THE IMPACT OF LEARNING SPACES ON CREATIVITY: A USER PERSPECTIVE ANALYSIS WITH REFERENCE TO STUDIO SPACE DESIGN

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Abstract
The learning process and learning environments have an unbreakable, embodied relationship. In almost all instances, learning environments have a negative or positive influence on the learning process of students. In the first part of this paper, the concept of creativity has been defined using a variety of theories and interpretations, and a comprehensive framework for assessing creativity has been established. The second part analyses literature on creative learning spaces and develops a theory to be used as a guideline in evaluating the quality of such spaces. A detailed description of the methodology in which the research is carried out and how the two frameworks derived in the previous parts connects to this methodology is illustrated by the third part. The study concludes with a user perspective analysis where the perception of the students on studio spaces is used to investigate the relationship between spatial characteristics of space types in studios and intrinsic characteristics of creativity. The results indicate that there is a clear relationship between studio spaces and the intrinsic characteristics of creativity. Therefore, design studios should be specifically designed with careful consideration of prioritized spatial characteristics relating to each space type.

Keywords: Creativity; Architectural design studios; Socio-psychology of creativity; Space types & characteristics; Intrinsic aspects of creativity

1. Introduction

In architectural education, creativity plays a major role. There are numerous definitions for the term creativity, out of which one influential definition is: "Creativity as an outcome should be novel (in terms of being original, unique, and surprising), meaningful, and useful at the same time" (Amabile, 1996). Even though there are numerous definitions to creativity, giving a precise definition to its nature is still a difficult task. This is because, creativity by nature is a subjective condition which is sensorial and forms within the mind of a person. Given that architecture is predominantly a creative process, there is inevitably a strong relationship between the function of architecture and the notion of creativity, although the very nature of that relationship is still difficult to fathom. With respect to architectural education, however, facilitating creative thinking is crucial to the production of future design intellectuals.

This study focused on the dual dependencies identified with respect to the juxta-positioning of architecture and creativity within a learning environment. Even though the main objective of this research was to find out the impact of the design-production spaces on the function creativity, a direct investigation was not possible due to the intangible nature of creativity. The assessment of student creativity can generally be done by using evaluation methods such as creativity tests, portfolio marks, exam marks etc. (both qualitative and quantitative measures). This study does not follow such evaluation methods, simply because of their unreliability and irrelevance to the end objectives. Instead, the study developed an indirect and qualitative analysis method to endorse and verify its findings.

The study thus aimed at defining a methodological framework to evaluate the relationship between the 'function creativity' and a physical space supporting that act of creativity. Secondly, from a specific technical standpoint, the research sought to investigate the relationship between learning environments and the creativity aspect of an architectural design process. The research methodology for achieving these objectives were primarily consisted of qualitative data collection and analysis methods. This particular methodology was identified and formulated to investigate the dependency relationship between spatial characteristics (of learning environments) and the creative process. The research identifies spatial characteristics as the 'extrinsic aspects of creativity' and the subsequent creativity process as the 'intrinsic aspects of creativity'.

There are several extrinsic factors which can create a strong impact on the creativity levels of people. Out of those 'several' factors, this research will only focus on the spatial characteristics of design studio spaces. Furthermore, creativity of the people wise, the research only focuses on the impact of psychological process of creativity, particularly concentrating on how students perceive space with respect to creativity potential. At no point the research evaluates students' direct creative outcomes. In other words, this research has neither focused on any creativity tests to assess the students' creativity outcomes, nor has it evaluated learning outcomes of students in order to measure the subsequent impact of spatial characteristics on creativity. By relying on a user-perspective study alone, the research has limited its assessment to a psychological evaluation on the creativity process. This however is a choice made at the initial definition of the study, where it was deemed as adequate to rely on a user-perspective study to achieve the expected research outcomes.

2. Creativity

2.1 DEFINITIONS OF CREATIVITY

In human psychology, creativity plays a major and significant role. Yet, regardless of its strong association to human psychology, precisely defining and interpreting the term "creativity" is still a huge task for researchers who are involved with studies related to creativity. Such ambiguity in meaning and characterization has led the researchers to build various new definitions and interpretations for creativity in different fields.

