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Validating a direction adopted in a basic design studio based on the principles of constructivism

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Abstract

With an intention to adopt principles of 'constructivist pedagogy' integrated with an objective to foster thinking skills, 'process oriented outcomes' were adopted in a basic design studio during the session June – November 2016 at the Department of Architecture, Sathyabama Institute of Science and Technology, India. It was about the framing of informal activities prior to design task was to encourage the novices to unravel the spirit of the design problem intangibly. The students documented the creative processes and outcomes associated with all the tasks. We discussed, gave inputs, monitored and examined both the processes and the outcomes regularly. At the end of the semester, outcomes along with the processes were evaluated by four experts. Even though the evaluation by us as well as the jury members displayed a strong correlation, the evaluation process was intuitive. With an intention to gather diverse opinions from staff members, the processes and outcomes of the tasks were presented at a faculty development programme in November 2016. At the training programme, pre and post tests were conducted to analyze the knowledge constructed by the participants. Open ended collective tasks based on cubism paintings were planned and conducted. The ideas, concepts, processes and outcomes evolved by the teachers were documented. The findings obtained through the qualitative and quantitative analysis adopting an exploratory confirmatory method. The findings post that the direction adopted in the basic design to be an approach to incorporate principles of constructivism.

Keywords

Constructivism, Basic design studio, Students, Teachers, Exploratory confirmatory study, Validation.

1. Introduction

Design in architecture is an integrated paradigm, where creativity and rationality need to be blended holistically (Bashier, 2014). Critical, creative and pragmatic thoughts are mandatory for architecture students (Ibrahim & Utarbeta, 2011). Design processes and outcomes in architectural design studios are the expressions of subjective knowledge and irrational creativity (Wang, 2010). Fostering critical thinking is associated with the development of rationality (Vijayalaxmi, 2012). However, studies reveal that there is need to explore various forms of pedagogy to foster creativity, and various thinking skills.

According to Salama (2013), inquiry based learning, active and experiential learning are identified as the three responsive learning mechanisms in architectural education. He posited that active and experiential learning are the sub forms of inquiry based learning which revolve around the 'spirit of self learning', 'individual and collective activities' and 'learner reads, hears, tells and writes about these realities but never comes in to contact with as part of the learning process' respectively. Salama (2005) observed that there should be a balance and harmony between the skill and knowledge based pedagogies. It is also observed that there is an utmost need for a unique pedagogy where 'real and hypothetical', 'the process and the outcomes', 'objective and the subjective', 'behaviour and the dynamics of the future architects are explored' during the period of education (Salama, 2013). With respect to architectural education, constructivist studio addresses appropriate, collaborative and shared design processes to improve the standards and quality of architectural pedagogy (Kurt, 2011).

1.1. An insight to 'constructivism'

According to Bada and Olusegun (2015), 'constructivism is an approach to teaching and learning based on the premise that cognition is the result of mental construction'. Constructivist pedagogy is a theory about learning. It revolves around the concepts like 'teacher actions', 'theory building'

and 'construction of knowledge by students'. 'Teacher actions' include intentions and behaviour, whereas 'theory building' identifies effective teaching practices for use in teacher education as well as professional development (Richardson, 2003). Teachers need to have an in depth knowledge in the respective domain to facilitate effective learning (Fosnot, 2005); must address the ways through which students evolve and develop the outcomes, must promote close relationship between students and instructors (Pagan, 2006). Minimally guided instruction is often criticized for being ineffective (Kirchner, Sweller & Clark, 2006). It is observed that motivation and constructivism based pedagogy are interrelated (Kim 2005; Palmer, 2005). Haqq (1998) stated that the role of a teacher is multifaceted: a guide, facilitator and co explorer who encourage the students to think, question, challenge and formulate their own ideas, opinions and conclusions. Providing experience to students for construction of design knowledge with minimal guidance, facilitating the students to find alternatives, formulating process oriented learning strategies, making the students as owners of process, generating self awareness are identified as the salient features of constructivist design studios (Kurt, 2011).

In this study, we take a position that when tasks are planned with informal or complementary activities to the primary design task, the students get an opportunity to unravel the design processes with involvement. The students are able to generate better outcomes and are able to discuss as well present their thinking process with confidence. We have focused on an approach to incorporate principles of constructivism in a basic design studio.

1.2. Diverse perspectives of basic design in architectural education

Basic design studio is offered as an introductory course for the students pursuing design related domains like architecture, interior design and product design. In architectural education, it is observed that, basic

design studio offered as a foundation course plays a crucial role (Erol, 2010). Parashar (nd) posited that basic design can be enhanced through curiosity and experience, where there is a need for a holistic, creative and experimental methodology. This develops long term unique values and attitudes (Farivarsadri, 2001).

