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Application of Constructive alignment in higher design education for curriculum renewal

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Abstract

A student's learning is not always a reciprocal of what the teacher teaches. A coherence between what is intended that the students learn, how it is taught, and how the performance is evaluated using various criterion tools becomes imperative for deep and effective learning. Higher educational institutions around the world have adopted the principle of Constructive Alignment to impart quality education and make the students future-ready. This paper presents an in-depth analysis and evaluation of a module named Spatial Design 1 which has been modeled on the principle of constructive alignment. The module is taught in semester 3 in the 4 year-8 semesters long Under Graduate course in an Interior Design Institute in India. By triangulating the module curriculum i.e its Intended Learning Outcomes, teaching-learning activities and assessment process the strengths,weaknesses and the gaps of the module have been identified. Suggestions have been given to bridge the identified gaps and shortcomings, which can result in a holistic student learning experience.

Keywords: design education, cognitive capabilities, design cognition, case study, human centred design, constructive alignment.

1 Introduction

"Education is for the social purpose of elevating the character of human conduct above what it would otherwise be" (Rugg & Whipple, 1969). One of the purposes of education is to enhance the overall development of a person. Education is the single best investment countries can make to build prosperous, healthy and equitable societies (United Nations, n.d.). Education is more than training skills and techniques. It is an intellectual preparation for life-long learning that cultivates the abilities of the mind to encounter new situations and respond with ingenuity, imagination, and creativity (Silva, 2022). Educational institutions worldwide aim to make their students well prepared for the future, balancing knowledge and skill-based learning. A well-designed educational system integrates professional academic excellence with personal growth.

Most institutions follow a set pattern – a syllabus is outlined which is taught by the teachers, the students learn the content, give examinations post which the results are declared. Thus an alignment of a course's intended learning outcomes, teaching and learning activities, and assessment becomes necessary for effective education. This principle known as ,'Constructive alignment' (CA) was introduced by Professor John B. Biggs**.**

The concept of constructive alignment can be applied from a unit level to an institutional level. This research paper analyses and evaluates the theoretical framework of constructive alignment applied at a module level of Semester 3, Level 1 of the Under Graduate course in Interior Spatial Design at Pearl Academy, India. Qualitative research methodology has been adopted to investigate the strengths, weaknesses and gaps of implementing CA.The module was evaluated based on its delivery. Suggestions for improvements have been proposed post evaluation.

2 Theoretical framework on constructive alignment

Constructive alignment is an outcomes-based approach to teaching in which the learning outcomes that students are intended to achieve are defined before teaching takes place. Teaching and assessment methods are then designed to best achieve those outcomes and to assess the standard at which they have been achieved (Biggs, 2014). Constructive alignment has become internationally established as an educational approach linking strategic planning and corporate policy to discipline and course teaching and learning practice (Ruge, Tokede, & Tivendale, 2019). The three main components of constructive alignment as shown in Figure 1. This approach recognizes that students learn by doing – performing activities, rather than laying focus on what's been taught by the teacher.

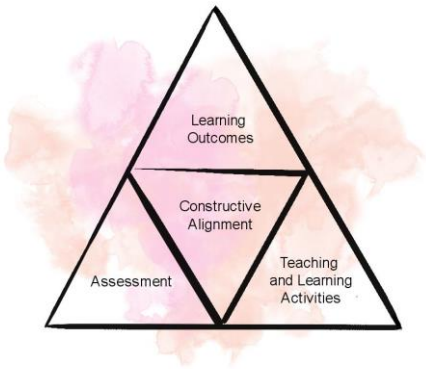


Figure 1: Components of Constructive alignment
Source: Forward with flexibility (2017)

According to Prof. Biggs, there are four major steps to achieve constructive alignment in education:

a) Defining the Intended Learning Outcomes (ILOs);
b) Choosing Teaching/Learning Activities (TLAs) likely to lead to the ILOs;
c) Assessing students' actual learning outcomes to see how well they match what was intended;
d) Arriving at a final grade (Biggs, Aligning teaching for constructing learning, 2003).

