Experiential Learning and Learning Space: Implication for TVET

Noor Dina Md Amin [1], Wahid Razzaly [1] and Zainal Abidin Akasah [1]
[1] Universiti Tun Hussein Onn Malaysia

Abstract

Increasing interest in learning spaces is discussed across the fields of architecture, facilities management (FM) and education. This paper is part of an ongoing PhD research that aims to explore the interface between experiential learning (EL) and learning space (LS). Based on Kolb's framework of learning space, we suggest the concept of thermal, visual and acoustic comfort as a function of experiential learning space. We also suggests the need of exploring indoor environmental conditions of physical learning spaces (e.g. classrooms, laboratories etc) in order to create enhanced conditions for experiential learning in higher education (HE). The importance of EL and LS in Technical and Vocational Education and Training (TVET) is also presented briefly.

Keywords: experiential learning, learning space, indoor environmental conditions

1. Background

> "If you tell me, I will listen. If you show me, I will see.
>
> But if you let me experience, I will learn" (Lao-Tse 5th-century BC).

Learning is defined in a variety of ways and most definitions explain the association of learning with behavioral change and experience. According to John Dewey, learning is an iterative process of designing, carrying out, reflecting upon and modifying actions, in contradiction to human behavior. Learning also can be defined as "a process (rather than an end product) focuses on what happens when the learning takes place" (Merriam & Caffarella, 2001, p. 76) while Kolb (1984) emphasizes that all learning is a process of relearning.

Five major theories namely behaviourist, cognitivist, humanist, social learning and constructivist explain the orientations to learning. Among these theories, behaviourist assumed that; (1) learning is manifested by a change in behaviour, (2) the environment shapes behaviour, and (3) the principles of contiguity and reinforcement are core subjects in explaining the learning process. On the other hand, constructivism emphasizes that "learners construct their own knowledge from their experiences" (Merriam & Caffarella, 2001, p. 85). Moreover, the cognitive process of constructing knowledge or meaning making involves individual mental activity and social interactions. Self-directed learning, transformational learning, situated cognition, reflective practice and experiential learning (EL) are examples to name the aspects of constructivism (Merriam & Caffarella, 200).

In this essay, we begin with a brief summary of experiential learning theory (ELT), followed by learning space (LS) from three different perspectives: architecture, facilities management (FM) and education. Drawing on the framework of LS introduced by Kolb and Kolb (2005), this paper explore how this knowledge can be expanded to understand its implication for Technical and Vocational Education and Training (TVET).

2.   Experiential Learning Theory

Experiential learning theory (ELT), a complex and integrative model of adult learning and development translated the earlier work of learning theories e.g. John Dewey, Kurt Lewin, Jean Piaget, Carl Jung etc. ELT is a holistic process of adaptation to the world resulting not only in cognitive, but also taking into account of the total person including mind, emotion, spirit and behavior in its natural context (Kolb, 1984). Kolb stated that new experience can generate new knowledge. Moreover, learning from experience is widely accepted and the outcome of that learning can be evaluated and certified for higher education (HE) qualification.

