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Promoting a Pedagogical Shift from Didactic Teacher-Centered to Participatory Student-Centered Learning by Harnessing the Portability and Versatility of Mobile Technology

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Abstract

Mobile learning promotes a pedagogical shift from didactic teacher-centered to participatory student-centered learning. The aim of this study was to examine how physical settings and human behaviour within an environment affect user productivity in a designed environment. A case study that emphasized social interactions and comprised a design interaction module was developed. Students evaluated a designed place using mobile technology alongside traditional teaching resources through lectures and design studio sessions. The research methodology comprised a case study that emphasized social interaction using five intended learning outcomes. The case was assessed using tools that measured its congruency with overall as well as specific learning outcomes. The design interaction module was developed and implemented through mobile and face-to-face deliveries. Over a one-week block, five mobile lectures, the minimum required for impacting students' learning experience, were delivered. Mobile learning was the most suitable approach for teaching the design interaction module. By combining the experiential and instructional learning modes that provided students with more opportunities for understanding the impact of design on the users of an environment, the goal of encouraging students to develop a critical understanding of industrial design was achieved.

Keywords

Pedagogy, Environment, Design Interaction, Mobile Learning

1. Introduction

Design interaction comprises evaluation, development, and design of a space, which acts as the framework for human activities. These interactions are often intertwined with complex aspects of physical design including pragmatic and psychological aspects that affect human perception and sensory experiences of room design (Poldma, 2003). The human reaction to building design has been investigated in the context of workplaces and particularly in design of hospitals, residences, and other work areas in need of design improvement to achieve user satisfaction and enhanced productivity. Thus far, there is no comprehensive reflection on pedagogic teaching strategies for design, which can be attributed to the lack of literature concerning the effects and user's perception of the environment, and related teaching strategies. To enable a thorough understanding of design interaction, and to produce independent learners who can apply their knowledge in industry and professional life, there is a need for innovative and creative assessment of student portfolios and identification of key components of design interaction module for investigating and contrasting the underpinnings and development of teaching and learning design.

Because design can impact human health, it is imperative that the design student evaluates the space for implementing a design from the inside out, and from an internal personal perspective. From a teaching perspective, the goal would be to maximize student application and engagement. It was hypothesized that a case study will provide critical appreciation of best practices in teaching strategic design and comprehensive delivery. The case study was developed with a few considerations such as a critical examination of the context of practice in curriculum development, the philosophical foundations on the extent of student engagement, the relevant adult learning theories adopted, the intended learning outcomes (ILOs), design and implementation related to design teaching, implementation issues, and lessons learned from the implementation. The overall aims of this study were to examine how human environmental behaviour and physical setting affect productivity of users in a designed environment.

2. Literature Review

2.1. A Constructivist Approach to Learning and Teaching

The theoretical underpinning of the design for this case study that is essential for achieving its ILOs (Merriam et al., 2007; Tough, 1967) is the Knowles' concept of andragogy (Knowles, 1980), which highlights experience, immediate relevance of the subjects learned to the profession, and emphasis on self-directed and problem-centred learning (Jarvis, 2010; Knowles, 2011). Dewey (Dewey, 1938) argued that it is the educator's role to decide on the most conducive environment for students to possess learning experiences that engages them significantly in the learning process. Therefore, a combination of behaviorist, cognitivist, and social learning components espoused by Ashworth and colleagues (Ashworth et al., 2004) was the impetus for designing this case study, where in-depth learning

is achieved by visiting and evaluating a site, which reflects learning in a real-life setting (Usher et al., 1997).

Because research on education concepts suggests that "*a constructivist pedagogic methodology in relation to traditional teaching enables students to the effective construction of knowledge*" (Mota et al., 2010), it may be necessary to look beyond andragogy (Knowles, 1980), and extend the underpinning idea of learning theory for successful teaching. Vygotsky (Vygotsky, 1978) emphasized the social experience of learning and argued that social interaction and interpersonal connections with fellow learners may provide a productive learning experience that creates and reveals meanings and concepts. On this note, social learning and constructivist approach form the theoretical reflections for setting ILOs, and teaching and learning strategies (Ashworth et al., 2004; Jarvis, 2003).

The social constructivist approach, which forms the basis for the design of this case study, is adopted from the early findings of Dewey (Dewey, 1938) who emphasized acquisition of knowledge through experience where the student has a more active role in the learning process, as opposed to the prevailing traditional forms of teaching. Subsequently, Gibbs (Gibbs et al., 1992) proposed a definition of constructivist theory that enabled students greater control over choice of subject matter, learning methods, and pace of study. Accordingly, Glasgow (Glasgow, 1997) emphasized that students are expected to progressively take more responsibility for their own learning, leading to complete self-sufficiency, with the teacher playing the role of a co-worker or a supervisor. More recent studies are in agreement with this approach (Bature, 2020).

