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Innovation Crisis in Design Studios: Whom to Blame?

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ABSTRACT

Design is a social phenomenon and researchers suggest that communications and negotiations between designers are essential to initiate creativity. Within the design studio environment, the social interaction and design negotiations between students and tutors and with their mates is influenced by a number of factors that hinder students from fully utilizing it in the design scheme. Design studios' students from the third to fifth year at the College of Architecture, UoD were surveyed the influences on the production of innovative design projects. The research found a number of potential interrelated factors that would play a negative role in hindering student's creativity. However, to develop students' design/ innovative abilities, the researcher recommends that certain measures should be considered. These would include the use of innovative design precedents, development of students and tutors' communications skills, and transformation of the design studio into interactive and friendly learning environment that motivate students to produce innovative design projects.

Keywords: creativity, innovative projects, design negotiations, creative environment.

INTRODUCTION

Architecture studio's education involves a number of varied activities. Before the project begins, the tutor'(s) establish the objectives, procedures, process, and assessment criteria he/ she will employ for the project. During each semester, tutors meet students either individually or in groups for design related discussions and clarifications. The design studio should not be considered as safe haven - as one would imagine- as conflicts regarding design ideas are very likely to take place between students and tutors and between tutors themselves. This research is driven by growing complains of the design studios' tutors from department of Architecture, College of Architecture, UoD about the low design abilities of students. Tutors from all academic levels repeatedly claim that students produce design projects but very few of them can actually produce innovative projects (the author 2009, personal contact 2009). Previous research points out possible causes that influence the education outcome thus innovation. It indicates that in many instances, the teacher serves as the "fount of knowledge" and the students are the empty, open containers anxiously awaiting knowledge to be poured in. Conversely, teachers may tend to be autocratic, repressive, and do little to encourage individuality creativity and many classrooms lack democracy, and students fear their teachers (Davis, Kogan& Soliman 1999). On the other hand, interactive and creative skills play an essential role in initiating/ fostering creativity (Casakin 2007, Johannessen et al 2011), thus, the absence or the shortage of these skills would diminish creativity. A number of approaches have been suggested to improve the design studio's teaching. Edmonds et al (1999), Fischer (2003), Mamykina (2002) and Shneiderman (2000) have put emphasis on collaboration and the social interaction/ dialogue to initiate creativity. Paker (2007) suggests that the role of the studio tutor is to create an organizational style in studio education and this would help in developing creative strategies in the design studio. This encourages educators to spark creative ideas, encourage follow-up of creative ideas, and evaluate and reward creative ideas (Sternberg& Lubart 1991). This research explores the social factors that would hinder/ support the production of innovative design projects. It examines how these factors interact within the design studio's environment to impact innovation.

Therefore, the objectives of the research were set as the following:

1.   To find out communication routes and techniques that they use to get innovative ideas and feedback

2.   To explore the social hindrances and drivers for innovation in the design studio; and

3.   To make recommendations

In regards to the research objectives, a combination of quantitative and qualitative research methods was used. The use of mixed methods is because the findings that relate to each method will be used to complement one another and to enhance theoretical or substantive completeness (Morse 1991). One hundred and ninety four male students from College of Architecture and Planning, year 3, 4 &5 were targeted with a questionnaire that asks about tools, systems and conditions that help in producing innovative products. Forty eight replied back which constitute 25% from the total number of 3-5 year's students. Two software are used to analyse the quantitative data; SPSS 16 and AMOS. The following statistical tools were used to analyse the data: Mean calculation, percentage, and path co-efficient. Consecutively, nine students were interviewed. The target of the interviews is to validate the questionnaire survey results and clarify ambiguous points.