These steps help in aligning various teaching methods to achieve the intended learning outcomes. Constructive Alignment supports positive academic outcomes for an increasingly

diverse group of learners, because it makes teaching and learning goals and methods Aligned - well organized, consistent, and Explicit - obvious, visible (Bie & Brown, 2017)

3 Course information

Pearl academy previously offered a four year undergraduate BA (Hon) in Interior Architecture and Design validated by Nottingham Trent University, United Kingdom which the paper is based. At present, the institute offers a diploma course in Interior Spatial Design. Future designers need to practice with the depth of knowledge required to solve complex interdisciplinary problems of human behaviour and design (Guerin & Thompson, 2004).The Interior Spatial Design program at Pearl Academy explores how design can transform a space into a unique experience. The program enables its students to conceive meaningful ideas which when converted into a built environment shall positively impact user experience. The course comprises of four main verticals - theory, tools, project and studio modules along with workshops called as open labs every semester to provide a holistic learning. The core values of the program enables students to think critically, take creative risks, and design for a larger social impact through research, understanding human needs, behaviour, and psychology.

4 Course Mapping with QAA standards.

The Quality Assurance Agency for Higher Education (QAA) is an independent charity working to benefit students and higher education globally. QAA is one of the world's experts in quality assurance (QAA, 2019). BA Interior Spatial Design falls in the 9th Scottish Credit and Qualifications Framework (SCQF) level of QAA benchmarking. The table below indicates the analysis of Course learning outcome extracted from the course document of the institute and QAA benchmarks which confirm a high-quality education.

Table 1: QAA benchmarks and Course learning outcomes of BA Interior Spatial Design at Pearl Academy

	9th SCQF level of QAA benchmarks	Course Learning Outcome
1.	Use their knowledge, understanding, and skills, in both identifying and analyzing problems and issues and in formulating, evaluating, and applying evidence-based solutions and arguments;	Demonstrate broad, coherent spatial design knowledge and skills with depth in the underlying practices, languages, forms, technologies, and techniques of commercial interior design.
		Demonstrate autonomy, judgment, and responsibility to provide specialized commercially based design advice and solutions for independent and collaborative professional practice
2.	Communicate the results of their studies and other work accurately and reliably in a range of different contexts using the main specialized concepts, constructs, and techniques of the subject(s);	Use communication skills and technologies to deliver evidence-based commercial interior design knowledge, skills, ideas, and solutions to a variety of audiences.
		Demonstrate propositional, imaginative, iterative, integrated, and analytical thinking to independently solve complex commercial interior design problems in a range of situations.
3.	Identify and address their own learning needs, including being able to draw on a range of current research, development, and professional materials;	Recognize and reflect on the historical, social, cultural, material, and ethical contexts of local and international commercial interior design practice, and engage ethically, professionally, and responsibly with colleagues, clients, audiences, and communities.
		Engage in ongoing critical self-reflection, self-directed research, learning, and development activities to evaluate and

		integrate emergent commercial interior design ideas, methods, and technologies into professional practice.
4.	Apply their subject and transferable skills to contexts where criteria for decisions and the scope of the task may be well defined but where personal responsibility, initiative, and decision-making are also required.	Apply research methods and critical thinking skills to source, analyze and evaluate information, and consolidate and synthesize knowledge, in response to commercial interior design problems
		Apply collaboration knowledge and skills to plan, coordinate and evaluate the work of self and others in the project and team-based professional commercial interior design practice

5 Course and Module details

The first year is the foundation year termed as Level 0 consisting of semesters 1 and 2. In the initial two semesters, the focus is on building the foundation of interior design through understanding design elements and principles, hand drawing, hand drafting, model making, anthropometrics, ergonomics and case studies.