The SMART4 principles (Specific, Measurable, Attainable, Relevant, Time-Bound) formed the basis for the case study's setting. Thus, ILOs should discern declarative knowledge (evaluating, knowing what to design) and functioning or creative knowledge (understanding the design theory, knowing how to design) (Biggs & Tang, 2011) in a defined and measurable manner that relates to the program level. As previously demonstrated (Barr & Tagg, 1995), the ILOs designed for this case study were aimed at giving students the responsibility for conducting an evaluation of a designed place and taking charge of their learning process, while guiding them through the learning process by providing coherent, instructive learning outcomes linked with clear assessments (Anderson, 2002; Maher, 2004). The ILOs enable them to engage in deep learning (Fry et al., 2009) and to equip them with knowledge that develops their academic, personal, and professional design skills (Biggs & Tang, 2011; Hussey & Smith, 2002, 2003).

2.2. Curriculum Design

The design process is at the root of what and how a designer thinks and is used as a guide through complex sets of requirements (Poldma, 2003). Asking questions when exploring and evaluating ideas in interaction design helps student understand people's preferred 3D design through their own preferred design experiences (Gashoot, 2012). Currently, the fundamental design process consists of two lay-

ers—the creative and the design development processes—applied by interaction design students during the evaluation of an environment. Human elements play an important, if not primary, role in meshing creative ideas to social activities in space (Poldma, 1999), where a playful and artistic sense inspires discovery of new ideas and alternative possibilities in design concepts (Poldma, 1999).

The curriculum was designed to measure the quality of understanding, rather than solely the quantity of knowledge after each session and the overall unit (Ramsden, 2003). This was achieved by creating a powerful, active student experience conducive to learning, and using a holistic approach in planning session contents (Ramsden, 2003) composed of active lecturing (Geer & Rudge, 2007), and interactive and contextual elements (Biggs, 1989). It may be argued that engaging learners can only be accomplished to a certain degree, as thinking styles, connected to varying personality types, and learning approaches are linked variables (Zhang & Sternbe, 2005). However, shared learning activities can be undertaken by setting clear ILOs and offering plenty of learning opportunities that lead to in-depth learning (Marton & SÄLjÖ, 1976). The curriculum's goal was to create ILOs and methods of teaching, learning, and assessment for all students at the Master's level (The Quality Assurance Agency for Higher Education, 2014c) that appeal to student motivation and achievements (Hoskins & Newstead, 2009; Pintrich, 2003), encompassing the activities, core and professional values of the United Kingdom Professional Standards Framework (UKPSF) (UKPSF, 2011).

2.3. Student Assessment

As stated by Boud and Feletti, "the assessment tail wags the learning dog" (Boud & Feletti, 1991). In order to conclude the constructive alignment of teaching and learning for this case study, the quality of learning through set tasks was assessed fairly to provide feedback for students (Cassie et al., 2000), and to improve the teaching methods used (Ramsden, 2003).

The design studio sessions were conducted in small groups and centered on student presentations during which feedback was provided to students and between their peers. The learning exercises comprised of one design project that focused on 1) evaluating and designing an environment (residential, workplace, etc.) and 2) exercises that provide peers with critical feedback that aimed to advance critical thinking and learning in order to master the learning content through an analytical and evaluative process. Learning occurred during the design studio sessions, reflective mobile exercises and a critical reflection of students' personal and academic development with the overall module experience.

Based on the feedback obtained, it may be imperative to evaluate each session to meet students' needs and enhance their learning experience, which can be achieved by designing rapid questionnaires for irregular sessions to explore problems and struggles faced by students and the aspects that they appreciate (Ramsden, 2003).

2.4. Adoption of Mobile Learning

Offering students an opportunity to evaluate a designed place using digital media (mobile technology) fulfilled the goal of encouraging students to develop a critical understanding of their discipline (industrial design). Combining experiential and instructional learning modes enabled students to better understand how design impacts the users of an environment.

The two teaching methods considered as positive in teaching design interaction are "face-to-face lectures" and "learning by experience". The mobile learning approach harnesses the portability and versatility of mobile technology (for example mobile phones and iPads) to promote "a pedagogical shift from didactic teacher-centered to participatory student-centered learning" (Looi et al., 2010). Therefore, mobile learning was the most suitable approach for teaching the design interaction module. This choice was based on determination of the best possible situated flexible learning experience that could be developed since most of the sessions were conducted outdoors to enhance the learning experience.

3. Methods

3.1. Case Study—Planning and Structure

The case study was designed with student interaction in mind emphasizing social interaction as proposed by Illeris who suggested a combination of cognitive, emotional, and social learning (Illeris, 2003). A learner's interaction and communication with their social and cultural milieu where learning takes place, also known as social learning, is key to the design in this case study. Using a constructive approach to learning that is fit for purpose for a range of student levels and assigned learning tasks (Ramsden, 2003) will ensure accommodation of culturally and educationally diverse learners with different levels of adult learning (Entwistle, 1991) that are in line with institutional curricula and professional sector requirements (Baron & Corbin, 2012; Bryson & Hand, 2007; The Quality Assurance Agency for Higher Education, 2014a, 2014b, 2014c, 2014d; University, 2014a, 2014b). Though XXXX University offers degrees in Master of Arts in Industrial Design and Master of Science in Product Design, these programme curricula have different learning outcomes. The contents and concepts outlined in this case study are in accordance with no "step-changes" in thinking proposed by Entwistle (2004) and apply to learning and skill strategies to be used in any design context.