CREATIVITY AND THE DESIGN STUDIO

Creativity Definition

Creativity term is used to reflect a psychological view of creativity on a personal level in contrast to innovation as used in the world of business on an organizational level (Sternberg and Lubart 1999). Innovation traditionally focused on products and processes. Hargreaves (2000) suggests that *'you can have creativity without innovation, but you cannot have innovation without creativity'*. Warr (2007) examines the work of a number of researchers such as Ford & Harris (1992), Starko (1995), Eisenberger & Cameron (1998) and Sternberg (2001), and points out that there was no definite consensus regarding how creativity is defined. He finds out that the creative process

looks different to different researchers. There is general agreement among researchers that the act of creation does not occur as a fixed point in time, but that it is manifested as a process that extends through time, varying in duration (Ford& Harris 1992). Rogers (1995) defines an innovation as "an idea, practice, or object that is perceived as new by an individual or other unit of adoption". Diffusion is "the process by which an innovation is communicated through certain channels over time among the members of a social system" (Rogers 1995).

Creative Design Projects

Mumford (2003) defines creativity as the production of novel, useful products. In the fields of art and literature, originality is considered to be a sufficient condition for creativity, unlike other fields where both originality and appropriateness are necessary (Amabile 1998, Sullivan and Harper 2009). So can we define creative architectural projects as the production of novel, useful, and original architectural projects. Such definition may look too general. Within the design studio context, the definition of creative architectural projects would be constrained/ featured by the goals/ objectives and prospected outcomes of the design studio course. Gero &Maher (1993) argue that ground breaking designs are those which possess innovative and creative qualities; and provide solutions that were previously unknown (innovative design) or subsequently produces entirely new products (creative design). To find out the features of creative design within the design studio context, a small survey was undertaken by the present researcher in 2009 on the design studio tutors and students to find out the importance of a number of design features in considering an architectural project as innovative. The survey showed the important aspects - arranged from more to less important, are as the following:

1. A creative functional solution
2. A solution that is in a harmony with the climate and Environment
3. A design solution that effectively address building users' needs
4. Successful response to the site parameters
5. Aesthetic treatment of Plans, elevations and form
6. A design solution that consider other design aspects such as user safety and security

7. A integration and harmony level between the 3D components of the form
8. Unique structural solution
9. A design solution with a high economic value

The tutors however, have set more emphasis on all design aspects than students and the difference in the importance weight between students and tutors is not always the same. This may cause possible conflict between students and tutors as each party has his views regarding the creativity weight of each design aspect. However, different outcomes would be resulted if the same survey is done on other colleges of Architecture around the world so what is considered as the most creative aspect here, would be/ not considered of the same creativity weight elsewhere.

Creativity and Architectural Design Pedagogy

One would suggest that the production of creative design projects is affected by the learning/ teaching styles. There are a number of teaching/ learning styles suggested by researchers (see for instance Riding 2002 and Kolb 2000) to initiate the exchange of knowledge between the student and the tutor. However, there is no uniform teaching pedagogy in higher education as there are substantial differences in the pedagogical language and theories used in higher education (Coffield et al 2004). Also, there is very little interaction between these differing approaches (the same source). Moreover, the architectural design pedagogy focuses more on form issues, while oversimplifying programmatic and contextual contexts within which buildings are created (Salamah 2005). This may suggest that the use of conflicting and unrelated teaching styles in the design studio and the incorrect focus of the design teaching would diminish creativity. Ostwald and Williams (2008a; 2008b) explore the relation between creativity and design education. They identify three key problems related to creativity and design education: firstly, there is a lack of understanding of the pedagogical dimensions of creativity in architecture and design; secondly, there is a lack of appropriate strategies to understand where different levels of creativity occur and how they should be assessed; and, thirdly, there is a lack of appropriate models or tools to support the assessment of the creative component of design. The student participants in the study argued that over-defined learning and assessment outcomes "stifles" their opportunities to be

creative and which teachers fail to recognise their creative efforts (Ostwald and Williams 2008a).