Amabile (1996) stated,

> Creativity researchers are often accused of not knowing what they are talking about. The definition and assessment of creativity have long been a subject of disagreement and dissatisfaction among psychologists, creating a criterion problem that researchers have tried to solve in a variety of ways. (p.19)

At the heart of this study's research objectives however is to explore how the social and environmental behavior of and around humans influence on the act of creativity, and how such observation is critical in developing a theoretical base to evaluate the impact of learning environments in the process of creative thinking.

2.2 CREATIVITY_IN_ARCHITECTURAL_EDUCATION_AND_THE_PROCESS_OF_ARCHITECTURAL DESIGN

In architectural education, creativity holds a very powerful position because architecture involves with conceptualizing new ideas. According to Danaci (2015), creativity and design course can be considered as the backbone of architectural education. Further she states that architectural education should facilitate the cognitive thinking which can productively use in the creative process. (Danaci, 2015). According to Nervi & Ricken (1990), "creativity" is an indispensable factor when considered architecture as a work of art. Agreeing with Nervi & Ricken, Willem (1990) stated that the function of designing in architectural education is fundamentally a creative problem-solving process. For, Torrance (1990), on the other hand, creativity can be lifted up to an advanced position through the training in architectural education. All these statements elevate creativity as an essential feature of an architectural educational process.

Understanding the architectural design process is therefore essential when investigating the connection between creativity aspects and the design outcomes of each creative individuals. Mozaffar and Khakzand (as cited in Darmei & Safari, 2017) explained that the design process contains two main characteristics: the first is the essential creative effort, and the second is the close association with drawings. According to Christopher Alexander, on the other hand, there are two main phases of design process, which can be named as analysis and synthesis. Alternatively, RIBA (1973) proposed a three stage design process, namely analysis, synthesis and evaluation.

After understanding that creativity is central to an architectural design process, the definition of a study-specific position for intrinsic aspects of creativity was seen as necessary to move ahead with the research.

To this end, four main creativity related theories leading to the derivation of 'Developed Theory - 01' was studied. Those being:

- Theory 1- Four steps of creativity solving process
- Theory 2- Creativity relevant skills
- Theory 3-Concept of divergent and convergent thinking
- Theory 4-Concept of flexibility and fluency

As such, the 'Developed Theory - 01' was established by evaluating the aforementioned four theories, in order to delineate "**intrinsic aspects of creativity**", which are the essential inner psychological attributes representing one's creativity function. The process in which the 'Developed Theory – 01' was formulated while considering the commonalties of the above 04 theories is illustrated below.

Name of the Theory	Aspects of the creativity process	Key terms	Category
Theory-01 Four steps of creativity solving process (Wallas, 1926)	1. Preparation	1. Ideas in all Direction	Variety of Ideas
	2. Incubation	2. Unconscious Processing	Incubation
	3. Illumination	3. Sudden insight	Illumination
	4. Verification	4.validate the idea	Verification
Theory 2- Creativity relevant skills (Amabile ,1983)	I). Breaking perceptual set		Unorthodoxy
	II). Breaking cognitive set	II).New cognitive pathways	Variety of ideas
	III). Understanding complexities		Understanding complexities
	IV). Keeping responses open long as possible		Non fixed – ideation
	V). Suspending judgement	Link between Diverse ideas	Variety of ideas
	VI). Using "wide" categories		
	VII). Remembering accurately		Remembering accurately
	VIII). Breaking out of performance scripts	Break out well used scripts	Unorthodoxy
	IX). Perceiving creativity	Perceive something differently	Unorthodoxy
Theory 3-Concept of divergent and convergent thinking (Guilford, 1967)	i). Divergent thinking	Large quantity And variety of ideas	Variety of Ideas
	ii). Convergent thinking	Narrowing down To one solution	concentration
Theory 4-Concept of flexibility and fluency (Guilford, 1967)	a). Flexibility	Variety of ideas, Diverging into different direction.	Variety of ideas
	b). Fluency	Quantity of ideas	Quantity of ideas

Figure 1, Analyzing similarity between selected four (04) theories (Source: Author)

Accordingly, the 'Developed Theory -01' consists of eight intrinsic aspects of creativity, which can be identified as follows:

