

# The Nexus of Cost, Quality and Creativity of Architecture Students in a Typical Nigerian University

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## Abstract

Globally, there exists a meaningful connection between the cost of education, quality of works and creative outputs of architectural students which revolves around the architectural design studio. It is on this premise that students are trained to master the vocabularies and understand the tenets of presenting creative works in schools of architecture. The powers of communication becomes the '*modus operandi*' of creative outputs that emerges in 2-D, 3-D or animated formats, otherwise, the activity ends up in futility, mirage experience and mental cramps to the creative world. Previous study in the United Kingdom and Nigeria has identified high cost of architectural education as a barrier to the training of future professionals. This paper examined the connections between the cost, quality and creativity of Architecture students in Covenant University, Nigeria particularly in presentation of their architectural design studio works. Questionnaires were administered to obtain related information from a cross-section of students from the second to the sixth level in the 2014-2015 academic sessions. The result of the study identified students' need for high performance laptops, fees payment as impediment to early resumption and the obvious expensive nature of architectural education as the predictors of creativity in the study context. Furthermore, recommendations stemming from the study suggested remedial actions that could be put in place to reduce the achievement gap between the financially weak and strong students to ennoble their self-esteem, create sense of belonging and develop potentials that are embedded in the students; so as to assist in attaining heights of competence, proficiency and acumen embedded in architectural propriety.

**Keywords:** *architecture, cost, creativity, design studio, quality, Nigeria*

## 1.0 Introduction

Across the spectrum of vocabularies that defined creativity, it can be simply titivated as the production of novel, useful products (Mumford, 2003) that possess the fundamental principles of architecture via order, arrangement, symmetry, eurhythmy, economy and propriety (Stein and Spreckelmeyer, 1999). The term 'creativity' 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. Asides, much effort can be made by adopting all-inclusive parameters not heavily based solely on products and processes, but pedagogic process, person, product, and praxis (Shaffer, 2004a; 2004b) of the creative works.

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These aspects can also create blank cheque for innovation through improvisations by the use of local materials and technologies.

In the past, there has been little or no investigation to establish a nexus between the creative outcome, quality of works, and the cost of producing such works in architectural education. The pedagogic teachers; instructors; accreditation agents (NUC, NIA, ARCON); regulatory professional body (professional jurors) and other stakeholders acts as gate keepers without investigating the connections between the listed factors. These personnel are denominators whose roles in creative eco-system gives them the power to decide whether or not particular creative acts or products have the acceptable *qualities* to be placed in the channels of transmission or outlets in order to make the creative works become visible to relevant audiences. This paper examined the connections between the cost, quality of materials and tools, in relation to creativity of Architecture students in Covenant University, Nigeria particularly in presentation of their architectural design studio works.

## **2.0 The Concept of Cost, Creative Seeds and Creativity**

Cost is the amount of money that one needs in order to buy, make or do something: a resource sacrificed or forgone to achieve a specific objective, usually measured as the monetary amount that must be paid to acquire goods or services; which may indeed be incurred ( actual) or forecasted-budgeted (OALD, 2010; Horngren, Datar, Foster, 2006). Generally today, the cost of higher education is on the increase. The peculiarity of architectural education, especially in the design studio course which requires extra spending or cost irrespective of the students' economic background was a major motivation factor that triggered this study. For tangible creativity to occur and profitable, it is imperative to establish a relationship between cost of learning and creative seeds. Creative seeds are the initial phenomenon around which creative interests and activities first develop. This may consist of problems, project works presented or discovered; it may also mean new ideas, perspectives, images, sounds, objects, materials processes or tools which elicit the curiosity and attention of creativity-inclined people which eventually evoked creativity (Runco and Pritzker, 2009). In any way, creative endeavor always consist in itself, the sustainable algorithm to solve problems through acquired skills, talents and gifts that rested in the creative persons.