ELT defines learning as "the process whereby knowledge is created through the transformation of experience. Knowledge results from the combination of grasping and transforming experience" (Kolb, 1984, p. 41). Kolb (1984) denotes the structural dimension of experiential on two axes, the combination of grasping experience [Concrete Experience (CE) & Abstract Conceptualization (AO)] and transforming experience [Reflective Observation (RO) & Active Experimentation (AE)]. A cyclical model of learning with four stages is outlined as follows (Figure 1):
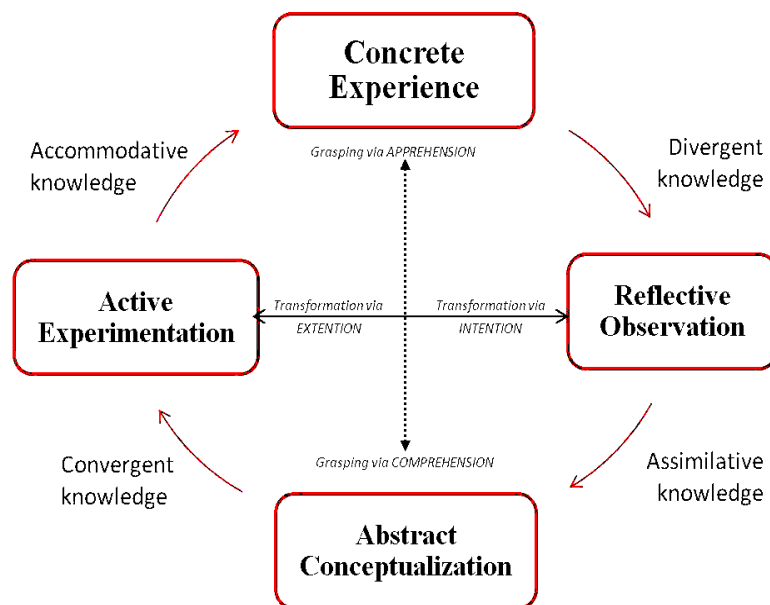

Fig. 1: Kolb's experiential learning cycle with structural dimensions underlying the process of EL and the resulting basic knowledge forms (Kolb, 1984)

CE is where the learners deliberately experience, for instance, a lab session or field work. Secondly, RO is when the learners consciously reflect on a particular experience, while thirdly, AC is when they attempt to form a concept of a theory or model of what is observed. Finally, AE is when they are trying to test or apply the theory or model into a new situation. Kolb envisages the interrelated phases within a cyclical process starting at concrete experience, followed by reflective observation, then abstract conceptualization and finally to active experimentation. However, this cycle may begin at any stage in the sequence as illustrated by the above model (Figure 1). This is also represented "the process of learning, ones moves in varying degrees from actor to observer and from specific involvement to general analytic detachment" (Kolb, 1984, p.31).

Studies of ELT are "highly interdisciplinary" (Kolb & Kolb, 2005, p.196) and a lot of research has been done in addressing educational issues in many fields, e.g. management, education, medicine, nursing, accountancy and law. However, this initial conceptual framework of learning spaces is likely to be unclear because very little research is found focusing in the field of architecture showing the lack of concrete evidence in understanding the associations between approach in EL and LS.
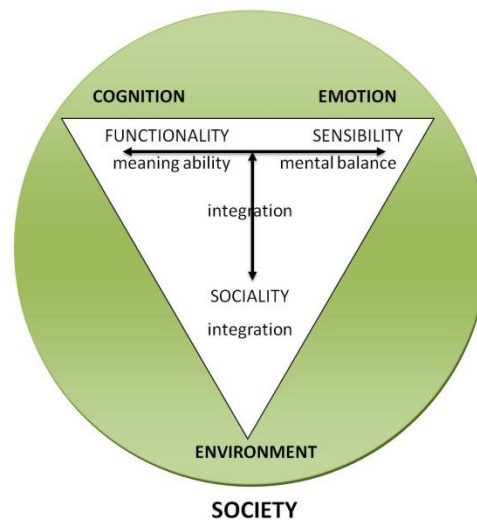

Fig. 2: Learning process and dimensions (Illeris, 2004)

From a comprehensive learning theory stressed by Illeris (2004) describes transformative learning involves three dimensions (1) cognition, (2) emotion and (3) the social environments which are fixed in a socially situated context (Figure 2). These dimensions envisage the complex types of learning: accumulation to assimilation to accommodation to transformation (Illeris, 2004). Furthermore, this concept is resemblance to the process of EL (Kolb, 1984).

3.   Learning Space

Recently, increasing interest in physical spaces of learning is discussed across the field of architecture, FM and education. Generally, space for learning is a place in delivering knowledge or where the process of learning is conducted. In higher education (HE), this term physically encompasses lecture theatres, classrooms, tutorial rooms, seminar or conference rooms, learning studios, etc. In engineering education for instance, learning spaces are to meet the requirement for research and development, design and operations. On the other hand, learning spaces for TVET could primarily focus on hands-on, application of theories and principles of engineering and science to daily operations such as manufacturing, electronic and field testing.