1. Novel initiation
2. Incubation
3. Illumination
4. Verification
5. Non -fixed ideation
6. Accurate memory
7. Understanding complexities
8. Concentration

3. Learning Spaces

3.1 DEFINITIONSOFLEARNINGSPACESANDTHEIR CONNECTIONTOARCHITETURALEDUCATION
Giving a precise answer to the particular question of "what is a learning space" is quite a difficult task. Because, the answer can spread across a large area of spatial and cultural commodities. As an example, a learning space can be a classroom, an auditorium, a studio, or a conference room; but it can even be a few benches under a tree. In that case, learning spaces can generally be divided into two categories:

formal learning spaces and informal learning spaces. According to Oblinger (2006), a physical and virtual space, which creates an impact on learning process, can be defined as a learning space. Further, she describes that the learning space is a place that generates human interaction while simultaneously satisfying the explorations and collaborations of a learning outcome (Oblinger 2006). This definition has attempted to break the conventional conception of a learning space, which often focuses on the physical aspects of it.

Learning spaces in Architectural education has clear distinction when compared to other subject fields. The main reason for that is the unique nature of architectural learning process. Mainly, the architectural learning process contains of design teaching on the one hand, and studying theory subjects on the other hand. In such case, the learning spaces will have to be different when they cater to one function as opposed to the other. Generally, design studio spaces are used for design teaching and the subsequent exploration of architectural design, and classrooms are used as the learning spaces of relevant subjects.

According to conducted research, there are sixteen (16) spatial characteristics of a learning space, which can create an impact on the student's creativity (Thoring et al., 2017). These sixteen (16) spatial characteristics are:

1. Atmosphere
2. Climate
3. Colours
4. Flexibility
5. Furniture
6. Health issues
7. Light
8. Location
9. Materials
10. Objects
11. Plants and flowers
12. Room Layout
13. Smells
14. Sound
15. Technology
16. View

3.2 LEARNING SPACES SUPPORTING CREATIVITY

Many researches have proposed that learning spaces should support the student's creativity and the traditional classrooms should change accordingly. Thoring et al. (2017) introduced a theory called 'typology of creative learning spaces' to describe the connection between learning spaces and creativity. This consists of five 'space types' and five 'spatial qualities'. The second theory selected to emphasize the study-specific position on creativity-supporting learning spaces consists of twelve propositions about the impacts of space on the function of creativity. (Thoring et al. 2017)

SPACE TYPES

1. PERSONAL SPACE allows for concentrated "heads-down" work (thinking, reading, writing), deep work, and reflection; needs a reduced stimulation to avoid distraction

2. COLLABORATION SPACE is used for groupwork, workshops, face-to-face discussions or student–teacher consultations

3. PRESENTATION SPACE is used to share, present, and consume knowledge, ideas, and work results in a one-directional way (oral presentations or exhibitions)

4. MAKING SPACE is used for modelmaking and building stuff; allows experimentation, play, noise, and dirt

5. TRANSITION SPACE connects the other space types; is used for breaks and transfers; includes hallways, staircases, cafeterias, and outdoor areas

SPATIAL QUALITIES

A: ORGANISATIONAL CULTURE space suggests a specific behaviour, either through common sense, rituals, labels and signs, or written/unwritten rules

B: KNOWLEDGE PROCESSOR space can store, display, and foster the transfer of information and knowledge (tacit, explicit, embedded knowledge)

C: STIMULATION space can provide certain stimuli (views, sounds, smells, textures, materials, etc.)

D: SOCIAL INTERACTION space influences social interactions and facilitate meetings and personal exchange

E: INFRASTRUCTURE space can provide specific spatial structures or technical infrastructure which might guide or hinder the work process