The second year is termed Level 1 consisting of Semester 3 and 4 where the students are introduced to the Interior Spatial Design curriculum. Semester 3 is categorized under four modules each of 14 credits. Open labs/workshops of 4 credits are also taught along with the four core modules in semester 3. All four modules and the open labs are aligned with one another to produce a single integrated design project as an outcome. The four modules are categorized as:

a) Project: Spatial design 1
b) Studio: Material principles and application
c) Theory: Design culture
d) Tools: Hand drawing and modelling.
e) Open labs/ Workshops : Site study

The student group comprised of ten students studying at the Delhi-south campus, Pearl academy. Out of the ten students, nine were females and one was a male. Their age group ranged from 19 to 22 years. This is the first time the learners are introduced to the importance of spatial design in the context of interior design. Spatial design 1 is a 14 credit module. The module was taught over 8 weeks with 64 hours of face-to-face teaching. The open lab/workshop of 4 credits formed the basis of pre-design for the spatial design 1 module where the students were taken on a study trip. They visited the site and understood the site context. The open lab module is of 4 credit. It was taught in 5 days comprising of 6 hours per day - total 30 hours.

Open Lab/ Workshop – Study Trip

The open lab is a plug-in workshop preceding the spatial design 1 module. A study trip was organised for the students to Auroville in week 1 of the semester course. During this visit the students were introduced to the site to be used in the Spatial Design 1 module. Deep learning takes place when new learning connects with the old. This is also called constructivism (Biggs & Tang, Teaching for quality learning at university: what the student does, 2011). The students did a live case study of a residence in Auroville. They sketched its plan with measurements, to understand its spatial distribution.

Spatial Design 1: Module outline and activities.

As per the spatial design 1 module outline the module aims to explore basic elements and principles of residential space design and their implications on human perception and behaviour. Students respond to basic quantitative and qualitative program briefs; analyze anthropometric data; estimate optimum space areas and clearances for various activities;

develop zoning, spatial divisions, volumes, and circulation paths. This is the ideation stage. After this the students develop floor plans, sections and views. Students explore design ideation, design execution and presentation skills to communicate design intent.

Project Brief of Spatial Design 1 module:

The Auroville house was given as the site for the project – to redesign based on the brief given by the faculty. The exercise was divided into two parts. First, students had to design a residential space for a couple, and then two children were added to the same space. This helped students to analyse and design the space based on varied requirements and to see how the same space can be transformed for changing requirements. This module is the student's first exposure to space design. The students made bubble diagrams and proximity charts to understand the spatial relationship and connectivity between private, semi-private, and public areas within the space (Fig. 2).

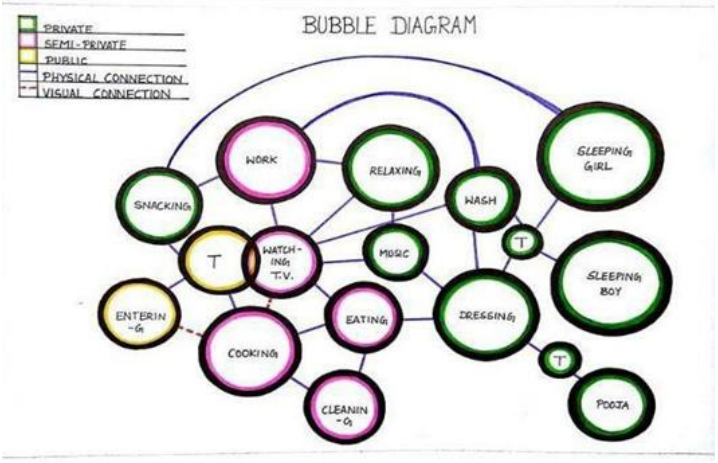
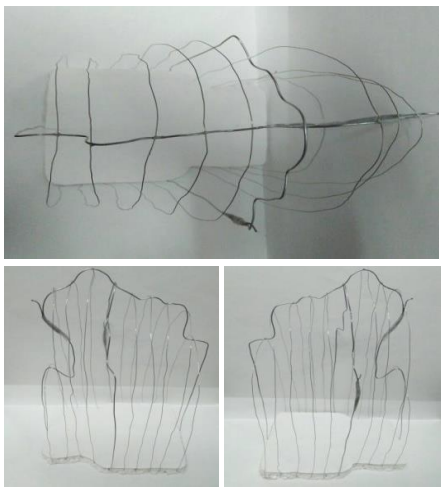