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In the Ten (10) Agendas for sustainable architectural education, relevant to this discuss is the third (3<sup>rd</sup>) agenda which stated that ‘a sustainable environmental education must *enthuse, and inspire students to rigorously and creatively address contemporary design challenges*’. More like this is the national policy on education (NPE, 2004). It states that the objective of vocational and technical education (VTE) is expected to (i) acquire vocational and Technical skills, (ii) expose students to career awareness by exploring usable options in the world of work, (iii) enable youths to have an intelligent understanding of the increasing complexity of technology and stimulate creativity. In lieu of these objectives, architectural education emanated from this practicum background geared towards *the production of the educated man who can effectively work with his head, heart and hands* (NPE, 2004). The simile of such man (as architect) is expected to be engaged in problem solving activities that involves ‘cultivation of knowledge, experience, and the exploration of unfamiliar and unconventional design solutions in the evolutionary processes of creativity; which requires creative skills (Cross, 1997; Gero, 2000b; Hsiao and Chou, 2004) to produce creative works.

However, design studio as the melting pot of architectural education has its design project proposal presented in a format (2-D, 3-D or animated) that is legible and assessable in an enthused and powerfully communicated manner. This charged architecture students with the responsibility of incurring extra cost in the pursuit of their career beyond what other counterparts put in for their programmes. Previous study in the United Kingdom and other schools of architecture around the world identified high cost of architectural education as a barrier to the training of future professionals.

### **3.0 The Creative, Ecosystem, Environment, Works and Assessment Criteria**

The entire system from which creative activity emerges is fitly connected with three (3) basic elements; (i) the centrally involved creative person(s), (ii) the creative projects, and (iii) the creative environment are the parametric variables which describe the *ecosystem*. The creative environment also includes the physical, social, and cultural environment in which creative activity occurs (Runco and Pritzker, 2011). Pedagogy is a mode of learning and teaching in the creative disciplines, with much attention paid to educational outcomes and how they are realized (Kellogg, 2004; Forsyth, Zehner and McDermott, 2007). More so, the traditional master/apprentice model of studio instruction fosters greater student dependence on faculty for decision-making guidance” than is desirable (Bose, Pennypacker and Yahner, 2006). Because of the ‘creative’ nature of the final artifact, it was argued that ‘assessment of creative

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work or design events or objects is difficult, if not impossible, (Ellmers, 2006); others questioned whether assessment criteria can truly capture what art products are about; that lecturers routinely struggle to identify criteria that capture the essence of the outcomes of art and design work and what students are attempting to accomplish (Sabol, and Zimmerman, 1997); for many, assessment remains squarely focused on the design or creative outcome, that is, the artifact, as opposed to the process of producing the creative outcome (Ehmann, 2005).

Therefore, many are now recognizing that, while there is a need to retain many aspects of the studio mode, there is also room for changes in the area of assessment (Kellogg, 2004; Forsyth et al., 2007). Despite this recognition, however, assessment is a “somewhat neglected area of design education” (Ehmann, 2005), with little literature available that focuses specifically on assessment in studio; especially in terms of suggestions and advice to guide practice (Ellmers, 2006).

#### **4.0 Educational Costs and Architectural Education**

Cost is the amount of money that one needs in order to buy, make or do something: a resource sacrificed or forgone to achieve a specific objective, usually measured as the monetary amount that must be paid to acquire goods or services; which may indeed be incurred ( actual) or forecasted-budgeted (OALD, 2010; Horngren, Datar, Foster, 2006).

Recently, in education financing studies, Akinyemi, Ofem and Adebisi, (2012) asserted that ‘tuition fees /school charges ranged between N75, 000 (\$477.71) and N348, 750 (\$2,221.34) for State universities and between N164, 000 (\$1,044.59) and N1, 590,000 (\$10,127.39) for private universities; tuition fees and other charges were higher in private universities than state universities. Also, the funding of private universities in Nigeria is mainly from the traditional sources of subvention from proprietors, external linkages and the internally generated revenues (Okojie, 2010).

Therefore, it is emergent now that the education managers needs to dovetail the *cost concept* into the educational programmes by employing it in the decision making especially to educate parents or guardians on the variances of programmes or services costs as differ from one another.

For instance, in architectural design studio where *denominator activity* (Needles, Powers, Crosson, 2008) takes place, without bias, students are expected to be fully equipped with all the materials and tools needed to produce and present creative works as demanded to earn

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grades or be assessed. Such needs are of great necessity, without it, nothing can be achieved just in the simile of a farmer that went to farm without hoe or cutlass. Therefore, the cognizance of the *cost* and *its object* are either ignore by the institution and parents, and have received little attention in the time past. But these have had great impact on the morale, performance, attitudes and student outcomes in the schools of architecture. For instance, if a set of students and parents have been well informed on the implications of having right tools and equipment, it may have greater advantage on the ones that have not. The latter would be at the disadvantaged edge because, if a student cannot afford the high cost of modeling materials, quality cardboards, originally sophisticated Revit/CAD software package and tools, high performance grade of laptops and printers, and access to latest relevant text books, etc., such will not be able to express creativity potentials as expected.