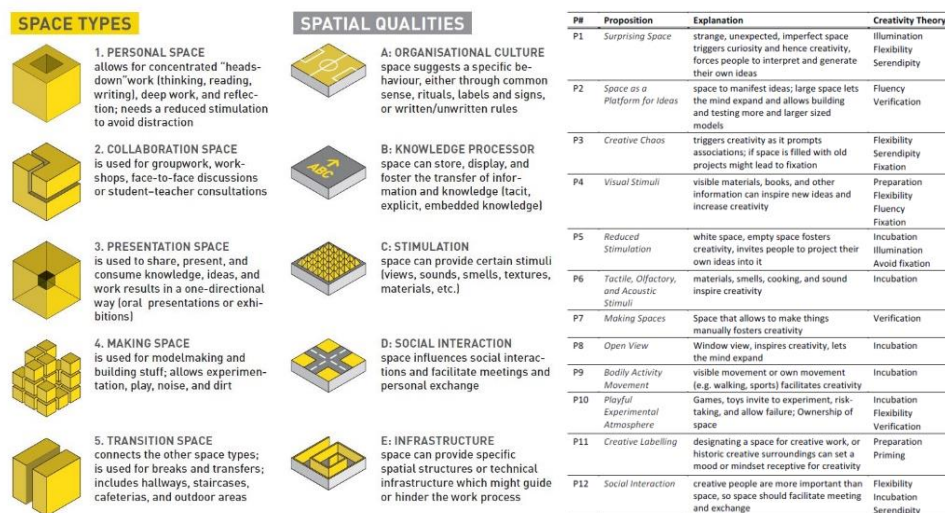| P#	Proposition	Explanation	Creativity Theory
P1	Surprising Space	strange, unexpected, imperfect space triggers curiosity and hence creativity, forces people to interpret and generate their own ideas	Illumination Flexibility Serendipity
P2	Space as a Platform for Ideas	space to manifest ideas; large space lets the mind expand and allows building and testing more and larger sized models	Fluency Verification
P3	Creative Chaos	triggers creativity as it prompts associations; if space is filled with old projects might lead to fixation	Flexibility Serendipity Fixation
P4	Visual Stimuli	visible materials, books, and other information can inspire new ideas and increase creativity	Preparation Flexibility Fluency Fixation
P5	Reduced Stimulation	white space, empty space fosters creativity, invites people to project their own ideas into it	Incubation Illumination Avoid fixation
P6	Tactile, Olfactory, and Acoustic Stimuli	materials, smells, cooking, and sound inspire creativity	Incubation
P7	Making Spaces	Space that allows to make things manually fosters creativity	Verification
P8	Open View	Window view, inspires creativity, lets the mind expand	Incubation
P9	Bodily Activity Movement	visible movement or own movement (e.g. walking, sports) facilitates creativity	Incubation
P10	Playful Experimental Atmosphere	Games, toys invite to experiment, risk-taking, and allow failure; Ownership of space	Incubation Flexibility Verification
P11	Creative Labelling	designating a space for creative work, or historic creative surroundings can set a mood or mindset receptive for creativity	Preparation Priming
P12	Social Interaction	creative people are more important than space, so space should facilitate meeting and exchange	Flexibility Incubation Serendipity

Figure 2, Space types (Source: Thoring et al)

Through the incorporation of related theories, an attempt was made to establish a relationship between creative learning spaces and intrinsic aspects of creativity. Subsequently, the 'Developed Theory – 02' was established to investigate **"the relationship between creative learning spaces (space types) and the intrinsic aspects of creativity** (identified by Developed Theory – 01 earlier)."

The process in which the 'Developed Theory – 02' was formulated after finding the similarities of Thoring et el's two (2) theories and their collaboration with the 'Developed Theory – 01' is given below.

Figure 3, Analyzing the similarities between two (2) selected theories of Thoring et al (Source: Author)

Intrinsic aspects of creativity	contributing creative space types
1. Novel initiation	A/B/C/D/E
2. Incubation	A/B/C/D/E
3. Illumination	A/D/E
4. Verification	B/C
5. Non -fixed ideation	A/B/C
6. Accurate memory	E
7. Understanding complexities	A/E
8. Concentration	E

In here:

A= Collaborative Space
B= Presentation Space
C= Making space
D= Transition Space
E= Personal space

4. Methodology

4.1 COLLECTION OF DATA

This research weaves around two (02) main data collection rounds. In the Preliminary data collection round (general observations and open-ended questionnaire) a number of fifty (50) architecture students from the level 5, B.Arch. degree program at University of Moratuwa formed the population sample undertaken for the user perspective analysis. The main objective of this data collection round was to collect more original, genuine and non-specific comments on the character of the design studio spaces. That step helped understanding and defining the methodological directions the research followed in its eventual unfolding.