Learning space may provide a platform to learners for consciously reflecting on and transforming the thoughts (Kolb, 1984). Kolb and Kolb (2005) introduce the concept of learning spaces as a framework in exploring the meeting points between student learning styles and educational learning environment. This concept is based on Kurt Lewin's theory of life space where "behaviour is a function of person and environment" (Kolb & Kolb, 2005, pg. 199). In their comparison study across HE business and art courses in the US, the finding shows that learning styles for students of both disciplines were very different. The study found that "text-driven approach in management education contrast with the experiential learning process of demonstration-practice-production-critique that used in most art classes" (Kolb & Kolb, 2005, pg. 202). Moreover, management education emphasizes theory, focusing on facts and classified learners as "outside-impression". In contrast, art education emphasizes integration of theory and practice, focusing on expressing idea and skills, while learners are classified as the inside-out expression. The authors concluded that a good relationship between the different learning styles requires by different subjects within its context of learning environments.

A holistic approach is highly important to develop abilities across the whole learning "region" in HE. According to Kolb and Kolb (2005):

"To learn skills outside of their home region, learners need to move to other regions and the learning process for any skill requires the ability to move through the experiencing, reflecting, thinking and acting cycle. To fully develop the whole person requires an educational culture that promotes divers learning spaces and locomotion among them. The enhancement of experiential learning in higher education can be achieved through the creation of learning spaces that promote growth-producing experiences for learners" (Kolb & Kolb, 2005, pg. 205)

Obviously, Kolb & Kolb (2005) highlights the important of creating spaces for the enhancement of EL in HE. They emphasize the following principles for the creation of learning spaces:

i. Respect for learners and their experience
ii. Begin learning with the learner's experience the subject matter
iii. Creating and holding a hospitable space for learning
iv. Making space for conversational learning
v. Making space for development of expertise
vi. Making space for acting and reflecting
vii. Making spaces for feeling and thinking
viii. Making space for inside-out learning
ix. Making space for learners to take charge of their own learning

Learning Space from Architectural Perspective
From architectural perspective, learning space enable collaboration and interaction both educational and social activities within the environment that stimulate thought or discussion (Boys, 2011). Figure 3 illustrates the design metaphors of spaces shifting from formal to informal model.
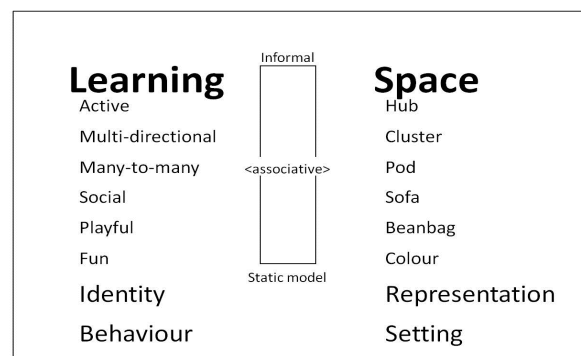

Fig. 3: Examples of associative design metaphors for informal learning. Adapted from Boys (2011)

Well designed learning spaces is also claimed to have a motivational effect on students. According to Joint Information System Committee (JISC), an expensive long-term resource of an educational building should be designed with learning spaces that motivate learners and promote learning activities, provide a unique identity and inclusive environment, support collaborative and formal practice of teaching and learning activities and be flexible to meet changing needs (JISC, 2006). Moreover, the shift from the lecture-centred approach to student-centred approach in HE promotes active, collaborative and problem-based learning, which directly implicating the built learning environments.