The primary objective of this studio is to harness creative spirit, encourages curiosity, complexity, skills, explores design process and offers a unique learning experience to construct knowledge in diverse dimensions (Alter, 2010). It is thought provoking and is observed to be highly compatible with the ideals of constructivist learning theory (Kocadere & Ozgen, 2012). According to Celik & Aydinli (2007), creativity can be fostered through an intellectual atmosphere offering a variety of experiences, sensations specific to the framed setting. The objective of this course is to stimulate and intrinsically motivate the students to develop diverse skills like rational, critical, creative and in parallel, contextual thinking specific to design tasks in the forthcoming years of study intangibly as well as in the profession.

The basic design pedagogy needs to be holistic that develops learning style and cognitive abilities of young minds with design principles (Boucharenc, 2006). It serves to initiate creativity, develop sensitivity to spatial perception (Makakali, 2015). The tasks framed in the introductory course are observed to be conceptual and experimental which serve as the two opposite ends of the spectrum (Asasoglu, Gur & Erol, 2010). Conceptual learning addresses 'learning by enquiry', whereas

experimental approach in basic design has never been investigated.

Formulation of tasks addresses the progressive evolution of forms, license of borrowing from different arts and deconstruction or decomposition which are generally adopted (Parashar, nd). Approaches which balance both skill and knowledge are crucial in architectural education (Salama, 2005). Identifying ways to foster creativity as a process need to be addressed (Cubukcu & Dundar, 2007). Thinking processes and creativity can be facilitated with good instructional strategies (Hargrove, 2011). According to Vrasidas (2000), planned assignments, activities and tasks need to be chunks of a wider spectrum. In this context, the tasks were sequentially planned. Based on the kind of knowledge and the level of understanding to be invested amongst the students, tasks need to be framed (Pugnale & Parigi, 2012).

1.3. Basic design studio in Indian context

In India, Council of Architecture is the statutory body which prescribe the Minimum Standards of Architectural Education for imparting 5-year undergraduate degree course in Architecture. From the official website (https://coa.gov.in/), various schools which were started before 1987 were identified. A study on the curriculum and syllabi of twenty six schools display that architectural drawing as well as art studio workshop are also offered along with basic design to enhance the aesthetic sensitivity, technical drawing, artistic skills, visual perception and sensory appreciation of forms amongst the novices. In addition, 'theory of architecture' or 'principles of architecture' or 'art appreciation' is offered either as separate course or integrated with basic design.

1.4. An approach to incorporate 'constructivism' in basic design studio

At Sathyabama Institute of Science and Technology, a theory course on 'architectural principles' is integrated with basic design studio and offered as Architectural Design I to foster creativity revolving around two and
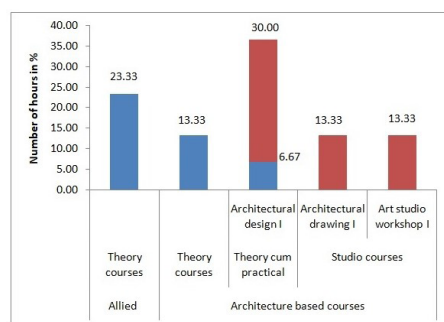

Figure 1. *Percentage of hours allotted for the various courses offered in the first semester.*

three dimensional thinking processes and outcomes. In addition to this, architectural drawing studio and art studio are offered to develop the logical, technical and graphical skills of the students' right from the first semester as shown in Figure 1.

With this as the background, we have developed a methodology to foster both 'logical thinking' as well as 'creativity' in the introductory basic design studio by adopting the principles of constructivism. With an intention to collect diverse opinions on the method adopted to frame and sequence the tasks, the processes and outcomes of the studio tasks were presented to group of teachers in a training programme to examine our approach as well as the intangible dimensions associated with it. To decode the rationale behind this process, the outcomes generated by the faculty members at the training programme was investigated. For this process, exploratory confirmatory model as shown in Figure 2 is adopted for the study purpose.

2. Methods and Procedure

According to Kahvecioglu (2007), design education need to provide unique design experience. With an intention to offer a variety design experiences, a series of design tasks with complexity compounding sequentially for the design studio predominantly based on the channels to creativity discussed by Antoniades (1991) as in Table 1.

According to Tashakkori & Teddlie (2003, p.687), the inferences drawn from the first strand emerge as the questions for the second strand. It tends to confirm the findings of the former phase. The first phase is retrospective in nature, whereas the second evaluates both the process and emergent outcome (Cameron, 2009). The exploratory phase is complementary to the subsequent confirmatory phase (Kimmelman, Mogil & Dirnagl, 2014). The method adopted in this study for validating the approach is mapped in Figure 3.