The case study (**Supplementary Table**) was administered to students who assumed complete responsibility for finding and evaluating the study environment (workplace, hospital, care-home) and were encouraged to operate as independent learners within an environment and share their learning experiences.

The case study brief presented to students comprised of:

1) Setting the ILOs

Five ILOs for the case study were constructed to meet the expected level of understanding as suggested by Bloom's taxonomy of learning (**Figure 1**) (Bloom,

1956), whose "classification" was revised and thresholds developed to be reached at the "application" level. The redesigned ILOs are presented in Table 1 and reflected all the above considerations (**Supplementary Table**), including learning outcomes (Hussey & Smith, 2003) that aligned with personally defined teaching and assessment strategies.

2) Task Description

The preliminary steps were to discuss and agree at tutorials the assessment criteria, the assumptions made and establishment of a final proposal to be used in the specific environment (residential, commercial, workplace etc.). Arrangements were made for appraisal of local places in XXXX designed by professional companies on site. While these specific environments were the focus of the appraisal, students were required to examine and compare similar designs from a live plan of their design and explain how they would have improved its design quality differently based on their in-depth understanding of design interaction

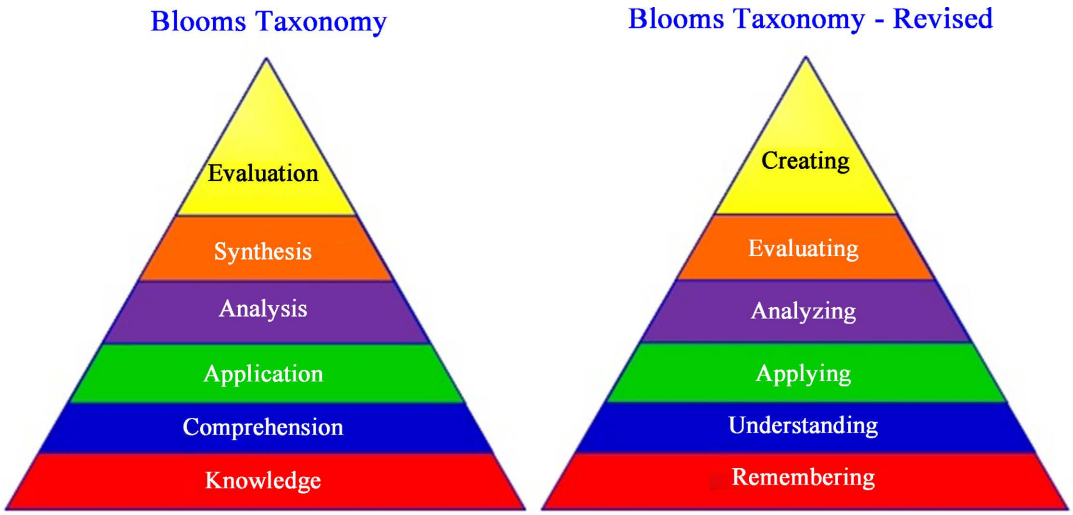

Figure 1. Adapted from Bloom's Taxonomy and revised Bloom's Taxonomy (Bloom, 1956).

Table 1. Intended learning outcome (ILOs) design interaction.

No	Deep Learning	Intended learning outcome (ILOs) Having completed this unit, the student is expected to	Understanding Level
1	Knowledge	Demonstrate deep understanding of ergonomic knowledge in the identification and definition of design interaction for the mind and body;	Comprehension understanding of the knowledge
2	Skills	Demonstrate a critical analysis of interaction design criteria to establish specific user needs and product requirements for a particular design problem;	Design skills and synthesis
3	Competences	Demonstrate expert ability to compile and articulate an ergonomic design specification and applied experimental methodology;	Application
4	Skills	Apply creative synthesis of interaction design criteria through the generation of an ergonomic design solution;	Evaluation (creative)
5	Competences	Create new design and demonstrate professional ability to reflect and represent an applied methodology to illustrate an ergonomic design process.	Designing

and behavior theory. Students were then tasked with performing a critical appraisal and evaluation of the interaction design criteria and its quality with respect to the following:

a) practical performance—the type of facilities available to the user

b) effect of design on the users and their perception of each element based on student understanding of environmental behavior theory and ergonomics

c) spiritual performance—establish user-specific needs based on spirituality and beliefs

d) responsiveness to change in product design and resulting user satisfaction

e) professional recommendations for improvements in design based on ergonomic guidelines, behavior theory, sensing the product, and individual responses to the built environment.