Figure 2: Bubble diagram to understand the space relation

Spatial Design 1 Module Activities:

To begin with, anthropometrics – study of human measurements and proportions was introduced to the students. Anthropometrics is an essential key learning for space design, furniture design, product design, etc. The students were given an activity to measure each other and reproduce their learning into scaled drawings. In the second step, the students were given different residential activities to study and measure like cooking, watching TV, eating, making the bed, relaxing, etc. The task assigned was to study various human postures and conclude the area and volume requirements for each activity (Fig: 3). To gain an enhanced understanding of the topic the students made a scaled down wire model of the measured residential activities (Fig: 4). This activity enabled students to design the space considering dimensions -area, volume requirements based on human proportions.



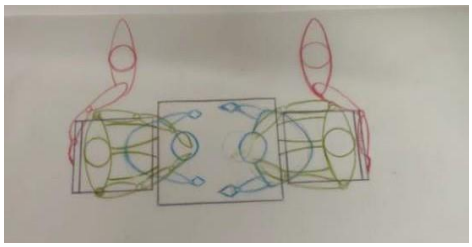


Figure 3: Eating activity mapped

Figure 4: Wire model of eating activity.

Once they were able to relate to the space they mapped the anthropometric model for massing exploration. With the help of these models, students were able to visualize the space to scale and they were able to try various possibilities with ease (Fig 5).

Figure 5: Massing exploration through Anthropometric model

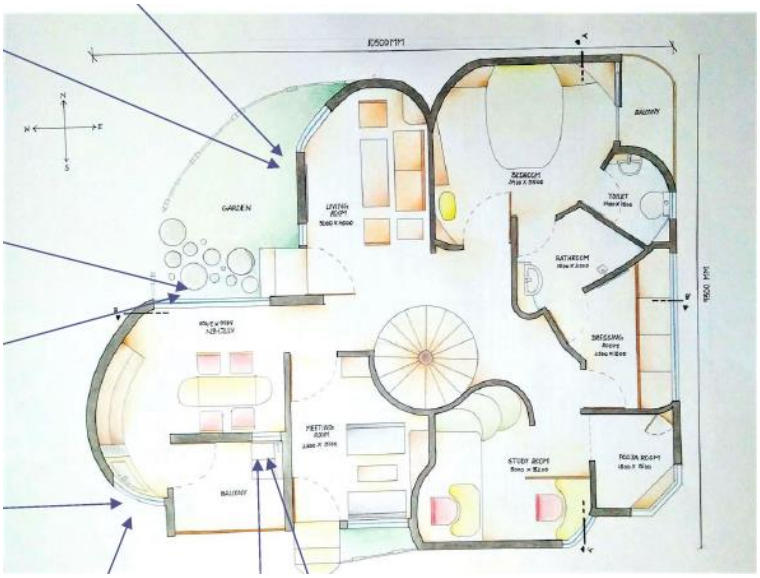


Figure 6: Proposed residential interior plan

Students found this exercise relatively interesting than collecting standard anthropometric data and we were able to achieve good results from the class activities. The students however felt overloaded with work as this module ran only for a duration of 8 weeks with 64 hours of face-to-face interaction with faculty. The next step was to make the layout plans with furniture placements (Fig 6).

6 Intended Learning Outcome, teaching-learning activities, and assessment

Student Learning Outcomes are statements of what students should learn, know, understand and apply and/or be able to demonstrate after completion of a process of learning (Gullickson,

2003). They are measurable and quite often observable (Indiana University - CITL : Developing Learning Outcomes, 2021).

A well-written learning outcome must have the following components:
a) Verb indicating what the learner is expected to be able to do.
b) Word/s indicating with what the learner is acting (Content).
c) Word/s indicating the nature of performance required as evidence of achievement of learning (Moon, 2002).