In this context, the exploratory revolves around a practicum where the faculty members unravel the hidden dimensions, constructed
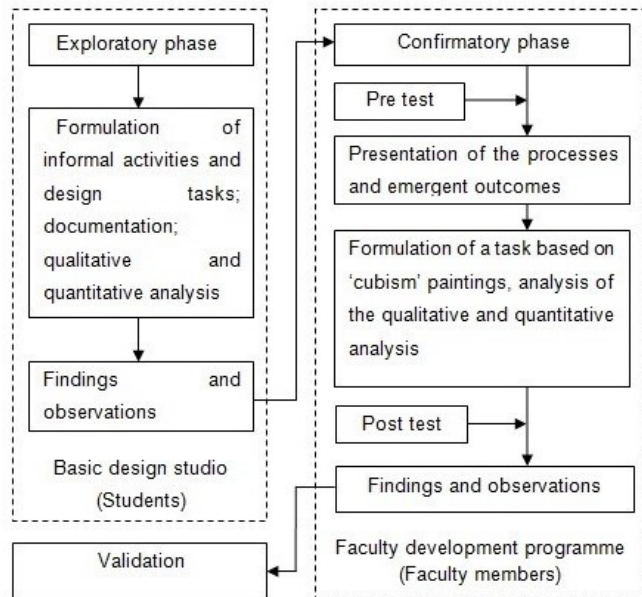

Figure 2. An exploratory confirmatory method in a nutshell.

through framing and planning a series of tasks in a basic design studio. We have the confirmatory phase which revolves around the faculty members' opinions, knowledge and experiences constructed at the training programme to validate the adopted direction as a constructivist approach,. A pre and post test was conducted for the faculty members at the training programme before and after the session which comprised of a lecture and a workshop with duration of six hours to investigate the level of knowledge acquired before the lecture and after the workshop.

A unique practicum was formulated with paintings for the staff members to give an insight to constructivist pedagogy through experiential learning. We collected both qualitative and quantitative data for analysis as posited by Creswell (2003, p.16).

Table 1. Framed activities and tasks.

| No.	Activity	Design Task	Channel to creativity	Time frame
I	Mediums, modes	Word art (2D)	Alphabets	Fixed
II	Fibonacci series	Grids, colours, shades, illusions (2D)	Geometry & creativity	
III	Impressions - clay	Figure & ground , Reversal (3D to 2D)	Focus on materials	
IV	Thread	Built with a single line (2D to 2D)	Geometry	
V	Paintings on walls	Tan-a-morph (3D to 2D)	Puzzle (Tangram)	
VI	Paintings	Decode, abstract (2D)	Creativity through association with other arts	Flexible
VII		Wire model (1D to 3D)		
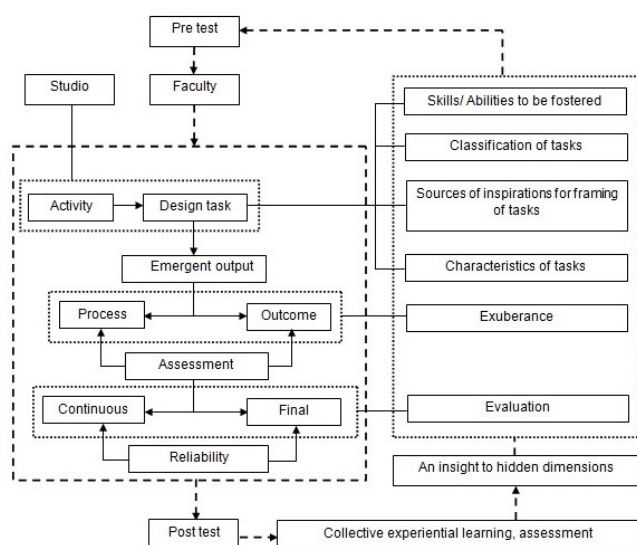
Figure 3. The method adopted in the exploratory confirmatory study.

The methods adopted to collect the qualitative and quantitative data is discussed in section 2.4. Pearson's correlation coefficient and Cronbach alpha was determined to establish the validity in the evaluation process and well the reliability in the framed questionnaires. During the analysis phase, both qualitative and quantitative collected data are triangulated from multiple perspectives to explore, analyze and synthesize the identified strategy in a basic design studio.

2.1. The tasks

The study comprised of two phases. Firstly, the informal activities and design tasks incorporating the constructivist principles were planned for the students pursuing first year architecture at the Department of Architecture during the session June – November 2016. To explore the appropriateness of the method adopted in the basic design studio and to get a rich knowledge for the evaluation process, a pilot study based on the principles were planned for the participants at the faculty training programme and conducted at Vellore Institute of Technology, Vellore on 21st November 2016 in association with National Institute of Advanced studies in Architecture along with Council of Architecture, India.