3) Presentation

In addition to an oral presentation, a report was expected in the form of bound, word-processed write-ups on A4 sheets. The writing was to be clear and concise, fully referenced and illustrated (floor plan, isometric, elevation, sections) to support the discussion, arguments and views as well as the design concept, and idea. The reports were to be handed in via appropriate assignment boxes at agreed upon dates.

3.2. Curriculum Design, Implementation, and Feasibility

The module leader (the author) developed and implemented the design interaction module on XX XX, formulated the delivery plan, timetable, location for visiting, learning outcomes, and detailed description of lectures, both mobile and face-to-face. The construction and timetable of the new module were designed to incorporate mobile learning alongside traditional teaching resources through lectures and design studio sessions, as shown in **Table 2**. The module was based on the re-design of the ILOs for the case study brief that reflected all levels and teaching considerations, including learning outcomes (Hussey & Smith, 2003) that were aligned with teaching and assessment strategies along the lines of the development and implementation of a mobile approach to enhance education at XXXX University.

The lectures were crafted to explain the ILOs and the rationale for the case study. The primary intention was to enhance the learning experience by assigning all lectures to be mobile. Over a one-week block, five mobile lectures, the minimum required for impacting students' learning experience, were delivered. These mobile lectures were aligned with the module's ILOs (Saunders, 2011) and complemented the four main face-to-face lectures scheduled in the module timetable. Inclusion of video functionality encouraged students to reflect critically on their experience in relation to principles of ergonomics and interactions, gain an in-depth understanding of behavior theory within the context of design, and reflect on topics discussed in the lectures.

The first lecture was designed to explain basic principles of interaction design,

Table 2. Planning, learning and teaching activities.

Aims	
• To provide the candidate with a critical and analytical understanding of design interaction and ergonomics, through systematic study; • To provide the candidate with a critical and creative understanding of interaction and ergonomic design methods, through a structured process and methodology.	
Monday	Introductions 10.30 A contribution to Interior Design and Décor Features in Single Occupancy Hospital Rooms 12.00 Group discussion 13.00 Lunch 14.00 Theoretical Framework for Design Interaction and Environmental Behavior—User Relationships in the built environment 15.00 Tea Break 15.15 Discussion 16.30 Close
Tuesday	09.30 The process of creating designs—beyond design as an aesthetic act 11.00 Discussion 12.00 Schematic Design and Decision-making Processes (Floor plan Traffic analysis-Circulation) 13.00 Lunch 14.00 Workshops, Sketches, Design Concepts, and Drawings, Discussion—Micro—Design activity 13:00 Tea Break 16.00 Close
Wednesday	09.30 Sensing the Place (hearing, smell, sight, touch and taste) 10.30 The role of ergonomics, which covers functionality in design, ergonomics in design and the effects of design on the user. 12.00 Micro—Design Activity 13.00 Lunch 14.00 Discussion 16.00 Close
Thursday	09.30 Discussions. Initial plan for assignment 11.00 Literature review, reading, and preparing for short presentation
Friday	09.30 Students will give short presentations about their plan for the Unit of Interaction Design course work 12.30 Feedback and evaluation of the course 13.00 Close

focusing on person and place (environmental psychology) and the use of mobile teaching. The remaining lectures developed by the module leader (the author) included video of real-life settings, three-dimensional (3D) design model, floor plan, perspectives, isometric of the design, and sketches. The mobile lectures comprised three stages: preparing 3D video, presentation, animation and real video recorded on site. Lecturers and students alike invested considerable effort and independent learning for all aspects of mobile lectures.

The teaching sessions (Table 2) represent the interlinked parts of the unit or the ILOs. The Design Unit at XXXX University functioned as a lecture room, since it has fitted computer screens and projector for enhanced visual instruction and presentation, which enrich the learning experience when used efficiently (Jarvis, 2010).

3.3. Teaching Activities

Having set the goal of developing critical thinking in relation to industrial design and helping students become independent learners, a variety of mobile lectures, presentations, design studio sessions, and seminars were presented on My XX for knowledge exchange amongst students, and between students and lecturers. Key lectures were on environmental behavior, ergonomics, design interaction model, and qualities in built environment design. In addition, lectures on design creativity, the design process of the physical setting, and user interaction with the environment helped students understand how designers develop and express their ideas. Activities included evaluation skills, hand drawing, computer 3D modeling, and an animation video of a location for analysis and communication of design ideas. Students were instructed to work in pairs, with each pair using iPad Touch and a personal mobile phone. Teaching using an iPad, considered to be an easy device to use, ensured student engagement with mobile learning mandated in the module. As part of a larger learning and teaching framework, these activities enabled students to enhance their knowledge and develop necessary skills. Since the unit was related to design, micro-design activity was used to stimulate the teaching experience.