Bloom's taxonomy of cognitive objectives describes learning in six levels in the order of: knowledge, comprehension, application, analysis, synthesis and evaluation (Bloom, 1956). A revised version of Bloom's taxanomy on a two-dimensional framework to include the cognitive process and knowledge was created by Anderson and Krathwohl (2001) shown in Fig. 7 . The cognitive process includes the six levels of thinking skills as remember, understand, apply, analyze, evaluate and create.

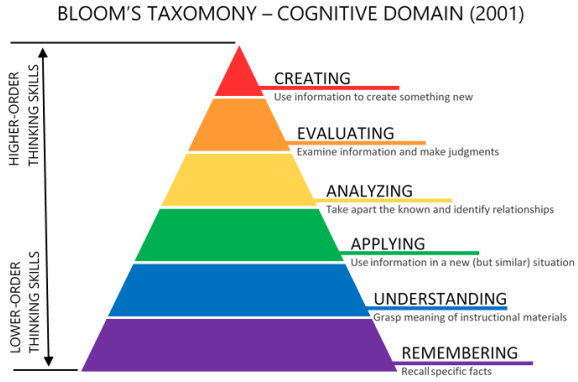


Figure 7: Revised Bloom's taxonomy by Anderson and Krathwohl
Source: Kurt, (2020)

Thus to gain a deeper understanding, the Intended learning outcome of this module has been analyzed as shown in Table 2. The level of achievement is based on Bloom's revised taxonomy.

Table 2: Analysis of Learning Outcomes

Intended Learning Outcomes (ILOs)	**Action Verb**	**Content**	**Level of achievement**
LO 1- Observe, document, and apply aspects of the human body in the design of spaces and objects.	Observe, Document, and apply	Aspects of the human body in the design of spaces and objects	Applying (3rd level)
LO 2- Integrate and apply basic volumetric, functional,and aesthetic principles to the design of an individual space.	Apply and Integrate	Volumetric, functional, and aesthetic principles tothe design of an individual space	Applying (3rd level)
LO 3- Respond to simple design briefs with self-critique, reflection, and discussion with peers.	Reflection	Design brief, Self-critique discussion with peers	Evaluating (5th level)

LO 4- Create basic abstract diagrams, sketches, and models as tools to generate progressive design options.	Create and generate	Abstract diagrams, sketches, and modelsas tools for progressive design options.	Creating (6^{th} level)

Analysis of ILO‘s indicates the statements are focused and follow Moon‘s three partite formulation for deep learning. By the end of the module the student can gain the highest level of achievement through creating and integrating ideas into a soultion.

According to Shuell (1986) “If the students are to achieve the desired outcomes successfully, then the primary task of the teacher is to get students to engage in learning activities that help in achieving those outcomes….what the student does is more important than what the teacher does.” The alignment between learning outcomes, assessment tasks is also very important for teaching and learning (Moon, 2002). According to Brown (2001), the purpose of assessment is:

a) To give license to proceed to the next stage.
b) To classify the performance of the students in rank order.
c) To improve their learning.

According to Biggs & Tang (2007), in constructive alignment, the connections between intended learning outcomes (ILOs), teaching/learning activities (TLAs), and assessment tasks (ATs) are aligned intrinsically. This alignment is imperative to get the best results from the students. Table 3 helps to analyze and understand how well Intended Learning Outcome, Teaching/ Learning strategy, and Assessment Task are aligned in this module.