Also, presently, little attention has been paid to budgetary slack and variances as it affects the pocket money, allowances and tuition fees made on behalf of the students by the parents and sponsors. Although, the school fees generally supposed to be classified as fixed cost and weighed on the quality outputs of the proficiency, competency acquired in schools and required in the professional market. But, it is a pity that for many years back, fluctuation has bastardized the landscape of educational budgets.

### **5.0 Quality Delivery among Students, Teachers and Other Stakeholders**

For the students' works qualities to be evaluated void of bias, effort need be made to harmonize criteria employed for assessments in schools; especially the phenomenal creativity. Also, the teaching facility (lecture room, laboratory, tutorial room and discussion room) should maintain standards, as stipulated in the IUCEA guidelines (2006), in order to assure quality teaching. This refers to the size of classrooms/ lecture halls and laboratories vis-a-vis the number of registered students for that course and its duration. For lecturers offering courses at the university level, it is important to maintain quality in curriculum development and delivery. Globally, university lecturers and professors are often not paid commensurate to the time put into lecture preparation, delivery and assessment. As a result, some lecturers do not fully participate in all areas of academia, such as in teaching, research and community development. It is important for universities to highlight consultancy processes and increase funds for research to motivate lecturers not only to teach, but also to participate in research and consultancy (MU, 2005-2009).

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The university needs to promote a culture of quality teaching, research and consultancy through honoraria and other rewards. In order for an employee to perform well, a good work environment is needed. In many African universities, lecturers lack basic work environment standards, such as office space, computers, printers, stationery and internet connectivity. The professional body and other gate keepers need to enthuse and educate the universities offering architecture about the peculiarities of the course in order to provide the basic amenities necessary for the lecturers to perform their tasks appropriately.

### **6.0 The Indeterminate Factors beyond the Control of Design Educators and Students**

Grading and assessment are evaluation tools used to determine the performance standards in schools. Architectural education does its own by the employment of jury assessment system purposed to boost a design student's confidence and articulation skills. Required by this system are the students' abilities to convey values and meanings of design works to the jurors and other members of the projects and community. The format, 2D, 3D, Revit tools and model making are means of presentation and basic enhancers to improve the student performance and elucidate the design intentions. The problem, however, is that the actual performance is influenced not only by the decisions of jurors but also by factors outside their control. Thus, some students may possess the privilege to meet a particular standard of presentation even if they are not too creative and lack the analytic ability for design. Whereas other students may find it impossible to meet that standard of presentation even though they are more skilled. It is neither fair nor effective for a panel of jury and its assessors to grade highly the students that achieve high performance due to the privilege of affordance of high cost materials and tools or to grade lowly the less privilege ones based on factors of affordability outside the students' control.

The central issue is that some students face difficulty to afford high cost prices of materials and tools due to relatively economic hardship they faced; others are economically buoyant but could not meet up with the standard expectations, while another sect could both afford high prices and at the same time be able to meet up with submission requirements of model making, 3D or authentic Revit tools and high grade computer lap tops.

In order to meet the individual needs, ensure fairness across the spectrum of students with sectional affordance abilities, the Teachers should endeavor to engage the benefits of group dynamics with problem-based learning schemes. This would also influence the *curricular modifications for effective ability*, and innovation through improvisation and other vital

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outcome. By these means, a leveler or equalizer could be established in the evaluation and appreciation methods of creative works. This could create grade columns and counterbalance opportunities to give rewards to students who possess other abilities (i.e analytic and intuitive) besides the financially-enabled ones. In other words, affordance (financially-enabled ability) criteria may now be an added advantage to perform well relative to other students with the same costs. The most important factors are the students' abilities to intelligently interpret the design brief, solve problems pragmatically and creatively. This can be achieved by adopting all-inclusive parameters in the assessment score sheets not heavily based on products but the pedagogical process, person, and praxis (Shaffer, 2004a;2004b) of the creative products; for instance, creating blank cheque for innovation through improvisations by the use of local materials and technologies.