Video recording equipment, provided by the module leader (the author) for recording mobile lectures were used during in-class seminars, and also made available on My XX to enable student access using iPad Touch for mobile learning. Students received instructions on how to view the video material on My XX, and were assisted by online information, from video to written tutorials. As part of their educational experience, students were responsible for producing their own videos that complied with the ILOs and tasks schedule and also using the video material available on My XX to contribute to mobile lectures in the design interaction module. All the videos produced by students were peer-reviewed during the design studio class work (Saunders, 2011) and the best work was made available on My XX. The mobile learning tasks involved one video submission and one cooperative work that combined written text, videos and other 3D visual images, which were made available on My XX at the end of the unit. A brief overview of steps taken by students during video recording and sketching designs for data collection included i) a creative process that emphasizes design and exploration of the aesthetics of interior space during a video consultation session using an iPad and mobile learning; ii) a transformation process of the design into a real-world concept within concrete and real parameters (Poldma, 1999).

3.4. Assessment Tools and Feedback

The assessment for this case study was performed using tools that measured its congruency with overall as well as specific learning outcomes (Boud & Feletti, 1991; University, 2014c). The tools (Race et al., 2005) that facilitated feedback during learning "formative assessment" (Biggs & Tang, 2011; Norton, 2009) and

positively influenced the learning process met the following criteria:

1) evaluation of the description of the designed space, proposed improvements and functional requirement based on a score between 3 to 1 (excellent, average or poor) and 0 for incomplete, which showed the layout, circulation, furniture, lighting, and color of all elements with visual examples of different environments showing the components of the design.

2) listing the design components and providing 3D images with scales of all components presented based on the principle of ergonomics; the assessment focused more on the products than the process.

3) visual examples that included the production of the layout design features, and technical drawing rules and features and presentation quality (artistic features) of the floor plan, sections, elevation, and isometric.

4) presentation quality of the report revealed the performance outcomes of the work assessed.

5) written assignments that were scored between 3 to 1 (excellent, average or poor) and 0 for incomplete or not presenting (Figure 2) and assessed for evaluation, critical thinking, proposing improvements, and creativity (**Supplementary Figures S1-S5**).

4. Results

An analysis of the ILOs showed that all but one (# 5) of the verbs used in the five ILOs were in accordance with the Structure of the Observed Learning Outcome

	Excellent (3)	Average (2)	Poor (1)	Incomplete (0)
Description of designed Space and proposed improvement	Completely accurate	Somewhat accurate	inaccurate	No description
Listing design components	All listed-6 components satisfying	Most listed 3-5 components All accepted	Some listed. Not Enough	No list. No Example
Visual examples	4 different types	3 different types	2 different types	1 type only
Presentation	Evaluation/critical thinking/proposing Improvement and creativities	Evaluation, and critical thinking/ improvement plan	Evaluation and critical thinking	Evaluation only
Written work, and assignment	Evaluation/critical thinking/proposing Improvement and creativities	Evaluation, and critical thinking/ improvement plan	Evaluation and critical thinking	Evaluation only

Figure 2. Scoring rubric for evaluation and marking (assessment).

(SOLO) taxonomy. This was therefore revised to use verbs referring to the relational and extended abstract level that met the learning and teaching requirement at the Master of Arts level (Table 1).

The new feedback in Table 3 was very successful. The purpose of the unit and the material presented were apparent, the content was as expected, the unit was well-structured and met their expectations, stimulating, handouts were useful, and the teaching techniques (presentations, animation movies, design activities, seminars) were linked to the lectures.

All students who completed the unit were successful in obtaining the required pass marks, despite coming from very different backgrounds. Although some had limited design skills, they produced excellent projects. The quality of the assignments submitted showed that students had developed a good understanding of the topics introduced in the unit. All students demonstrated, to varying degrees, their ability to develop knowledge related to design interaction. They successfully managed to evaluate, enhance, and apply creativity to their discussion and written assignments with up-to-date references in relation to design settings. There were no issues related to the material or the delivery plan as it was carefully planned to meet the unit specification and stimulate learning experience.

5. Discussion

The success of the design interaction module, designed on the basis of a social constructivist philosophical theory and taught to industrial design students may be attributed to the pedagogic strategy developed over years of personal experience of teaching design, developing skills, and creating new approaches such as mobile learning.

Table 3. An example of feedback of the work.

Intended learning outcome (ILOs)	Lecturer Feedback
Deep understanding of ergonomic knowledge in the identification and definition of design interaction, for the mind and body;	a) The practical performance of the proposed environment is well addressed through wider reading and review.
Demonstrate a critical analysis of interaction design criteria to establish specific user needs and product requirements for a particular design problem;	b) You developed a broad factual, design conceptual understanding of the subject.
Demonstrate expert ability to compile and articulate an ergonomic design specification and applied experimental methodology;	c) Ergonomic design principles in relation to your design need more explanation; however, you have successfully explained the use of colour in relation to the user's perception and its effects.
Apply creative synthesis of interaction design criteria through the generation of an ergonomic design solution;	d) Able to apply knowledge and understanding of Environmental Behavior Theory and generate a range of design interaction solutions for a given situation.
Create new design and demonstrate professional ability to reflect and represent an applied methodology to illustrate an ergonomic design process.	e) Some of your references are based on personal knowledge and this should be supported by an original reference.