Table 3: Constructive Alignment between Intended Learning Outcomes, Teaching Strategy, and Learning Activities

Intended Learning Outcomes	Teaching Strategy	Learning Activity	Assessment Task	Limitations (based on teaching activities and student outcome)
LO 1- Observe, document, and apply aspects of the human body in the design of spaces and objects.	**Interactive learning**- Students were asked to sit on the floor, chair, and then on the sofa. This helped them to understand the need of knowing human measurements because as per the height of students some were comfortable on a short stool, some on the sofa, etc. After that students were asked to measure each other to understand the human dimension and then they had to create the wire model which helped	**Class exercise**- Students were able to make the wire model and 2D models which were used in their Spatial design.	They have to give the report, documentation of measured drawings, wire, and 2D model.	The activity done by students to understand the human body measurement was only sitting, though there were other activities like standing posture, bending, sleeping, etc which was not covered in class due to time limitation. Wire model took lots of time so students were only able to cover one activity.

	them, to visualize the space.			
LO 2- Integrate and apply basic volumetric, functional, and aesthetic principles to the design of an individual space	**Presentation and experimentation-** Students were shown the presentation on how volume of the space psychologically affects human beings.	Based on the presentation, students had tobuild the process model of the site to understand its volume and function.	Students had to submit the 3D model with some rendered views.	Since students studied residential space, they were able to examine only a few spaces required for a residential area. Students were not able to concentrate more on aesthetic principles.
LO 3- Respond tosimple design briefs with self-critique, reflection, and discussion with peers.	**Presentation of work-** From zoning stage to final design, students were asked to present their work. All the faculties, student classmates, juniors, and seniors were present to give peer review.	As per the design brief shared with students, they had to bring massing and zoning options. Once the critiques were given, students had to self-reflect and bring the final outcome.	Process sheetsand model, final presentation, drawings, and their working on critiques given by faculties and peers.	Though students were able to achieve this learning outcome due to time limitation second part of the assignment (family space), students were notable to take many critiques on that.
LO 4- Create basic abstract diagrams, sketches, and models as tools to generate progressive design options.	**Presentation and class assignment-the** presentation was given to understandthe basic bubble diagram, how to make concept sketches, and process model.	Classroom activity- Based on the design brief, students were asked to create the bubble diagram, concept sketches, process model in the class.	Concept sketches, process sheets,and 3D modelswith process models.	All the students made process sheets but as discussed before due to time limitations less focus was given on the second part of the module which was Family space.

7 Assessment

The assessment process examines the level to which students have achieved the intended learning outcomes. Learning outcomes form the basis of what is assessed and how it is assessed. The assessment method for the Spatial Design 1 module is shown in table 4. The table shows what is expected from the student under the assessment criteria. All 4 LO's are assessed in each project.

Table 4: Assessment Criteria and tools for Spatial Design 1 module

Assignment	Assessment Criteria	Assessment Tool
Assignment 1 Dwelling Space for 1	Subject Folio , Design Proposal , Presentation	40%
Assignment 2 Dwelling Space for Family	Subject Folio , Design Proposal , Presentation	60%

8 Suggestions:

The analysis of the module based on Constructive Allignment identified gaps, which can be fulfilled based on the following suggestions:

a) The original aim of the module focuses on the various stages of the design process essentially explaining class activities. The typology of the project is entirely omitted. The scope of the project is not limited to spatial design, the students develop interior concepts, aesthetics and details by the end of the semester. The recommended aim is concise, direct and explicitly explains the module intent.

Table 5: Original and recommended aim of the module, 'Spatial Design 1'

Original Aim of the module	Suggested aim of the module
The aim of the module is to explore basic elements and principles of space design and their implications on human perception and behaviour. Students respond to basic quantitative and qualitative program briefs; analyze anthropometric data; estimate optimum space areas and clearances for various activities; develop zoning, spatial divisions, volumes, and circulation paths. Students explore design and presentation skills to communicate design intent.	The aim of the module is to design functional and aesthetically appealing spatial and interior environment of residence(s) through research and integration of human anthropometrics, ergonomics, needs, requirements, behaviour, perception, and psychology.