Studies reveal that, a series of tasks are framed in basic design studios adopting the principles of
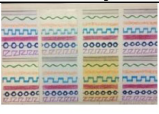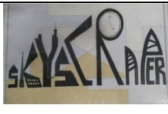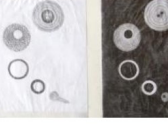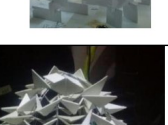
progressive evolution of forms, licence of borrowing from other arts and deconstruction or decomposition (Parashar, nd.). With this as the back ground with an intention to foster appropriate problem structuring and experience the spirit of the formal task intangibly, a new direction to introduce a related informal activity loaded with an objective to gain knowledge on s specific subject was framed prior to the formal introduction of each and every design exercise.

2.1.1. Tasks framed in the studio

The first task comprised of lettering, mediums and modes, word art giving an opportunity to identify the suitable modes in different mediums followed by the morphing of alphabets. Choosing the appropriate sequence, identifying a rule for repeating the numbers along the horizontal and vertical axes, along both the diagonals, creating patterns, colours, sizes, shapes etc were explored in the next task. With an intention to foster the concept of 'figure and ground' and the process of reversal, an informal activity with clay creating impressions with a variety of objects was identified. Play of light and shade was introduced while during the real as well the mirrored expression. Following 'materiality', an informal activity titled 'thread' was introduced as part of 'built with a single line' without any intersection. We perceived the thread to symbolize a line and different methods to create a composition same rules were the aim. Experiencing texture, colours, strategy to stick the thread on the sheet was explored, followed by the identification of a built form drawn with a single line as in Table 2.

A real time task 'painting the walls of MRTS station at Thiruvanmiyur, Chennai' was planned as a collective task prior to an open ended task based on a dissection puzzle, 'tangram' adopting 'anamorphic' ideas (Ramaraj & Nagammal, 2016). An integrating approach, revolving around both the composition with planes as well as paintings on the front, rear as well as the base in order to create illusions or anomalies was the challenge. The principles of differential learning along

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Table 2. The emergent outcomes.

Tasks	Complementary activity	Process	Task driven outcome	Observations	
Word art(2D)				Students explored th creating the mediu according to the modes the adopted	
Grids (2D)	Grids were generated with horizontal, vertical and diagonal lines			Colours, patterns, illusion were explored	
Figure, ground (3d to 2D)				Difference between the positives and negatives wer explored with the impressions created	
Built with a single line				The exercise with the threa intangible facilitated the students to create a buildin with a single line	
Tan-a-morph(3D to 2D)				Illusions, literal mimesi abstract ideas wer generated	
Decode, abstract (2D)				Decoding density of colurs, brush strokes, colors, art principles	Higher order thinking which revolved around the ideas and pproaches which are both creative and rational as the thrust
Wire model (1D to 3D)				Offered an oppurtunity to translate 2D to 3D, materiality, scale and proportions	
to 3D				Geometric profiles, angles of intelocking, depth of the slits, three dimensional compositions, sizes	
Nature (3D to 2D; 2D to 3D)				Taking inspiration from nature and trnalating 3D elements in to 2D followed by creating a a metaphorical expression	

with varying time periods based on the individual's calibre were adopted as strategies for the last three tasks which revolved around paintings, geometry and nature. For each of the framed task, a sample output with respect to the complementary activity, process and the task driven outcome is shown in Table 2.

2.1.2. The framed task in the confirmatory phase

The emergent design processes and the outcomes by the students were presented to the faculty members from different schools of architecture who participated voluntarily in the training programme. With an intention to give an insight to the constructivism

principles in basic design, we framed an exclusive collective task, abstract in nature titled 'interpreting the fourth dimension three dimensionally' for the faculty members. With 'borrowing' as the focus, Cubism paintings by Georges Braque and Albert Gleizes were identified (See appendix B for a sample brief). Faculty members were requested to document the design processes. In addition, approaches adopted and the processes were documented every fifteen minutes by us. At the end of the day, the groups presented on how they decoded the given paintings, their approaches as well as the emergent outcomes.

2.2. Materials

For the studio tasks, we facilitated the materials for the students. Mount boards, wires, black markers, black poster paints and sketches, A2 size sheets, wire cutters, glue, pencils, erasers, scissors, cutters were provided for the participants at our request, sponsored by National Institute of Advanced Studies in Architecture in association (NIASA) with Council of Architecture (COA) at the faculty development programme by the organising school.