Following this approach, students completed the case study by first taking responsibility for choosing a project that needs to be addressed. Students were encouraged to use their skills within an environment by solving design problems through drawing, sketching, designing, and writing. The goal of this exercise was to let students feel included in the learning process, become more self-directed, and while guidance is given, they are encouraged to engage in lifelong learning (Regan, 2005; Tough, 1967, 1979) all of which promote a range of skills as an emergent learning outcome.

This case study (**Figure 3**) was aimed at the relational and extended abstract levels of Bigg's SOLO taxonomy using sample verbs indicating levels of understanding (Biggs & Collis, 1982). The enhanced ILOs constructed for this case study were novel and creative, though the bands were based on a modified version adapted by the author to fit the design interaction module (**Figure 4**). The ILOs aligned with analytical and evaluative mastering of the learning content that students were expected to be able to apply, analyse, characterize, compare, create, design, and invent (relational/extended abstract) (Biggs & Collis, 1982). When designing ILOs, the relational and extended abstract levels are effective and may be best attained when applying the learned matter to a broader set of topics and problems (Biggs & Collis, 1982; Biggs & Tang, 2011). It is therefore important to stress that delivery of learning content is key to a successful application of a

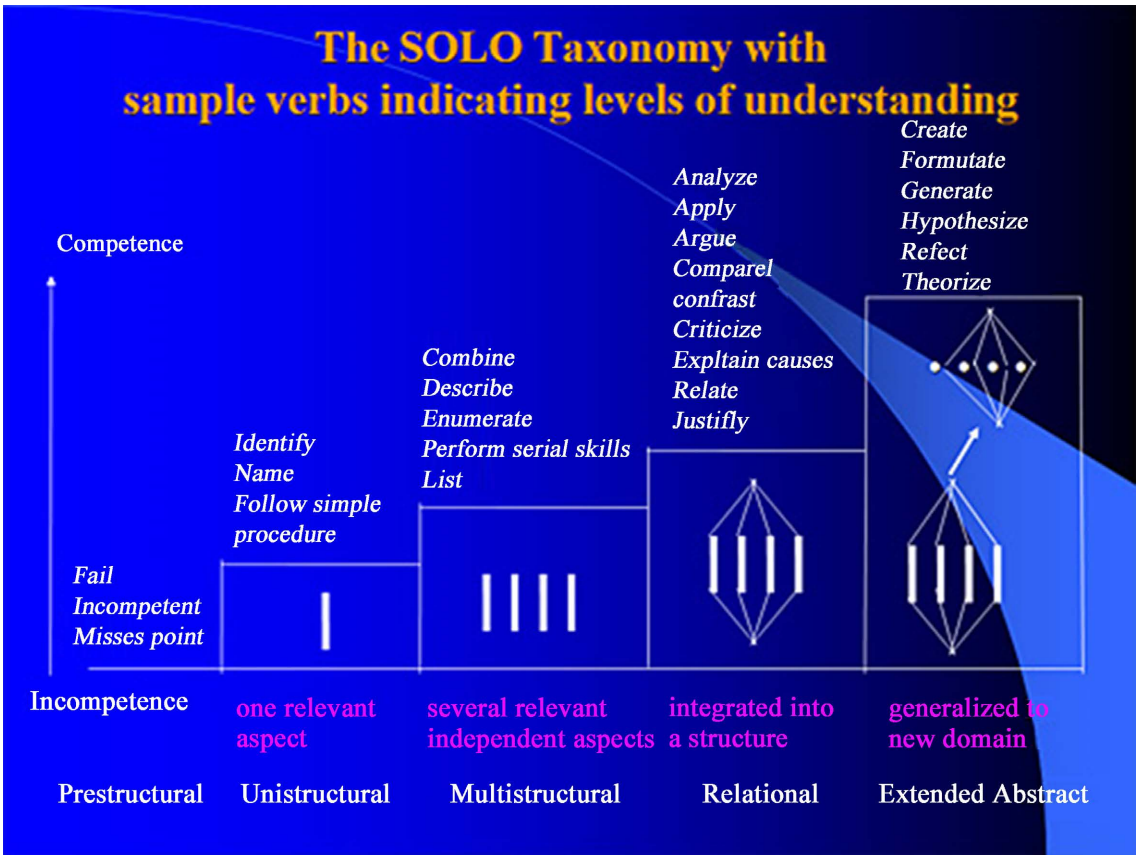

Figure 3. Adapted from Bigg's SOLO Taxonomy model (Biggs & Collis, 1982).