b) This module was taught from week 9- 16 a total of 8 weeks. Before the commencement of this module these students had learned Theory: Design culture and Tools: hand drawing & modeling modules in the first 8 weeks. Inputs and discussions are very important right from the beginning of the Spatial Design 1 module, therefore this module should run from the beginning to the end of the semester so that all the modules can be well integrated.
c) Face-to-face teaching hours were only 64 in 8 weeks, which means 8 hours per week. The design process takes time to evolve. Understanding basic human dimensions to developing a dwelling space takes time. As discussed before all four modules are integrated to get the final outcome in this module. Therefore face to face teaching hours should be increased for this module from 64 to 96 spanning 18 weeks.
d) The assignment was divided into two parts. The first part consisted of a basic understanding of human dimensions and developing a residence space for a couple. The second part consisted of diverse requirements by the addition of children in the same house. Through this exercise, the students developed a wholesome understanding of space, volume and space transformation but they lacked the aesthetic sensibility of space design. Due to the nature of other assignments in the other modules, students couldn't dedicate quality time to the second part of the project. With increase in the module hours, the assignment can focus on achieving detailing on interiors as well.

e) LO's suggestion

Table 6: Original and recommended Learning Outcome's (LO's) of the module, 'Spatial Design 1'

Present LO'S	Recommended LO's
LO 1- Observe, document, and apply aspects of the human body in the design of spaces and objects.	LO1 - Observe, document, and apply aspects of the **human anthropometrics and ergonomics** in the design of spaces and objects.

LO 2- Integrate and apply basic volumetric, functional,and aesthetic principles to the design of an individual space.	LO 2- Integrate, apply **and analyse** basic volumetric, functional,and aesthetic principles to the design **of residential spaces.**
LO 3- Respond to simple design briefs with self-critique, reflection, and discussion with peers.	LO3 – **Evaluate** by responding to simple design briefs with self-critique, reflection, and discussion with peers.
LO 4- Create basic abstract diagrams, sketches, and models as tools to generate progressive design options.	LO4 – Create abstract diagrams, sketches, and models as tools to generate progressive design options **from basic to detailed level.**

f) The assessment of the module is divided into two assignment deliverables. The LO's arent given weightage leaving the assessment open ended to the faculty. Assigning weightage to each LO will ensure best outcomes. The rationale of the weightage distribution is derived from the hericarcy of Bloom's taxonomy of cognitive objectives of six levels of learning. LO4 which intends the heightest level ,'create' has been given the heightest weightage of 35%. The LO3 intending , 'evaluation' has been given the second heightest weightage of 25%. The remaining weightage is equally distributed between LO1 and LO2 which equate to the third level of learning, 'apply'making the cumulative of all four LO's to 100%.

Table 7: Recommended weightage distribution to each Learning Outcome for assessment

Assignment	**Assessment Criteria**	**Assessment Tool**	**Recommended ILO's weightage**			
		100%	**LO1**	**LO2**	**LO3**	**LO4**
Assignment 1 Dwelling Space for 1	Subject Folio , Design Proposal , Presentation	40%	20%	20%	25%	35%
Assignment 2 Dwelling Space for Family	Subject Folio , Design Proposal , Presentation	60%	20%	20%	25%	35%

9 Conclusions

Spatial design 1 module develops the student's knowledge and skill through teaching learning activities such as anthropometrics, zoning, volumetric analysis etc which forms the basis of any space design. The students learn the process of design through this module which is a foundation step in the design field. Self-reflection on the internal experiences of new learning helps in meaningful learning (Marton & Booth, 1997). The teaching method used was learning by doing. The students were taken to the site to understand site context and design the space accordingly. The students' feedback was positive with respect to site visit and taking site measurements. Making anthropometric models of space utilization gave the students a clear understanding of space requirements in terms of volume. The students thoroughly enjoyed the design process including making iterations of the possible layouts of space planning. The students enjoyed working throughout the module but time constraints and the nature of activities made it hectic for them to finish the tasks on time. Inspite of time constraints of 64 hours of face-to-face teaching and learning , students were able to achieve the aim of the module. Constructive alignment helped in connecting and integrating all aspects of this module positively. Gaps in the constructive alignment of the module have been identifed and appropriate recommendations have been made to enhance student learning experience such as rephrasing the aim and LO's and assigning weightages to make the assessment process clearer.

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