2.3. Participants

In the exploratory phase, a series of nine tasks were planned and sequentially introduced as part of architectural design studio I to a class of forty students (19 boys and 21 girls, average age 17 years) pursuing first year at the Department of architecture during the academic session June to November 2016. With an intention to confirm the knowledge constructed through experience and further explore the hidden aspects associated with the conducted design studio, a unique collective task based on paintings was introduced to the 21 participants (14 females, 7 males, and average age 32 years; average years of experience in teaching 3 years and 3 months) who participated voluntarily. Seven groups with three participants from different schools were formed for the collective task.

2.3.1. Skilled assessors

In the exploratory and the confirmatory phases, several skilled assessors with different experience and knowledge were involved primarily to construct an in depth knowledge of the framed tasks, the emergent processes and the outcomes. For the basic design tasks, six assessors evaluated the emergent processes and the outcomes. We monitored, discussed and evaluated the outcomes of the nine tasks on a regular basis. Four jury members assessed the overall outcomes at the end of the semester. We examined the processes involved in generating a three dimensional form for the fourth dimension at the training programme qualitatively. Five skilled inter raters and two intra raters evaluated the emergent outcomes and the processes quantitatively. We were part of both the exploratory and the confirmatory phases as we wanted to decode evaluation process qualitatively and check whether the same approach holds good while evaluating the outcomes of basic design tasks.

2.4. Data Collection

Qualitative and quantitative data was collected from the two groups, the students who pursued first semester architecture at the Department of Architecture and the participants at the faculty training programme sequentially. A questionnaire (see Appendix A) was framed to collect data from the students is addressed in the exploratory phase. In the confirmatory phase, two types of data were collected from the faculty members who participated voluntarily at the faculty development programme. Quantitative data addressed the knowledge construction before and after the one day session at the training programme. The other focused on the knowledge constructed through experience.

2.4.1. Exploratory phase

The emergent outcomes along with the processes which were documented by the students, portraying the ideas evolved and developed, were examined both quantitatively and qualitatively. For analyzing the emergent outcomes, two skilled intra raters with a minimum

of eight years of experience examined the processes and the emergent outcomes simultaneously on a ten point scale regularly. The experiences of the students were collected through a predesigned questionnaire (See Appendix A). Further, opinions on the tasks, experiences and knowledge gained were collected from the students. In December 2016, forty students were divided in to four groups of ten students each and four inter raters evaluated the unravelled the design processes and the emergence outcomes. The performances of the students are as shown in Table 3. It is observed that nearly 45% of the students scored more than 72%.

2.4.2. Confirmatory phase

With an intention to collect the opinions on the sequentially planned tasks, the processes and the outcomes were presented to the participants at the training programme for one hour. A task based on 'cubism', interpreting of fourth dimension in paintings three dimensionally was the challenge as shown in Table 4. To understand the knowledge constructed by the participants, a questionnaire was pre framed with five sub sections (See Appendix C). The six subsections broadly revolved around the 'objectives of the basic design studio', 'classification of tasks', 'channels to frame tasks', 'characteristics of the tasks', 'the emergent outcomes' and 'evaluation criteria'. A pre and post test was conducted at the training programme at the beginning of the session as well as at the end of the day for an in depth knowledge of the direction adopted in the basic design studio as well as the task framed for the training programme.

Further, mapping the design process while decoding fourth dimension in the painting as well as creating a three dimensional outcome was made mandatory for all the groups. In addition, still pictures were every fifteen minutes to document the processes and the outcomes. Each group presented their ideas individually along with the process and features were noted down. Moreover, feedbacks given by the participants at the training session about the session, task and experience were also gathered at the day.

2.5. Data analysis

Data collected during the exploratory and confirmatory study from two groups of participants were analyzed. In the exploratory phase, the performance of students was taken in to consideration. To construct a holistic knowledge about the direction adopted in planning academic exercises through the experiences gained by the participants at the training programme, a generative task based on paintings was planned, conducted and analyzed in depth. The processes and outcomes are as shown in Table 2, were explored, analysed and evaluated based on the in depth understanding of the framed tasks, thinking skills, processes and outcomes.

2.5.1. The exploratory phase

Responses to questionnaire comprising of both the open and close ended questions were consolidated to interpret the students' perspectives on the framed tasks, the experiences and knowledge constructed through active participation in the sequentially framed tasks. The informal activities were introduced prior to the formal task primarily to encourage the novices

Table 3. Students' score expressed in percentage.

Very good (> 80%)	Good (72% to 80%)	Above average (66% to 72%)	Average (58% to 66%)	Below average (<58%)
7.5	37.5	27.5	17.5	10

Table 4. Framed task in a nutshell.