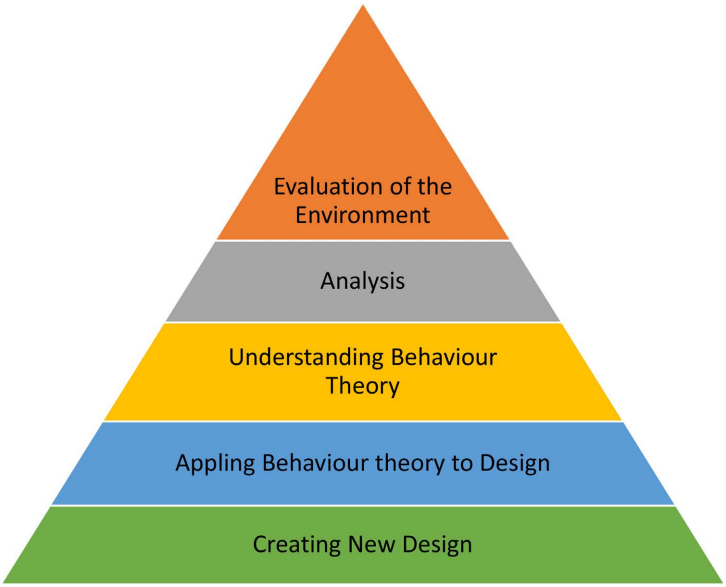

Figure 4. Revised taxonomy by the Author for teaching design based on (Bloom, 1956).

design interaction module that meets the needs of students (Biggs & Tang, 2011).

The mobile learning plan was designed to pursue knowledge and encourage students to develop a critical understanding of the discipline, resulting in an improved learning experience. From a teaching perspective, mobile learning was a constructive process that allowed the lecturer to refer to students' experiences when discussing the content of mobile lectures, particularly their decisions on design in studio sessions (Saunders, 2011).

This study met its overall objective of developing a comprehensive learning experience by constructively aligning pedagogic strategies that embraced the possibilities offered under this umbrella of thought (Anderson, 2005). This was the foundation for building a comprehensive framework of learning theories that accompanied the ILOs of the case study. The shift from being learners to a teacher's role was intended to enhance the level of interaction, which has a positive impact on student engagement with the subject.

Future plans include 1) changing the nature of the case study, teaching material and approach to enhance the learning experience to meet students' expectations; 2) develop expertise to compile and articulate specifications and applied experimental methodology in industrial design; and iii) develop an in-depth understanding of industrial design so that students are able to apply a philosophy of phenomenological aesthetics to perform sophisticated detail design in the development of products and aspects of spatial design in a professional manner.

6. Conclusion

Thus far, there is no comprehensive reflection on pedagogic teaching strategies for design, which can be attributed to the lack of literature concerning the effects and user's perception of the environment, and related teaching strategies. The case study was developed with a few considerations such as a critical examina-

tion of the context of practice in curriculum development, the philosophical foundations on the extent of student engagement, the relevant adult learning theories adopted, the intended learning outcomes, design, and implementation related to design teaching, implementation issues, and lessons learned from the implementation. This case study, designed on the basis of a social constructivist philosophical theory, showed that the success of the module taught to industrial design students may be attributed to the pedagogic strategy, developed over years of personal experience of teaching design, developing skills, and creating new approaches such as mobile learning.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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Supplementary Table

This is an: Individual assignment which carries 100% of the final unit mark

Task Description

You are to carry out a critical appraisal and evaluation of the quality of a designed environment (Residential, Commercial, Workplace etc.) this should include critical analysis of interaction design criteria within the designed place.

You are to report your findings in respect of:

1) Practical Performance—what kind of facilities available for the user of your proposed plan and design?

2) Explain your plan and its design effect on user and how they may perceive each element based on your understanding of the Environmental Behavior theory and ergonomic.

3) Spiritual Performance—critical analysis of Interaction design criteria to establish specific user needs.

4) How responsive are the products to a change in the designed space and how it may lead to satisfaction with the planned design?

5) Professional Recommendations for improving the designed place based on ergonomic guidelines/behavior theory/sensing the product/based on what you have learned about individual responses to the built environment.

Prior to this critical appraisal you are to discuss and agree at tutorials the assessment criteria you consider appropriate for your work (Residential, Commercial, Workplace etc.). Various assumptions will have to be made and final idea established.

Whilst the appraisal is to be focused on Residential, Commercial, Workplace design you are also required to examine and compare similar design from a live plan to your own design and explain what have you done differently to improve the quality of your designed choice based on deep understanding of design interaction and behavior theory.

Arrangement will be made for an appraisal of (local places in XXXX) designed by professional companies on site.

Presentation

You are to present your assignment in a bound A4 report Word-Processed and illustrated. It should be clear and concise, fully referenced and illustrated (floor plan, Isometric, elevation, sections) to support your discussion, arguments and views as well as design concept and design idea.

The reports are to be handed in via the appropriate assignment boxes—dates to be agreed. This will be followed by an oral presentation when you will be required to discuss your design and design concept.

Learning outcomes assessed

All learning outcomes will be assessed by 100/% coursework (5000 word or equivalent).

The knowledge and understanding from the ergonomic generic principles and practice associated with the environmental behavior theory and how human per-

ceives and response to the designed environment.