Creativity and the Design Process and Communications

The architectural design studio offers a prime example of a collaborative, multi-sensory, learner-centred, constructivist, experiential problem-based teaching environment (Kurt 2009). The education in the design studio stimulates its' characteristics from the nature and process of architectural design. The development of architectural project from the initial concept to the end product is an interactive social and psychological process. Through this process, the designer negotiates various solutions of the design problem with oneself and communicates ideas with colleagues and tutors. Gennari and Reddy (2000) describe the design process as, 'human activity, involving communication and creative thought among a group of participants'. The design process consists of a number of stages and these are suggested as: analysis, synthesis, appraisal and evaluation (Lawson 2006). These stages are linked with forward and backward loops. Lawson (2006) points out that the design process is a simultaneous learning about the nature of the problem and the range of the possible solutions. The designer repeatedly evaluates and alters the design scheme and would return back to the previous or to the start stage to find/ test a solution for the whole or a part of the design scheme. Lawson (2003) argues that experienced designers see some kind of underlying pattern or theme and made connections in a design situation (between design aspects) and also make a connection with some precedent in the episodic memory more than inexperienced designers. Expert designers acquire knowledge about solutions rather than necessarily about problems (Lawson 2003). This design approach style would initiate creativity as: "it is probably commonly accepted in design that creativity involves making use of solution ideas from apparently superficially different situations" (the same source). Casakin (2007) argues that designers should explore unfamiliar and unconventional design solutions. They need however creative skills that enable them to transcend conventional knowledge domain(s) so as to investigate new ideas and concepts which may lead to innovative solutions. It enables the designer to perceive a problem from unorthodox and innovative perspectives (Casakin, 2007). When conventions are challenged, design moves from routine solutions towards innovative, non-routine solutions. Though design activities encapsulate the spectrum

from routine to non-routine design, the ground breaking designs are those which possess innovative and creative qualities; that is, design that changes the design variables in such a way that the results are solutions that were previously unknown (innovative design) or design that introduces new variables and that subsequently produces entirely new products (creative design) (Gero & Maher 1993).

Innovative / Creative Conditions and the Design Studio Environment

Within the professional context, it is suggested that the cultural communication secures the exchange of experiences, the learning outcome and the innovation in the project and this is a function which is strongly de-emphasized in project contexts, both in the literature and in practice (see Ekstedt, Lundin, Søderholm & Wirdenius 1999). Social communication is meant to balance stability and change in order to promote dynamism, creativity and innovation (Johannessen et al 2011). Knowledge development in itself is crucial for innovation (Hamel 2006). Creative environments are generally described as organizations that enable the production of knowledge, facilitate learning from experience and from one other; thus provide knowledge sharing (Parkinson & Robertson 1999). Ekvall (1991) suggests that broad requirements for a creative climate include:

1. Open, participative culture (rather than suspicious, closed)
2. Having an idea-handling system
3. Whole workforce involved in idea generation
4. Whole organizational Endeavour (through pockets of innovation can emerge and survive)
5. Experiment-encorement
6. Forgiving culture, patience with failure, trust
7. Conflict-handling through debate and insight rather than warfare
8. Networking and sharing systems
9. System of incentives
10. Multidisciplinary working
11. Research and development investment and
12. Some champions (for any change but particularly for newer ideas)

Sternberg and Lubart (1991) observe that in order for creativity to exist, the environment needs to be supportive and rewarding of creative endeavours. The design studio's environment is unique and it is the core of architectural education. The design studio however assumes the mastery of the instructor and the student has to believe in the power of the instructor (Salama,h 2005: Schon, 1980s). This is despite that design instructors are not clear about their studio goals or objectives and will change them from the beginning of the studio and during the assessment process (Seidel 1994). Furthermore, they tend to consider teaching practice to be an intuitive process based on subjective view points and personal feelings (Salama, 1995). The teaching and judgement of design creativity inevitably relies on the instructor's subjective understanding of creativity. This, in turn, may potentially diminish transparency and consistency in teaching and assessment practices, and students may find themselves confused as to the requirements of their creative tasks (Williams et al 2010). Eventually, current studio culture rewards students with the best looking projects (AIAS 2003, see also table 1). The teacher should show appreciation and approval of the students courage. Moreover, the teacher must encourage students to integrate production with perception and reflection, to engage in self-assessment and to be open to feedback from teachers and peers (Williams et al 2010). The literature review has very briefly highlighted the complexity of the creative design process, communications and environment. Also, it illustrates the impact of social factors on the exchange of knowledge and development of creative abilities of students. This research tests this possible impact of social factors within the context of design studios of college of Architecture, University of Dammam. The field survey aim is to find out the most important factors and how they are interlinked and influence innovation in the design studio.