Channel to creativity	Intention	Design Task	The outcome
Cubism paintings	To explore and interpret the fourth dimension Document the design process	To transform the 4th D in paintings three dimensionally	dry assembly, essence of kinetic architecture , expressing the spirit of the painting dynamically

to explore various values through a play way mode. The novices were motivated to maintain their initial sketches, still pictures of the initial models which were composed separately and were presented to the jury. Each and every task had a complementary task, design processes and the final outcomes. We interacted, discussed and facilitated in evolving and developing each one's idea. The outcomes of both the informal as the design tasks and the creative processes were continuously evaluated by two intra raters on a ten point scale. Pearson's correlation coefficient between the continuous and the final assessment is 0.72 establishes a strong relationship. The overall performance of the students is categorised as in Table 3 and nearly forty five percent of the students performed well.

2.5.2. The confirmatory phase

The intention for introducing a generative task was to encourage the faculty members to internalise the experience and knowledge constructed through documenting the design process while evolving appropriate ideas in creating the three dimensioned outcome collectively through active participation as in Table 4.

Closed ended questionnaire (See Appendix C) was pre designed with the knowledge constructed and experience gained through conducting the basic design studio. Pre and post tests were conducted before the session titled 'Art of facilitating basic design studio' in the morning by 10:00am and at the end of the practicum by 5:00pm in the evening. The questionnaire had six sub sections as in appendix B with sixty eight items. We adopted a five point Likert scale corresponding to 'strongly agree', 'agree', 'neutral', 'disagree' and 'strongly disagree' with scores five, four, three, two and one respectively.

We evaluated the emergent processes and the outcomes at the training programme qualitatively. For this, we considered three parameters, ability to interpret the essence of the given painting, the degree of seamlessness to translate the essence and the level of content portrayed by both processes as well as the outcomes.

A group of five skilled assessors with a minimum of twelve years of experience from the Department of Architecture, evaluated the outcomes along with the brief on 'principles of art', translation of ideas from 2D to 3D, content expressed in three dimensional form, type of connections and the relationship between the process and the outcome on a seven point scale. Teaching experience, sensitivity to Cubism paintings, evaluating skills were the parameters considered in identifying the skilled assessors. For assessing the total creativity on a ten point scale, the outcomes were shown sequentially twice, giving an opportunity to recheck the rating. The score on the ten point scale was converted to a seven point scale to examine the correlation adopting pearson's coefficient, a modified method by Dorst & Cross (2001).

To evaluate the essence of the decoded content from the paintings, the processes and outcomes sequentially, two skilled assessors with arts as the background were identified. Five to seven minutes were allotted to read each brief, fifteen minutes to interpret the design process and five minutes to evaluate each emergent outcome. Finally fifteen minutes were allotted for analysing the essence of the painting exhibited in all the models.

Table 5. *Percentage of agreement about the framed tasks from the students' perspective.*

Task	Experiences					
	Though provoking	Enjoyment	Curiosity	Playfulness	Peer learning	Challenging
Word art	22.5	15	27.5	22.5	10	2.5
Grids & illusions	45	37.5	2.5	7.5	2.5	5
Figure & ground	22.5	30	22.5	15	2.5	7.5
Built with a single line	10	27.5	22.5	12.5	10	17.5
Tan-a-morph	12.5	51.5	2.5	23.5	2.5	7.5
Decode, abstract, model	17.5	12.5	20	12.5	15	22.5
Model with planes	32.5	27.5	7.5	15	2.5	15
Nature	35	15	15	2.5	15	17.5

Table 6. Novices' perspectives on creativity and the process.

Creativity	Unique, think differently, imaginative, subjective, innovative, complex, beautiful, original, individualistic, peculiar, crazy etc
Processes	Trial and error, a phase before the final outcome, a path to a successful outcome, a series of phases, tedious, exploration, deeper thinking, improves our skills etc.

Table 7. Coefficient of stability (Pearson's correlation coefficient).

Pre & post test	Formulation of Tasks				Outcomes	
	Skills	Classification	Sources of inspiration	Characteristics	Exuberance	Evaluation
	0.47	0.46	0.97	0.84	0.89	0.73

3. Findings
3.1. The exploratory phase

The percentage of agreement on the factors like 'thought provoking', 'enjoyment', 'curiosity', 'playfulness', 'peer learning' and 'challenging' (See Appendix A) represented is displayed in table 5. It is observed that the task 'Tan-a-morph' was rated as most enjoyable task; 'grids' followed by the task on 'nature' was thought provoking. We observed a mixture of responses from the students. The percentage of 'peer learning' was high with respect to the task based on paintings.

Interpretation of 'creativity' and the 'process' from the novices' perspectives are consolidated as in Table 6. With the experiences gained through participation in the framed tasks, students accept that each and every planned task is observed to be loaded with the identified aspects and exhibit the knowledge constructed by the individuals through problem structuring. The responses to 'creativity' and 'creative process' were the outcomes of the processes which were unravelled during the ideation phase.