The creative thinking behind this coursework as expressed under the headings 1-5.

Assessment Criteria/Marking Scheme

1) 75% of the weighting for the course work for this unit will be awarded for the hand in.

2) 25% also will be awarded for 20 minutes presentation of your design.

Feedback written

Supplementary Figures

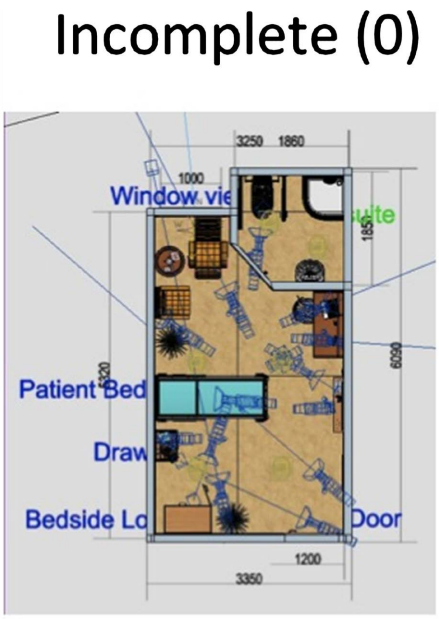

Figure S1. Design assessment example one.

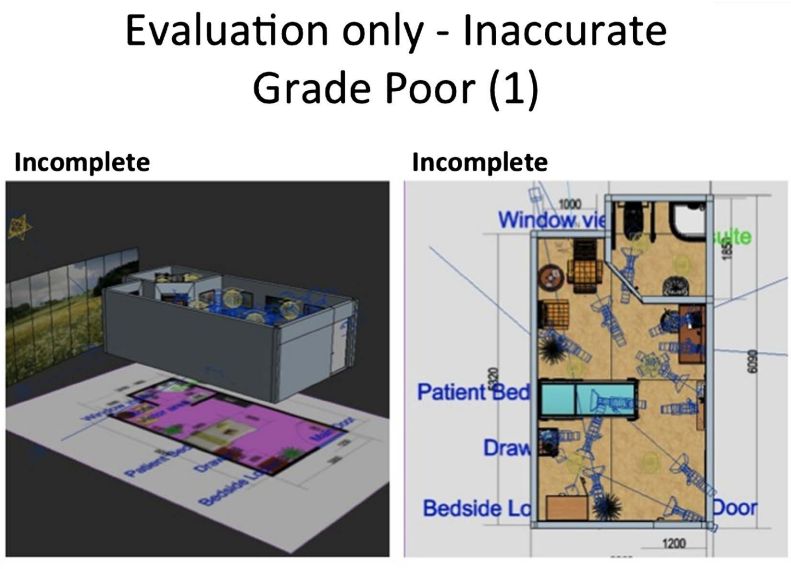

Figure S2. Design assessment example two.

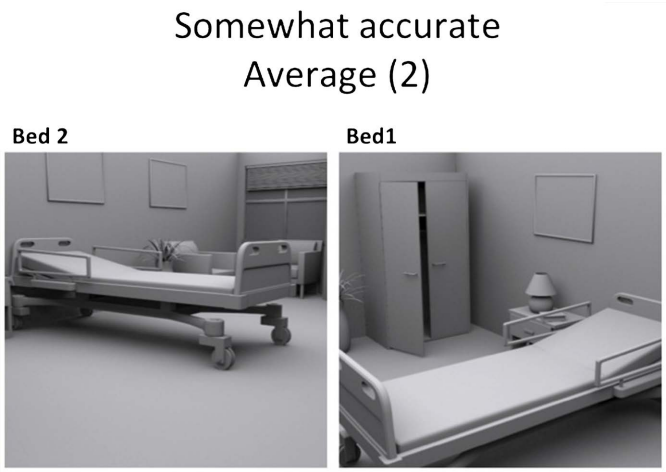

Figure S3. Design assessment example three.

Figure S4. Design assessment example four.

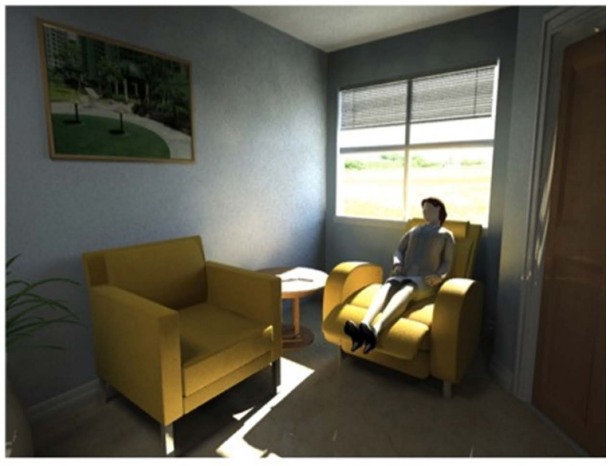

Figure S5. Design assessment example five.