In the secondary data collection round, a close-ended questionnaire was given to a 25 number of focus group, which has been selected by evaluating the findings of the preliminary data set. The objective of

this data collection round was to find out more specific details about the spatial characteristics of design studio spaces and their impact on the function of creativity.
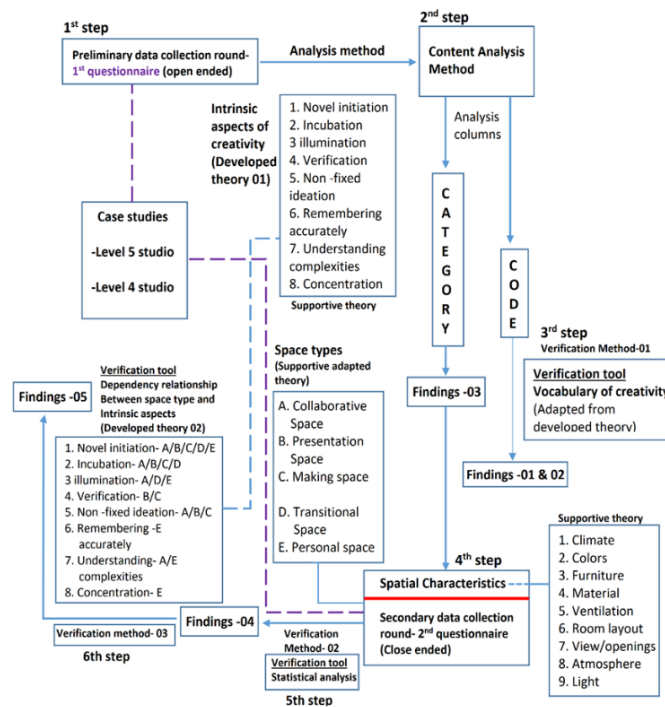

Figure 4, Detailed research program (Source: Author)

4.2 VERIFICATION AND ANALYSIS OF DATA

In the verification of the research findings, the study followed the 'content analysis method'. In the first step of this analysis, preliminary data collected from 50 undergraduate architecture students were evaluated using the afore-mentioned 'content analysis' method. This contained two main steps as follows:

1. Deriving codes
2. Categorizing the codes

The subsequent analysis of the research has followed three main verification methods and tools.

1. Verification method 1- use the "vocabulary of creativity" (adapted from Developed Theory-01) as the verification tool
2. Verification method 2 - use the statistical analysis methods as the verification tool
3. Verification method 3 - use the 'Developed Theory - 02' – i.e., Dependency relationship between space type and intrinsic aspects - as the verification tool.

The following diagram illustrates the usage of adapted and developed theories in data collection rounds and verification process, and the subsequent research program of the overall study.

5. Case Study Analysis

The case study investigation pursued for this research was predominantly a user perspective analysis, where the preliminary and secondary data collected from the two selected case studies were analyzed to obtain research findings. The two selected case studies were Level 5 architecture design studio and Level 4 architecture design studio located at the University of Moratuwa. As mentioned earlier, the preliminary data (user perspective data) derived from each case study was evaluated under the content analysis method. Following this - as the second step of the analysis - the results of content analysis were verified under the Developed Theories 01 & 02. The third step of the case study analysis was to evaluate

the statistical content of the secondary data. Afterwards, the results of the statistical analysis were verified under the Developed Theory -02 to establish the final conclusions of the research.

5.1 CASE STUDY 1: LEVEL 05 ARCHITECTURE STUDIO

Level 5 architecture design studio is located in the ground floor of the "Sumanadasa" building at University of Moratuwa. It usually accommodates over 50 architecture students. The user perspective analysis of this design studio consisted of two methods of analysis.

1. Content analysis of preliminary data
2. Statistical and theoretical analysis of secondary data

50 samples were selected for the content analysis, which resulted in the identification of 26 codes. The identified codes from the above analysis were then divided into the code types. As the third step of the content analysis, the identified codes were classified into categories. According to that, ten (10) categories were founded as outlined below.