Table 1: Potential Hindrances to Creativity

Context	Design pedagogy	Design instructors & design studio culture
Design studio environment	The architectural design pedagogy focuses more on form issues, while oversimplifying programmatic and contextual contexts within which buildings are created (Salamah, 2005) There is a lack of: a. understanding of the pedagogical dimensions of creativity in architecture and design; b. appropriate strategies to understand where different levels of creativity occur and how they should be assessed; and c. appropriate models or tools to support the assessment of the creative component of design (Ostwald and Williams 2008a; 2008b). Over-defined learning and assessment outcomes "stifles" the students' opportunities to be creative and that teachers fail to recognise their creative efforts (Ostwald and Williams, 2008a).	Design instructors are not clear about their studio goals or objectives and will change them from the beginning of the studio and during the assessment process (Seidel, 1994) Instructors tend to consider teaching practice to be an intuitive process based on subjective view points and personal feelings (Salama, 1995) The teaching and judgement of design creativity inevitably relies on the instructor's subjective understanding of creativity. This, in turn, may potentially diminish transparency and consistency in teaching and assessment practices, and students may find themselves confused as to the requirements of their creative tasks (Williams et al 2010) The design studio assumption of the mastery of the instructor thus the student has to believe in the power of the instructor (Schon, 1980s) Current studio culture rewards students with the best looking projects (AIAS, 2003)

THE FIELD SURVEY RESULTS

The Questionnaire's Survey Results

Respondents considered the following information resources as most useful resources that help in producing innovative projects and these are ranked according to their usefulness (from more to less useful): tutor's feedback and advice; discussions with your colleagues from the same year; and the projects of higher year student's. Whereas they said that the following information resources are the least useful: projects of the same year students; and the hard copy and electronic references of the University library. The most frequent activities and communications of students that happen in the design studio during the term time are the followings:

1.   The generation of many sketches before making up mind while working on a design problem

2.   Doing interactive and useful dialogue with tutors on how to reach to a creative design solution

3.   Capturing innovative ideas of colleagues of the higher academic level from other departments

4.   Not taking many risks because of the fear of failure

    Whereas the least frequent activities and communications of students are:

1.   Seeking the students and staff from different departments to help in solving specific design problems

2.   Capturing innovative ideas of the same academic year colleagues from different departments

3.   Capturing innovative ideas from other departments' tutors

It seems that the design studio is governed mainly by two types of activities/ behaviours (see table 2). One of these seems positive which is the student's frequent use and integration of different communications activities and techniques to initiate creativity and innovation and the other seems negative which is the tutor dominance on the design process. Students said that tutors mostly encourage them to: do many trails to develop the design solution, follow various design approaches to reach to an innovative solution, and to present a creative design solution. However, around one third of students said that strategies to motivate and initiate innovation are rarely applied in design studio and conflicts are hardly handled through constructive dialogue. The most frequent support that students get from the tutors is regarding the following cumbersome situations (arranged from more to less): the attempt to change the whole design solution during the design process, confusion over the nature and context of the design process, the attempt to change the approach to a design solution during the design process and misunderstanding of some project requirements. The least frequent support that students get from the tutors is regarding the following cumbersome situations: little knowledge of students regarding one of the design aspects and misapplication of one of the design requirements.

Table 2: The Frequency of Activities and Communications that Happen in the Design Studio during the Term Time
(scale: 0 does not happen, 4 always happen)

Criteria	Type of communications and activities within the design studio	Mean value
Design studio environment	The tutor's ideas have the greatest weight on the design process	3.5
	We always use and integrate different tools to initiate creativity and innovation (e.g. brainstorming, group work, etc.)	2.77
	The design studio environment is govern with an open, participative culture	2.6
	The design studio environment is govern with forgiving culture, patient with failure and trustful	2.6