In Malaysia context, Tahir et al. (2009) argues that today's teaching and learning environments is incomplete in providing a place and space that meet the needs for problem-based learning (PBL) context particularly in engineering education. The authors then identify three key elements for the design of active learning space suitable for PBL context, as follows:

- providing a sense of belonging space (e.g. small dimension space for small group discussion activity that create an identity for each student population; and the use of natural lighting to promote energy efficiency in buildings and it's benefits impacting learning process).
- catering to the need for flexible and multi-use spaces (e.g. movable furniture for variation in teaching delivery and multifunction activities; highly flexible spaces covering the needs for both student centered and teacher centered approaches; and design features to maximize flexibility and user control)
- recognizing the use of non-classroom spaces for learning (e.g. integrated design with an access to other facilities in campus; and the transition space between indoor and outdoor)

Learning Space from Facilities Management (FM) Perspective

From FM perspective, sharing facilities, advanced technology installations and applications, greater efforts in improving quality of learning space are examples to name the potential implications of the changes for learning environment. In addition, changes for this environment also include maintaining the existing building, adapting existing buildings towards meeting educational requirements, dealing with budget constraints, as well as making decision and aligning the universities' policies (Lavy, 2008) Consequently, space management has been recently an important consideration to promote space efficiencies, thus to improve the quality of physical assets of universities and colleges, and also to create identity or landmark buildings (Barnett and Temple, 2006 as cited in Temple, 2008). While Douglas (1996) defines good building should be adaptive (loose fit), durable (long life), energy efficient (low energy consumption), habitable (comfortable and healthy) and secure (stable and intruder-resistant), Boys (2011) argues that the difficulties in exploring how educational requirements are better intersect with teaching and learning patterns:

"Space are also becoming not just about learner-teacher roles and relationships but about health and well-being, community engagement and work-related environments; not just about space usage and cost implications but also about quality of experience, identity and sustainability" (Boys, 2011, p. 59)

From a social context, Temple (2008) states that most of the learning spaces in HE institutions are intended to create a sense of community. In addition, Temple emphasizes that small elements of a physical space and the impact of its conditions may make a difference to learning. Temple argues that:

"How do ideas of community and participatory governance in higher education relate to teaching and learning, and to space? This is an under-researched, but potentially important, field. It has been proposed that the physical form of the university is important in supporting its integrated nature, intellectually and socially, and that it is 'the preservation and development of this integrated form, with its dense network of connections, that provides many of the management and planning challenges in higher education' and which supports institutional effectiveness" (Temple, 2008, p. 232)

Learning Space from Educational Perspective

From educationalist perspective, both virtual and physical spaces impact students' learning experiences. In the context of HE institutions, the relationship between learning spaces and learning are reported in several studies (Jamieson, 2003; JISC, 2006) lead to the debates around architectural and educational theories. For example, Boys (2011) highlights the connection of contemporary architectural theories and current educational theories are considerable undefined to build more conceptually framework in order to understand the inter-relationships of space and learning. Temple (2008) deeply explains that learning spaces are "under-researched" topic. Simultaneously, Laurillard (2002) describes learning based on theories of social constructivism, and to understand efforts in improving and enhancing virtual learning in HE. Crucially, the structure that all learning is located "cannot be separated from either its participants or the conditions in which it takes" (Boys, 2011, p. 39)

Learning, space and curricular sounds interrelated within HE. Saven-Baden (2008) describes the creation of learning space as "re-arrangement with understanding and presuppositions of what counts as knowledge, curriculum and pedagogy" (Saven-Baden, 2008, p. 34). Additionally, new curricula and new learning spaces are seen as a starting point for students in developing their problem-solving and problem management in their academic life. Explanatory knowledge among new students, for instance, its problems and fact-finding problems can be learnt (Saven-Baden, 2008). Again, Saven-Baden (2008) emphasizes the needs in engaging possibilities for the creation of learning space in HE. Some of it is outlined below:

- Writing spaces to develop a voice and writer identity (e.g. taking stance towards what is read, discovering and using a writing voice, finding flow, understanding the circumstances when writing most easily takes place)
- Dialog spaces to argue and discuss intellectually (e.g. creating platform for conversations, undertaking confirmation that is critical, framing possible action to make practical decision)
- Reflective spaces to assist student consider learning and their approach to learning (e.g. problem solving and thinking about experience, utilize cognitive mapping or embrace complexity theory).
- Digital spaces to enable virtual and online learning and facilitate understanding of knowledge (e.g. e-portfolio, mobile learning, PBL online)

4. Thinking Space Beyond Learning

From the above three perspectives, learning space is one of the essential components need to be considered in achieving the intended outcomes of the university, college and other academic settings. The changes on LS of the future educational system encompass the advances in communication technologies, e.g. virtual-learning spaces. However, the importance of space in a physical form is "remains an important factor" of student experiential learning (Boys, 2011, pg.62).