1. Functionality of the space	6. Outcomes
2. Physical impact of the space	7. Climate
3. Psychological impact of the space	8. Atmosphere
4. Color	9. Furniture and layout
5. Views	10. Concentration

Selected codes from the 10 categories were then used to evaluate and verify the connection between the learning space (as a whole) and intrinsic aspects of creativity.

For the statistical and theoretical analysis, the data from the questionnaires were used to find out the specific relationship between intrinsic aspects of creativity and spatial characteristics of the design studios. The first part of this secondary data analysis was conducted through a statistical analysis. The second part includes a theoretical analysis which has been carried out by referring to the 'Developed Theory – 02'.

5.2 CASE STUDY 2: LEVEL 04 ARCHITECTURE STUDIO

Level 4 architecture design studio is located in the fourth floor of the "Sumanadasa" building at University of Moratuwa. It also generally accommodates over 5 architecture students. As with the level 05 studio, the user perspective analysis of the level 04 studio followed two analytical methods:

1. Content analysis of preliminary data
2. Statistical and theoretical analysis of secondary data

50 samples were selected for the content analysis, which yielded in the detection of 24 codes. The identified codes from the analysis were then divided into the code types. As the third step of the content analysis, the identified codes were classified into categories, which were the same as the analysis on the level 05 studio. As with the level 05 studio, the steps were repeated for the statistical and theoretical analysis using the data obtained from questionnaires.

5.3 SUMMARY OF THE STATISTICAL AND THEORITICAL ANALYSIS OF THE TWO CASE STUDIES

The ideal conditions of spatial characteristics for space types were founded to be different from one space type to another. When considering the two case studies, similar ideal situations were found in some spatial characteristics, while others were different in terms of their impact on the function of creativity.

When considering the both case studies, the most important and prioritized spatial characteristics that contribute to the formulation of each specific space type were identified separately.

6. Conclusions

The findings of this particular research have addressed different resolution levels. The findings of content analysis, which were particularly related to the user perspective analysis of level 4 and level 5 studios, have established resolution levels of low and medium conclusions. According to those particular results, it was found that the overall studio spaces have created a clear and direct impact on the several intrinsic aspects of creativity. The confirmation of the hypothesis that the function of creativity is indeed impacted by the character of learning spaces (studios) can be considered as a low-resolution conclusion, while the identification of directly impacted aspects within the creativity component - such as non- fixed ideation, concentration, incubation, novel initiation, illuminance and accurate memory, etc. - can be identified as a medium-resolution conclusion. Furthermore, the user perspective analysis has clearly shown evidence supporting the fact that the overall creativity is directly and indirectly affected by the conditions of the studio spaces. The established 26 code types and 10 categories, while directing to a broader understanding of the creativity component, have proven the aforementioned connection between creativity and space.

After establishing low- and medium-ranked conclusions, the secondary data analysis was used to generate high-resolution conclusions, which were instrumental in proving that the specific space types catering to the intrinsic aspects of creativity should be meticulously designed by incorporating the relevant spatial characteristics. Furthermore, the developed theoretical frameworks introduced in this research are expected to be used in the advancement of the fields of architecture and psychology. Indeed, such research should be introduced as tools for designing student-friendly studio spaces, which would foster the creativity of students and make their learning experience stress free, effortless and productive.

7. References

Amabile, T. M. (1996). *Creativity in Context*. Boulder: Westview Press.

Daemein, A., & Safari, H. (2017). Factors affecting creativity in the architectural education process based on computer-aided design. *Frontiers of architectural research, 7*, 100-106. doi: 10.1016/j.foar.2017.09.001

Danaci, H. (2015). Creativity and knowledge in architectural education. *Procedia Social Behavioural Science*, 1309-1312.

Nervi, L. And Ricken, H. (1990), *Der Archkitekt-Ein Historisches Berufsbild*, Deutsche Verlag Anstalt

Oblinger, D. G. (2006). *Learning Space*. Boulder, Colorado: Educause.

RIBA. (The RIBA Publication). *Hand Book of Architecture*. London: 1973.

Thoring, K., Goncalves, M., Mueller, R., Badke, S., & Desmet, P. (2017). Inspiration Space: Towards a theory of creativity-supporting learning environments. *Research perspectives on creative intersections: Design Management Academy Conference*. Hong Kong. doi:10.21606/dma.2017.19