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Instructors	My tutors encourage me to do many trails to develop the design solution	3.29
	My tutors encourage me to follow various approaches to reach to an innovative solution	3.16
	I am praised and rewarded when I present a creative design solution	3.10
	My tutors work on developing my innovative ideas	3.04
	My tutors give me the complete freedom to do innovations	3
	Strategies to motivate and initiate innovation are applied in design studio	2.89
	The tutors successfully handle conflict through constructive dialogue	2.875

The Co-efficient Path Results

Only co-efficient path relations that have significance value (i.e.<0.05) are reported here. The co-efficient path results show that when the frequency of tutor's support regarding some cumbersome design situations of the tutor increases, the student's performance (represented by the final grade) of the student improves. The results show that when the instructors encourage the student to follow various approaches to reach to an innovative solution more frequently, the student would be more able to proceed from one design stage to another smoothly and to make radical changes to the design solution. Also, when students do more interactive dialogue with their instructors on how to reach to a creative design solution and attempt to capture innovative ideas from colleagues in the same and higher academic level, they would be more able to: quickly understand the design problem, do quick analysis of the design problem, set quick conceptual design solution and to do fast appraisal of a design solution and their grades. Students who seek students and staff's help and capture innovative ideas of colleagues of the same academic level from different departments more frequently, would be more able to make radical changes to a design solution. Eventually, when design studio environment is govern with forgiving culture, patient with failure and trustful more frequently, the student would be able more to do quick analysis of the design problem, fast appraisal of a design solution, and proceed from one design stage to another design stage smoothly. On the other hand, the co-efficient path results revealed some odd results.

For example, more frequent support of the tutor regarding the student's uncertainty about a design aspect and misapplication of a design concept affects negatively the student ability to do fast appraisal of a design solution thus his design grades. Further investigation was undertaken to clarify the questionnaire results.

The Interviews Results

The interviews showed that communications and social interaction problems exist on a number of fronts i.e. the tutor, the student and the design studio environment.

The student: One student mentioned that the design process requires extensive knowledge of certain types of design information and if the student does not have this knowledge, he cannot produce good design scheme. Another student said that some students do not like to radically change the design concept unless the tutor asks to do so. On the other hand, some students have low design abilities; they are stubborn and unwilling to change the design scheme even if the tutor has asked them to do so. The tutor would spend considerable time and effort with these students without any progress, thus got depressed and start trying to enforce the student to follow certain design scheme. On the other hand, some students do not trust the design abilities of their tutors! One student said: "I take the alterations to my design scheme that is suggested by one tutor to another so I would find out what is the opinion of the other tutor about these alterations, thus try to co-ordinate between their opinions". Some students –even in the final year- have a communication problem with the tutors. They do not know how to communicate with them and how to discuss design issues with them.

The tutor: Students complained about the following aspects that are related to the teaching methodology and tutors' behaviour. The study found the following issues that are related to tutors:

1. *Support amount, type, timing and clarity:* Guidance at the start of the project development is very important. A student said that intensive guidance is mostly needed at the initial stages of design. However, the guidance is sometimes not clear as some design parameters are missing. This is because of some tutors who do not explain it in the

right way, or they do not even mention it. Some tutors guide his students to a certain way of developing the design scheme, but they describe it in a way that students do not get the message and do not know what their tutors aim to reach. During the design negotiations, some tutors do not clarify what is the nature of the design problem, and where to start to sort it out. They ask students to explore various approaches without giving sufficient guidance of where and what to explore. The student continues: *"the problem is that the tutor would ask us to change the design concept without giving a convincing reason or point out exactly where the problem exists"*. Some tutors give unclear critiques to the design scheme and demand radical changes. One student says: *"tutors might say develop any design scheme and we will help you to develop it further. At the end, you discover that you return to square one as you bring a complicated design scheme that they cannot comprehend and this gives them an opportunity to reject it or to heavily criticize it"*. During the design process, tutors – sometimes- provide support on an inappropriate time i.e. too late or too early, thus it affects the project's quality, the student psychological condition and his final grade. Another student mentioned that the tutor should start from where the student has already designed and he should not impose his own ideas. Tutors should show some design precedents to students and explain about various negative and positive aspects of the project's design. Thus students would have background on how professional architects deal with each design problem and how they sort it out. Tutors should develop awareness of the student's abilities (i.e. weakness and strengths) thus provide support that is tailored to each student's ability. They should motivate and encourage students and this can be in kind of praises, bonuses and incentives.

