of satisfaction. Students who took part in the research pointed out that adequate lighting was imperative in facilitating the visual clarity of the entire learning environment, which was integral in facilitating project completion. The students also perceived well lit studios as safe compared to dimly lit learning environments and argued that working in a well lit environment increased their confidence when undertaking their project tasks because of the visual clarity of the classroom environment. Overall, the students pointed out that adequate lighting in the studio created a learning environment that was comfortable and helped them complete the visual task at hand with confidence. Designers of studio classrooms should ensure that the learning space is well lit to guarantee visual clarity. This

should entail a mix of both natural and artificial lighting according to the lighting requirements of users of the learning space.

4. Impact of the Studio Temperature on Learning Weinstein (1979) performed a case analysis aimed at evaluating the relationship between classroom temperature and learning process. Weinstein (1979) compared the task performance of students in a Physics Studio learning space between lower and warmer classroom temperatures and also documented the views of the students with regard to the classroom temperature. Weinstein (1979) pointed out that lower classroom temperature improved the student's task performance. In addition, the students reported that improved air ventilation and lower classroom temperatures made the learning space comfortable, which was integral in improving their task performance.

A comfortable learning space allowed the students to complete their projects more quickly and accurately. On the contrary, warmer classroom temperatures resulted in discomfort and distraction among students, which had negative impacts on the concentration levels of the students. In addition, warmer temperatures made the students feel bored whereas lower studio temperatures were associated with alertness among students. Designers of studio classrooms must ensure there is adequate air flow to maintain the temperature at a comfortable level; this would entail incorporating air conditioners in the studio classroom to regulate the temperature at the desired level. 5.

Impact of Color of the Studio Classroom on Learning Aydin (2007) performed a case analysis to determine the impact of color in higher education learning

environments. From the case analysis, it was found that the color of the learning space played an integral role in the learning process. The students reported that the color of the studio learning space was instrumental in contributing to the ambience of the learning environment and creating a perception of a conducive learning environment. Aydin (2007) reported that colors could be used to deviate from the formality of the learning environment, which was a core requirement in studio-based learning environments. Overall, it is fun to work on projects in a visually interesting learning space.

Besides the aesthetical value of color in the learning environment, color can be used from a functional perspective to enhance the learning process in the studio classroom by relieving the eye fatigue, increasing accuracy and productivity, and facilitating a way of finding and supporting the development process. Neutral colors such as grey, white, and beige are detrimental to learning in the studio classroom. Whereas beige and soft whites can have a calming effect, they are extremely monotonous and do not stimulate student activity. In addition, too much white in the learning studio can be intimidating and create an institutional feel, which is detrimental to learning in the studio classroom where students expect freedom while learning and performing their tasks. As a result, it is imperative for designers of studio learning spaces to adopt the right mix of colors that will ensure that students are least distracted, guarantees ambience in the learning environment, and makes the learning studio aesthetically appealing.

Conclusion In the contemporary education system, studio-based teaching and learning are based on the need to deviate from the conventional lecture-based pedagogy towards a model where the instructor plays the role of a facilitator by issuing projects, students working in groups, activities that emphasize on cooperative and collaborative learning, and placing the responsibility to learn on students. There are a number of design elements of a studio classroom, which have an impact on the learning process; they include lighting, color, temperature, physical layout, and privacy. It is imperative for lighting to be adequate in a learning studio depending on the particular needs of that studio classroom. In addition, the type of lighting adopted should depend on the purpose of the learning studio. With regard to colors, learning studios should balance cool and warm colors with and subdued and bright colors to create a pleasing effect in the learning environment. It is imperative to make sure that the temperature of the learning studio is not overly cold.

Therefore, the temperature should be adjusted to a level where the students are comfortable, so that they can focus and concentrate on their projects. Flexibility in the learning space is a critical success factor for learning. The physical layout of the classroom must facilitate individual project work, group work, and discussions among students and facilitators. A key feature of studio learning spaces is that they should have flexible furniture to facilitate interactive and collaborative work among learners and instructors. Overall, designers of studio classrooms should combine the features of the elements of design that guarantees optimal learning; in this regard, the designer should strike a balance between temperature, color, privacy and

flexibility, physical layout and lighting in a manner that guarantees

maximum learning. In addition, some elements of design such as privacy can

be compromised in accordance with the needs of the students.