Responses to the listing of 'experiences' in Design studio I is observed to be 'involvement', 'joyful', 'concentration at the micro level is important', 'curious', 'interesting', 'wonderful', 'to think out of the box', 'interactive', 'give respect to multiple perspectives', 'challenging', 'need to manage time', 'learning is a process', 'determination', 'aesthetically sensitive', 'presentation', 'understanding the task is mandatory', 'hard work counts' etc portray various ways through which they perceived the framed tasks.

Feedbacks from the final jury members reveal the adopted methodology i.e. informal activities as well as the design tasks to be effective as the students were able to discuss the approaches along with the design process and the outcomes easily, effectively and dynamically. Pearson's correlation coefficient calculated between the continuous evaluation considering both the 'process' as well as the 'outcomes' and the total creativity converted on a ten point scale is 0.72 and this establishes a strong reliability as in Table 7.

3.2. The confirmatory phase
3.2.1. Pre and post test

The mean score for each item in the questionnaire for the twenty one subjects provided to the staff is summated for both the pre as well as the post tests. The coefficient of stability using Pearson's correlation is worked

Table 8. Number of responses expressed in percentage.

Likert items under six broad sub divisions	Strongly agree/ agree		Neutral		Disagree/ disagree	Strongly disagree
	Pre test	Post test	Pre test	Post test	Pre test	Post test
Skills / abilities to be fostered	82.07	94.68	17.08	5.04	0.85	0.28
Classification of tasks	70.95	95.71	17.14	3.81	11	0.48
Channels to frame tasks	78.79	93.07	20.35	6.93	0.86	0
Characteristics of tasks	83.67	96.94	15.31	2.72	1.02	0.34
Outcomes	83.81	93.33	15.24	6.67	0.95	0
Evaluation criteria	89.61	94.81	9.53	4.76	0.86	0.43

out and the values are as in Table 8. The reliability coefficient for the 'skills to be fostered' and 'the classification of tasks' is observed to be 'moderate', whereas the other factors like 'source of inspiration', 'characteristics', 'exuberance' and 'evaluation' show a strong relationship.

Responses for each item under the five sections which address 'classification of tasks', 'various channels to frame tasks', 'characteristics of the framed tasks', 'outcomes' and the 'evaluation criteria' on a Likert scale with five classes were consolidated to determine the percentage agreement for each item for both the pre and post test respectively. The values are displayed in Table 8. Under the 'strongly agree/ agree' category, the percentage of responses in 'post test' is more when compared to the 'pre test', which gives an insight to the construction of knowledge on the ideals of constructivism in a basic design studio.

3.2.2. The emergent models

Pearson's correlation coefficient between the various parameters and total creativity focusing on the emergent outcomes is displayed in Table 9. The values display a strong relationship with the parameters like 'principles art in 2D', '2D to 3D', 'content in 3D', 'process and the outcome'. With respect to the parameter 'connections', the calculated coefficient falls under the 'moderate' category as the spirit of the task was in the translation of fourth dimension of the painting three dimensionally.

3.2.3. Informal feedbacks

The opinions shared by the faculty members during the feedback session are consolidated in Table 10, under four categories namely, 'lecture', 'experience', 'problem formulation' and 'collective task' with the knowledge gained at the end of the day. The comments confirm that the method adopted in the studio tasks follow the essence of constructivism.

4. Conclusion

A study on 'constructivist approach' in architectural pedagogy reveal that self awareness, self motivation, provide experience to students; facilitate the young minds to find alternative solutions, process owner learning strategies are the key aspects. In this context, perceiving the ways through which the students arrive at solutions and defend the emergent outcomes, we planned a series of tasks along with related informal activities with an increase in the degree of complexity from one to another. Tasks were framed with an intention to foster thinking skills, creativity, interpret and internalize the spirit of translation and transformation from 1D to 3D, 2D to 2D, 3D to 2D and 3D to 3D.