What Matters About Space for Learning?

Learning and space have been studied collaboratively. Researches on learning spaces for instance: Scott-Webber and his colleagues (2000) studied student and faculty opinions regarding university classrooms in the United States. The study found that lighting and noise control achieved students' satisfaction in upgraded classrooms while in standard classrooms with no noise control, seating inflexibility and lack of social interaction space failed to meet students' and faculty's needs. Furthermore, uninspiring classrooms and unpleasant experience of space for learning represented negative feedbacks from the occupants (Scott-Webber, Abraham & Marini, 2000). However, Montgomery and Millenbah (2011) research did not conquer with the above findings. Comparative study conducted in outdoor spaces for EL and in indoor spaces for traditional learning. Even though the performance rate of the students better in outdoor space, no significant difference was found in the retention of experiential knowledge (after 60 days) (Montgomery & Millenbah, 2011).

The Significance of Comfortable Learning Environment

Improvements in comfort and quality of indoor environment are likely to enhance people experiences of a space. In academic place setting, there is a growing interest in improving learning spaces and facilities in order to provide enhanced environments for teaching and learning activities (Boys, 2011; Krüger & Zannin, 2004), promote sustainability (Hodges, 2005), influence academic performance (Laiqa, Shah & Khan, 2011; Mendell & Health, 2005; Tanner, 2008), improve quality management (Ndirangu & Udoto, 2011), improve facility management (FM) (Douglas, 1996; Lavy, 2008, Tay & Ooi, 2011) and as an added value for FM in educational environment (Kok, Mobach & Omta, 2011) as well as to improve the effectiveness of educational provision and increase value for money, especially from the government perspective (Amaturanga & Baldry, 2000).

Providing comfortable learning environment is important as it gives implications for teaching and learning process. However, the complex relationship between learning and spaces is still in argued (Boys, 2011). While the impact of quality space on students' outcome is realized, scholars provide evidence that thermal, visual and acoustic conditions influence students' behaviour (Cash, 1993), attitudes (Weinstein, 1979), preferences and comfort (Cognati, Filippi & Viazzo, 2007), personality development (Roberts & Robins, 2004) and learning performance such as reading, calculating, understanding and typing (Lee et al., 2012). In addition,

recent scholar emphasizes that "the high-quality of facilities supports learning and poor-quality facilities are detrimental to student achievement" (Uline & Tschannen-Moran, 2008, p. 66). Earthman (2002), Hill and Epps (2010) and Mendell and Heath (2005) have reported similar findings.

Introducing Indoor Environmental Comfort in The Built Learning Environment

The World Health Organization (WHO) highlights indoor environmental conditions influence health and well-being of the building occupants. Particularly, their satisfaction level of indoor environmental conditions is related to thermal, visual and acoustics characteristics. In the recent survey of how different factors influence human comfort in indoor environments, thermal comfort is ranked by building occupants as the most important compared with other indoor environmental conditions (Frontczak & Wargocki, 2011).

Jamieson (2008) clearly highlights that the design of learning environment directly shapes student's formal educational experience. Moreover, students' behaviours are seen to be affected by the environmental qualities of the space:

"In formal classrooms, in particular, the physical environment is fundamental to the experience of the student. The physical setting shapes expectations, class size, enables certain possibilities for acting whilst impeding or excluding others, and impacts on matters such as student control and ownership of the setting. More subjectively, the setting is intrinsically linked to student comfort and motivation as it involves fundamental characteristic such as acoustic quality, thermal and lighting levels as well as decorative aspects such as colour and material finishes that are integral to the occupant's well being and capability" (Jamieson, 2008, p. 20)