### **7.0 Methodology**

The study is derived from a parent-study and it adopted the survey research design and utilized a structured questionnaire as the research instrument. The study population is 268 students (200level to M.Sc.2) in the department of Architecture of Covenant University. A total of 193 students responded to the survey, representing 72.02% return rate.

The data from the survey were analyzed using SPSS 17. The analysis tools used were descriptive statistics which include frequencies, percentages and mean which were adequately represented by bar Charts and tables.

Furthermore, regression analysis was used to ascertain the variables that significantly determine the effect of high cost of architectural education on the performance of the students of the department. Two methods or processes were used in the regression analysis. The initial step was to embark on forced entry of the variables and then later a stepwise method of regression was used to isolate the variables with little or no significance to the outcome variable - Architectural students' budget.

### **8.0 Presentation and Discussion of Results**

The respondents were 65.4% male and 34.6% female depicting higher male subscription to course of study. However the percentage of female enrolment into the schools of architecture is on the increase. The distribution by levels of the respondents the 400level students had the highest participation with 64 respondents while the least level of participation was from the M.Sc.2 class with responses from 5 students. Figure 1 shows a chart describing the distribution of participation from the levels.

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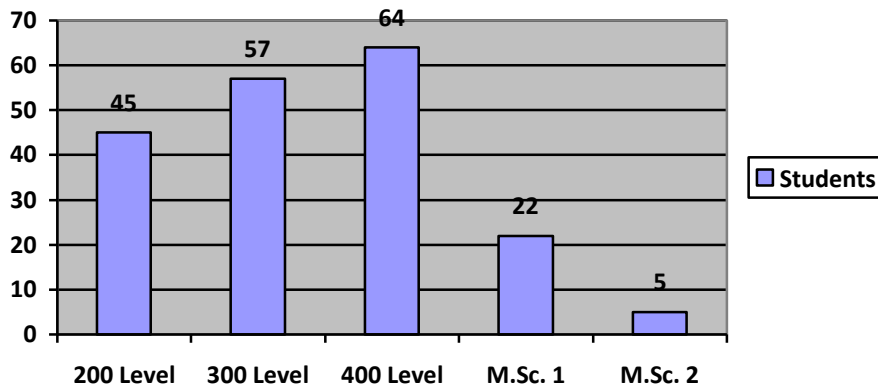


Figure 1: Chart Showing Level Distribution of Respondents

The paper examined the performance of the students in Design studio and graphic communication across the various levels and found that 91 students had good performance (C grade) in design studio and graphic communication assessments. This portion represent 46.6% of the respondents while 23 students (11.9%) had excellent (A) grades in the assessments. The percentage of students with failure in these courses is the least, with only 0.5% of the study respondents in this category. It was found that more than 90.1% of the respondents had performances of C, B and A grades (between Good and Excellent).