2.   *The tutor's performance and way of communications with students:* A student said that the atmosphere of the design studio is friendly – in general- but some tutors occasionally intimidate students. This would affect badly the student's attitude and quality of work. In some instances, some tutors do not like the initial design concept and they accuse the student that he does not want to learn. The style of instruction is sometimes humiliating and aggressive as some tutors make fun of the student. In regard to communications, some tutors are less able and slower to communicate with students. The matter is not

about the communication frequency but about communicating ideas and one student claimed that the tutor's imagination of the design outcome differs from that of the student. So one may reach the end of the semester and the tutor would say suddenly to him that he has a bad design scheme. One student said that a tutor may suggest an idea to the student who is unable to develop it. The student may interpret the tutor suggestion in a wrong way thus apply it wrongly.

3.   *Level of flexibility of the tutor's thinking:* Some tutors do not have flexibility of thinking. It is hard to convince them of a design solution as they see that it does not comply with their thinking and approach to sort out the problem. Thus they are unwilling to help the student. They would rather ask the student to change the design scheme to something that they are willing to negotiate. Some tutors are also unable to discover the innovative aspects in the student's design. They insist on their own ideas and when a student represents his ideas to them, they hesitate to accept it. The interviews revealed that students follow their tutor's opinion not because it is convincing and rational but as the tutor has a good chunk of the total grade.

4.   *The tutor's commitment and knowledge:* Some tutors are committed and helpful whereas others are not. There is support during the start and the end of the project whereas it is not stable and changeable at the middle of the project. In regards to the level of design knowledge, some tutors do not know –for example- how to apply sustainability in a practical way into the design scheme.

The design studio's environment: The design studio's environment has its' problems and students claim:

1.   *The lack of democracy at the design studio and college level:* Students do not feel that they are an integral part of the college as they are not allowed to participate in the college's making decisions. This reflects badly on the student's psychology and his relation with the college's staff. The students claimed that the design studio is governed and restricted with unwritten conditions and laws that hinder innovation. One student said that he feels that the College is segregated. He continued: *"we do not know what each tutor teaches. Also we do not*

know which department other students belong to, and their academic strength areas that we can utilize".

2. *Lack of support from colleagues, other departments' tutors and students:* The communications and discussions within the design studio help in developing the design scheme. Some students stay and work at the College even during the night. There is daily communications. A fifth year student said: *"when I do a design scheme, I show it to another colleague who give me his feedback. This also happens to me as students from second and third year come to me and get advice. Even if the student did not follow what has been discussed, he would utilize from the methodology and the way of thinking and how to make judgments etc."* The communications with other tutors and students is good as a student commented: *"the higher year students would give you advice and show you another approach or easier way to sort out design problems".* However, there is weak and infrequent communications with other departments' tutors and students.

DISCUSSION

This study -supported by the previous research- shows that the social settings of the design studio play an important role in the life of architectural students and influence their creativity. The field survey highlights the potential factors that would affect innovation in design studios. These can be categorized into initiation and constraints factors. The study unfortunately found few positive factors. It revealed that students usually seek advice and they benefit from the communications with their tutors, other design studio tutors and higher year students as they learn new ways of thinking, approaches to the design and sorting out design problems. On the other hand, some students work hard, this mostly though does not lead to any fruitful and innovative design outcome because of a number of negative influences, these are:

Design Resources

1. The library's references are considered to be the least useful resources and this would negatively affect the student's ability to obtain design examples thus produce innovative projects; and

2. Despite design precedents are necessary though they are useless without proper analysis of their negative/ positive features and innovative aspects

The Student's Knowledge, Communication Skills and Attitude

1. Students have little knowledge on how to design some architectural aspects of a project

2. Some students are unwilling to collaborate with their tutors and have little trust of the tutor's design abilities

3. Some students have Communication problems with their tutors as they do not know how to communicate with them

4. During development of the design scheme, it appears that each party i.e. the tutor and the student have different imagination/ idea of what the final/ possible design solution/ outcome would be; and

5. Students communicate frequently with their design instructors and with colleagues of the same department whereas some of them communicate infrequently with the tutors and students from other departments.