Students' immediate setting such as classroom is termed the 'microsystem' contributes to their experience of learning spaces (Bronfenbrenner, 1977). The impact of classroom environment on students' satisfaction has also been explored by Hill and Epps (2010). This study stated that adult students (22 years and above) had higher expectation of satisfaction and comfort level in classrooms (Hill & Epps, 2012). This finding led to the consideration of age and other individual characteristic (e.g. gender) due to differences among occupants' perception, satisfaction, preference, etc. Another study emphasized the importance of indoor environmental parameters (thermal, visual, acoustic, air quality) in providing a conducive learning environment in the architecture studio (Nasir et al., 2011). Evidently, learning is seen to be affected by the environmental qualities of the space (Jamieson, 2003).

5. Experiential Learning (EL) and Learning Space (LS) in TVET

According to the United Nations Educational, Scientific and Cultural Organization (UNESCO), Technical, Vocational Education and Training (TVET) is crucial for advancing sustainable development (SD) and addressing economic and social challenges. In the context of SD, Majumdar (2007) emphasizes that education for SD in TVET should apply relevant generic knowledge/concept, skills and attitudes related to SD in the workplce. Adapting to varied situation, thinking critically and creatively, resolving conflict peacfully, working honestly and responsively are examples of the generic concept/skills/attitudes. Recommendation for implementation of education for SD is outlined in Table 1:

Table 1: Teaching-learning methods and guidelines for their use, adapted from Majumdar (2007)

Method	Description	Where used
Lecture (exposition)	Direct and continuos communication from teacher through speech, demo and visual media	For introduction to a topic
Group discussion	Student centered: exchange of opinion mainly between students	For changing attitudes, exploring values and sharing viewpoints
Lab work	Student interacts with equipment and/or people and/or material; can be structured or open-ended	Teaching or verifying principles, hypotheses, investigate data collection, etc.
Workshop	Use of machines, tools to produce specific articles	To improve and perfect psychomotor skills, scientific thinking
Simulation and gaming	Student interaction with people takes part in events, uses 'Model' materials	Practical skills for dangerous and large-scale situations
Seminars	Student presents viewpoint or problem-solution, followed by discussion/evaluation	In-depth study of specific problem changing attitudes

TVET has focused in preparing students for the world of work. Unfortunately, Majumdar (2007) highlights that TVET in many countries "remain locked into the role of being a mere supplier of skilled labor to industries" (Majumdar, 2007, pg. 1). In Malaysia for instance, only 15% of secondary students is enrolled in TVET compared to China and Korea (40% and 35% respectively) (Utusan, 2012). Based on the practical-oriented approach practiced by Germany and Hong Kong systems, the Malaysia Government is committed in preparing technically skilled workforce through the incorporation of vocational education in tertiary education (Md Yunos, 2007). Recently, TVET providers in Malaysia encompass government's ministries and agencies, and private providers. While learning is experience-related, interestingly, situated and self directed learning in TVET (particularly in Germany)

is implemented mostly on multimedia-based learning environments (Göhlich & Schöpf, 2011).

On the other hand, Spöttll (2009) emphasizes that the improvement of instruction quality in TVET should consider the following elements (Figure 4). One of the important considerations is shaping of learning environment. Even though a professional teacher training is based on standards for programmes and contents, training facilities must be maintained to ensure hands on and operation works are conducted in safe conditions and comfortable learning environment.
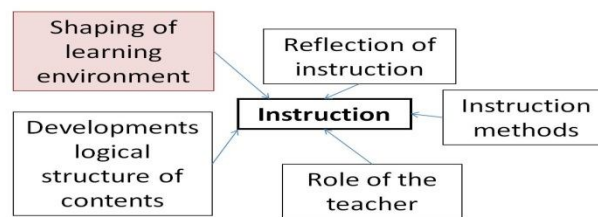

Fig. 4: Elements for the shaping quality management for instruction (adapted from Spöttll, 2009)

Implication of EL and LS for TVET

As previously noted, this paper defines learning environment as a physical LS where the delivery system of TVET is situated, while EL here is defined from the context of the students' cognitive (e.g. knowledge), psychomotor (e.g. skill) and affective (e.g. motivation) domains. Why these three domains are considered? Lecture method for instance, is basically low and high cognitive domain, but low in affective domain. Additionally, tutorial method is objectively high in cognitive domain, but low and high in both affective and psychomotor domain. In contrast, laboratory teaching method mostly involves affective and psychomotor, but very little in cognitive domain. However, project-work method highly involves all learning domains (Majumdar, 2007).