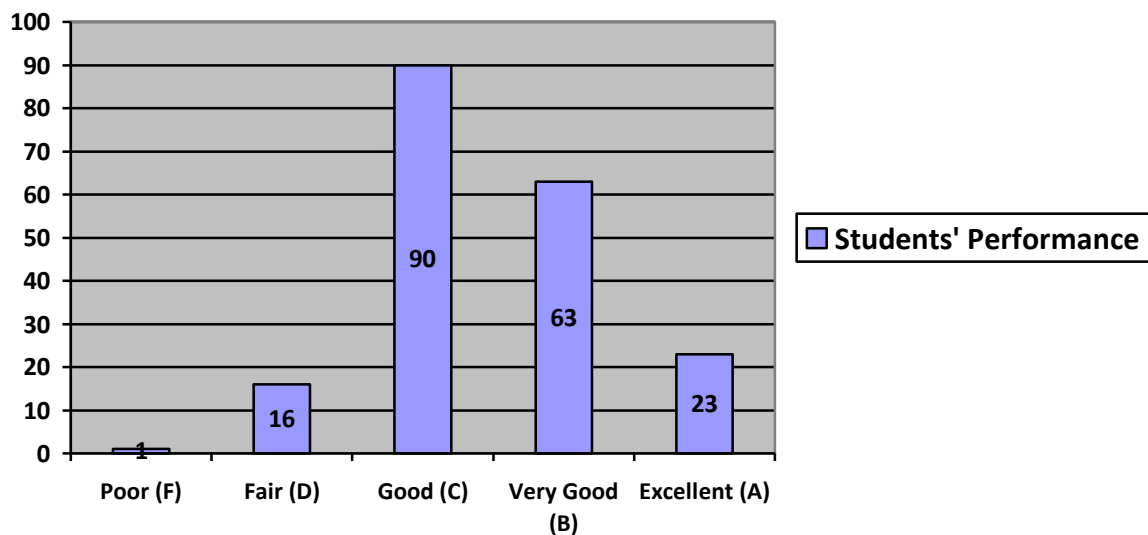


Figure 2: Chart Showing Students performance in Design Studio and Graphics

The paper also examined the impact of high cost variables in architectural education on architectural students' creativity in studio presentations. Multiple regression analysis was

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employed using the stepwise method. Creative use of quality materials (CRTCSQ) was adopted as the dependent variable. The three predictors (Independent variables) derived from the regression analysis include: need for high performance laptops (HGLPT); School fees payment an impediment to early resumption (IMPFES); and expensive cost of architectural education (EDEXP). The result of the analysis reveals that substantial variance in the creative use of quality materials is explained by the regression model. The multiple R= 0.398, R square= 0.158 and adjusted R square= 0.144. It implies that 15.80% of the variance in the creative use of quality materials is explained by the regression model. Table 1 shows the model summary of the regression analysis.

Table 1: Model summary of the Regression Analysis

Model	R	R Square	Adj. R Square	Standard error of the estimates
1	.398 <sup>a</sup>	.158	.144	1.069

a. Predictors: (Constant), HGLPT, IMPFES, EDEXP

Dependent Variable: (CRTCSQ) Creative Use of Quality Materials

Table 2: Report of the Analysis of Variance (ANOVA)

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	36.968	3	12.323	10.785	.000
	Residual	196.526	172	.923		
	Total	233.494	175			

a Predictors: (Constant): HGLPT, IMPFES, EDEXP

b Dependent Variable: CRTCSQ

The result of the ANOVA shows that there was significant impact of variables associated with cost on the creative use of improvised materials, for Model 1 as presented in table 2 - F (3, 172) = 10.785,  $p < 0.05$ .

## 9.0 Conclusions

This paper established the fact that there is a nexus between the cost, quality of works and creative outputs of students in terms of performance. It depend not only factors that arises as a result of non-affordability of high cost materials, equipment and tools which are beyond trainers' and tutors' control; but also on factors that are outside their control, including input prices, such as cost of modeling materials, quality cardboards, original Revit/CAD software,

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high performance grade of laptops and printers, and access to latest relevant text books and other environmental factors, such as unforeseen spending. It follows directly that the cost of education is not the same in every university offering architecture as a programme with higher costs in private universities than with public educational environment.

A paradigm shift to educational performance standards, whether these standards are simply budgeted or are incurred in a program, can be neither fair nor effective unless it recognizes the variances in the cost of education. This paper identified three variables that have significant effect on the students' creativity in the use of *quality* materials. The quality and specification of students' laptops is shown to affect their creativity in presentation works. The use of high performance laptops for architectural design and presentations in the master's class is seen to be a significant determinant of the level and quality of creativity displayed. It was also found that late payment of fees due to financial constraints which serve as impediments to early resumption for academic activities affects the creative output of the students. Furthermore, the general belief that the cost of architectural education is expensive has imminent effect on the creativity since the level of one's affordability of the demands of the course may increase the potential for producing highly creative works. The Institutions also have a part to play in improving students' creativity. The ability of institutions to attract scholarships, grants, and especially subsidies to cushion the effects of high costs of architectural education may however improve drastically this situation. The paper calls for improved funding of architectural education in the country by all relevant stakeholders. The most comprehensive methods, which recognized the role of environmental factors (beyond teacher and students' control) for efficiency, involve some complex, hard-to-explain steps. There is emergent need for the stakeholders to engage in evident-based research (EBR), in-depth analysis enquiry and build a research data base to be able to know more connections that exists in the spectrum of pedagogy, practice and students' economic, social and cultural backgrounds.