The Tutor's Attitude, Knowledge and Teaching Style

1. Tutors have their own views about the importance of various creativity aspects and these are different to the students' views;

2. Ambiguous instructions and guidance to the design of the project are given to students;

3. Some design parameters are explained in a vague way or being forgotten or neglected;

4. Some tutors have misunderstanding/misinterpretation of complicated design schemes that is done by students;

5. Support is not provided to students at the right time thus it was considered to be useless;

6. Some tutors do not have the capability to perceive the creative design abilities of students i.e. the weakness and strength. Thus they are incapable to provide support that is tailored to student abilities;

7. Some tutors seem that they humiliate students;

8. Some Tutors insist on their own design ideas so they are unwilling or hesitant to appreciate/ accept the student ideas; and

9. No strategies were set on how to apply the creativity dimensions in the design project

The Design Studio Environment

Low level of democracy is practised at the college and University level and students do not feel that they belong to the college. Accordingly, students complained from the dominancy of some design studio's tutors.

CONCLUSION

To improve the design studio environment and help students to produce creative projects, the study recommends that corrective measures should be undertaken on the following fronts:

Design Resources

Innovative design precedents are important and should be made available to students as it would remind students of possible design solutions thus students would use and experiment how to link it to design problems. These include case studies that have potential partial or complete creative design solutions for architectural, technical, structural etc aspects of building design. Students should keep a record of the design negotiations as this would help to track the progress of the design, explore new links and experiment these links with the design problem.

The Students' Knowledge, Communication Skills and Attitude

Students should frequently communicate design ideas with colleagues and tutors as this would substantially improve their design abilities. Students should be open minded and think outside of the box, have flexible attitude and negotiate design ideas. This may help them to find new design variables and that subsequently produces entirely new products in a similar way that expert designers do (see Gero & Maher 1993).

The Tutors' Attitude, Knowledge and Teaching Style

Clear instructions and objectives should be set at the start of the course though these should be linked to the creativity dimensions. However, such linkage requires deeper understanding of creativity in architecture and design and how to assess it. Tutors should be sensitive to the needs' signals of students so they provide their support at the right time to them. Tutors should define the creativity criteria for the given project. They should set clear roadmap of how to apply it in the design project. Thus they need to discuss it with students to reach to common understanding and application of the creativity dimensions in the design project. Shared understanding between tutors and jurors is required. Students should be taught how to look for innovative architecture solutions (Gero & Maher 1993), explore the innovative aspects of each case study, experiment possible links between innovative design aspects/ solutions and each dimension of the design problem similarly to what expert designers usually do (Lawson 2003). Also, they should experiment possible links with the ideas that they obtained from the design negotiations. Students should be encouraged to frequently communicate with their tutors and other students and explore the potentiality of various design solutions. The architectural design pedagogy or assessment should not focus on form issues as it does nowadays at the college of architecture, UD or elsewhere (see also Salamah 2005, AIAS 2003). It should rather focus on how to achieve the creativity dimensions in the design projects. Tutors should not impose their own ideas on students but introduce to students and encourage students to explore how it can be integrated with the students' design ideas. Training courses for tutors and students regarding the improvement of communications' and interactive skills and how to perceive students' creative abilities and needs are required (see Lindström 2006).

The Design Studio Environment

The college should set and apply professional conduct mechanisms that regulate the relation between the tutor and student and provide democratic environment that is necessary for initiating innovation (see for instance Ekvall 1991). The future research should explore the application of creativity dimensions in design projects at different levels of the architectural education and how this can be achieved. In regards to the design process and innovation, it would be useful to find out how to devise the design process/ decision making process to initiate innovation. Some troubled social issues surrounding the student's relation with the tutor, such as the mistrust, misinterpretations and misunderstanding should be explored further.

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