Hence, why LS is important in TVET? In the Queensland University of Technology, Australia for example, laboratories are positively empowered engineering students to take responsibility for their learning. In addition, the function of laboratory is integrated as part of the curriculum. According to Dawes, Murray and Rasmussen (2005) study, enhanced laboratory environment with new virtual and physical facilities is beneficial to students in allowing student-centred implementation. After 3-years period, the study found that collaborative team work among students and technical staffs is more efficient, while laboratory testing in safer environment is more excited but under control, which it is impossible to happen in traditional laboratory environment (Dawes, Murray and Rasmussen, 2005). Evidently, learning space does contribute to students for taking charge of their experiential learning. In the context of vocational teaching and learning spaces for instance, refurbishment of existing spaces may not always be feasible (JISC, 2006).

However, audiovisual media, cameras and wireless local area network (WLAN) is examples to name of technologies that are currently available to be integrated in vocational spaces to enhance students' experiential learning (JISC, 2006).

What matters about comfortable LS for TVET? Generally, most of TVET providers allocate spaces in a socially situated context (university, polytechnics and community colleges are examples to name here). LS for TVET could be considered as a real 'workplace' for students, while a healthy and comfortable LS is highly required in improving health and well-being of the building occupants (WHO). Thermal environment specifically consider four physical parameters: air temperature, meant radiant temperature, relative humidity and air velocity. Additionally, human's parameters include their clothing and activities. Studies of thermal conditions in classrooms conducted by Corgnati et al. (2007) and Wong and Khoo (2003) have reported that unsatisfactory thermal condition had on learning and performance. Moreover, overheated or too cold classrooms for example, led to thermal stress (Krüger & Zannin, 2004). Evidently, air temperature is the most important factor in determining thermal comfort: the recommended temperature for comfortable work is between 24-28^{0}C (WHO).

On the other hand, a comfortable lit environment in TVET facilities must be responsive to the psychological and emotional needs for learners. Pleasant and attractive space, stimulate feelings of spaciousness, stimulate learning and improve behaviour are examples of the importance of good interior lighting (IESNA, 2000). While a good lighting is objectively for (1) safety, (2) performance of physical tasks and (3) an appropriate visual environment (ANZ/NZS, 2006), poor lighting condition is commonly associated with discomfort glare or psychology glare. It refers to glare sources that produce discomfort and the symptoms could be immediately or identified after long periods, such as headache or eye strain (Osterhaus, 2005; Winterbottom & Wilkins, 2009). In contrast, different activities will require specific lighting requirement. For instance, 40 lux is the minimum requirement for safe movements in corridors, while moderate to difficult tasks require 320-400 lux for daily activities, such as reading and writing tasks. For extremely difficult tasks, such as graphic arts inspection, 1200 lux is required (ANZ/NZS, 2006). Furthermore, acoustic comfort is referred as "a state of contentment with acoustic conditions" (Navai & Veitch, 2010). Even though acoustic characteristics is not extremely influence human comfort in building, poor acoustic environment in spaces is associated to communication problems, annoyance and possibly psychosocial stress (Leather, Beale & Sullivan, 2003).

As a conclusion, this paper has reviewed the theory of EL and LS from different perspectives, while the interface between it is discussed from the situated context, particularly, in the built learning environment. Indoor environmental conditions namely thermal, visual and acoustic are introduced, a number of evidence is provided, and the importance in creating comfortable LS in TVET is presented briefly.

6.   Acknowledgements

7.   References

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