## Reference

- Akinoyemi, Ofem and Adebisi, (2012). Educational Financing Reforms in Nigeria: A Survey- and 198, Pearson Prentice Hall, NJ, 07458. Architecture Students (AIAS), Washington, DC.
- assessment framework. Teaching and Learning Scholars Report, Faculty of Assessment Research in Art Education in LA Pierre and E. Zimmerman Based Cost Implications, Analysis for University Education. International
- Bose, M., Pennypacker, E., & Yahner, T. (2006). Enhancing critical thinking through Independent design decision making" in the studio. *Open House International*, 31(3), 33-42.
- Cross, N. (1997). Descriptive models of creative design: Application to an example. *Design*

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- Studies, 18(4), 427-455.
- Ehmann, D. (2005). Using assessment to engage graphic design students in their learning
- Ellmers, G. (2006). Assessment practice in the creative arts: developing a standardized experience. Paper presented at the 2005 Evaluations and Assessment
- Forsyth, G., Zehner, B., and McDermott, R. (eds.). (2007). National Forum on Studio Teaching. Hardcover – June 6, 2011. Academic Press, U.S.A
- Gero, J. S. (2000a). Computational models of innovative and creative design processes. *Technological Forecasting and Social Change*, 64(2-3), 183-196.
- Gero, J. S. (2000b). Creativity, emergence, and evolution in design. *Knowledge Based Systems*, 9(7), 435-448.
- Hsiao, S., and Chou, J. (2004). A Creativity-Based Design Process for Innovative Product Design. *International Journal of Industrial Ergonomics*, 34(5), 421-443.
- Hornngren, Datar, Foster, (2006). *Cost Accounting: A Managerial Emphasis*. 12th Edition, Pp.27 International, 31(3), 33-42.
- January 2012 from [www.nape.org.ng/index.php?option=com\\_docman&task](http://www.nape.org.ng/index.php?option=com_docman&task)
- Journal of Humanities and Social Science, Vol. 2 No. 15; August 2012.
- IUCEA, (2006). Inter-University Council of East Africa (2006): Guidelines on Quality in Curriculum Development (IUCEA), Nairobi.
- Kellogg, C. (2004). The Studio Culture Summit: An Overview Report. American Institute of learning. *Journal of Interactive Learning Research*, 15(2).
- MU (2005) 'Moi University (2005)': Moi University strategic plan 2005–2015, Eldoret.
- MU (2009) 'Moi University (2009)': Moi university service charter 2009, Eldoret. National Art education Association.
- Mumford, M.D. (2003) Where have we been, where are we going? Taking stock in creativity research. *Creat. Res. J.* 2003, 15, 107–120.
- Needles, Powers, Crosson, (2008). *Principles of Accounting*; pp. 1040, Houghton Mifflin Co.,
- NPE (2004). National Policy on Education, Fourth Edition. Published by Nigerian Educational
- OALD8, (2010). *Oxford Advanced Learner's Dictionary, Intl. Student Edition*, Pp. 329 Oxford
- Okojie J.A. (2010). Systems and strategies for funding Nigerian universities. Retrieved on 8<sup>th</sup> Paper No. 2005-3, Center for Education Research, School of Education, Pedagogy as a Model for Mathematics Learning. WCER Working Pp.155.
- Runco, M.A and Pritzker, S.R (2011). *Encyclopedia of Creativity, Two-Volume Set, Second Edition*. Oregon, U.S.A
- Sabol, F. R., and Zimmerman, E. (1997). An Introduction: Standardized Testing and Authentic
- Shaffer, D. W. (2004a). Pedagogical praxis: The professions as models for post-industrial
- Shaffer, D. W. (2004b). When computer-supported collaboration means computer-supported
- Shaffer, D. W. (2005). *Studio Mathematics: The Epistemology and Practice of Design* (eds.) *Research Methods and Methodologies for Art Education*. Reston, VA:
- Stein, J.M., and Spreckelmeyer, K.F, (1999). *Classical Readings in Architecture: The education of the Architect*, McGraw-Hill companies, inc.U.S.A, pp.3
- Sternberg, R.J.; Lubart, T.I (1999). *The Concept of Creativity: Prospects and Paradigms*, *Handbook of Creativity*; Sternberg, R.J., Ed.; Cambridge University Press: Cambridge, UK, 1999; pp. 3–15. University of Wisconsin–Madison; <http://www.wcer.wisc.edu>. University Press, UK.