We planned tasks integrating the principles of 'borrowing' and 'transformation' from paintings, geometry and nature sequentially. Decoding of the cubist paintings and abstraction of impressionist paintings, followed by the creation of a three dimensional model with wires inspired from one of the paintings was the next task. Material, colour, thickness

Table 9. *Pearson's correlation coefficient between intra and inter raters evaluation.*

Principles of art in 2D	2D to 3D	Content in 3D	Connections	Process & outcome
0.72	0.76	0.79	0.56	0.67

Table 10. *Feedbacks by the teachers at the training programme.*

Lecture	Portrayed the involved deep thought processes, an insight to frame informal activity as a way to simplify the task, ways to integrate creativity and rationality, importance of sequencing the tasks
Experience	Wonderful, loaded with fun, thought provoking, an opportunity to construct knowledge, cherish the experience unravelled
Problem formulation	Unique ways to formulate open ended tasks, using puzzles in basic design is interesting, decoding painting is a complicated task
Collective task	Dynamic, a platform fostering peer learning, interesting task, importance of group work, increased the confidence level, multiple perspectives

of the wires as well as the techniques adopted for joining, interlinking and interlocking were explored retaining the spirit of the chosen painting addressing decoding, abstraction, translation and transformation. In order to foster the relationship between the size and proportion, a task addressing two dimensional planes with rectangular profiles varying in sizes were interlocked to create a three dimensional model was introduced to the students. The idea revolving around translating the grammar in a three dimension element or a part of creature in nature two dimensionally and then transforming it three dimensionally in to a structure enclosing a space was the final task. Strategies and approaches unravelled by the students followed by the features exhibited by the outcomes as observed during the studio hours, reviews from ours' as well the students' perspectives are as consolidated in Table 11.

The novices were finding it very difficult to comprehend the essence of the tasks which revolved around translation of 2D to 3D and the vice versa. Even though the basic of problem structuring was discussed in the class, the students were finding it difficult as each one was given the freedom to select a painting for decoding, abstracting, model making; sizes of the planes, natural element etc. Duration was not fixed and it varied depending on the individual's knowledge. Motivating the students to explore the processes involved and to come up with the outcomes was challenging and time consuming. It was observed the efforts by the young minds as well as us were directly related.

In design education the outcomes are the primary focus of assessment, students' experiences and design processes are neglected (Cikis & Cil, 2009). However, in our approach, the informal activities were planned

Table 11. *Intention behind formulation of the tasks and the features of the outcomes.*

No.		Activity	Intention	Design Task	The outcome (Feature)
Basic Design Studio 2016	I	Mediums, modes	Intangible understanding of mediums and dry modes	Word art	Shades and tints of black and white, colours, perspective, literal as well as abstract ideas
	II	Fibonacci series	Identification of any sequence of three to four continuous numbers	Grids, colours, shades, illusions	Sequence of numbers, repetition of sequence along X, Y axis as well as along the diagonals, Choice of colours, dexterity, theme
	III	Impressions - clay	Understanding of materiality - plasticity	Figure & ground , Reversal	Choice of objects, pressure, composition, understanding the proximity of surface to light, interpreting the reversal of the same
	IV	Thread	Metaphoric expression of line	Built with a single line	Explore different patterns with a continuous line without intersection, texture and thickness
	V	Paintings on walls	Collective task in painting the walls at MRTS station,	Tan-a-morph	Anamorphic expressions – story boards, symbolism, metaphor
	VI	Paintings	Construction of knowledge in impressionism and cubism art movements	Decode	Understanding the principles of art – strokes, colours, mediums etc in cubism paintings
				Abstract	Simplifying the impressionist paintings
	VII		Translating the embedded ideas three dimensionally	Wire model	Understanding the properties of different metal wire and exploring the techniques to depict the three dimensioned ideas evolved from the painting
	VIII	Planes interlocked	Explore dry joints		size of planes, proportion, depth and angle of slits, architectural principle adopted in creating the model
	IX	Nature	To interpret the grammar		Transforming the grammar three dimensionally to enclose meaningful spaces.
Faculty		Paintings	To interpret the 4D		Translate and transform the essence three dimensionally

Table 12. *Classification of the emergent outcomes.*

Approach / Content	Content free	Content bound	Content rich
Less or medium seamless	Below average	Average/ Above average	Above average/ Good
Medium or very seamless	Average	Above average/Good	Good/Very good
Very seamless	Above average	Good/Very good	Very good

intentionally and the documentation of the design process by each student was enforced. Pagan (2006) posited that in studios which adopt the principles of constructivism, the ways the responses are derived and defended is the focus and the outcomes need to be analyzed with context based techniques. We were able to establish a strong relationship between assessments by us as well as the as the invited jury members. As differential learning and flexible duration was allowed it was very difficult to structure evaluation processes for all the tasks

The emergent processes, outcomes at the training programme were investigated in detail which can be extended to the studio tasks by the novices also. While analysing the emergent outcomes by the participants at the training programme, we adopted 'content – rich/bound/ free' (Moore & Karvonen, 2008) for describing the outcomes. For assessing the 'processes', we have used 'seamless' with degrees of variations as put forth by Christaens (2013). The emergent outcomes are observed to fall under the nine descriptive scales as in Table 12 which can be extended to the basic design studio. The scales revolve around the approach and the content.

The variety of outcomes displayed that both the groups i.e. novices and staffs were able to think beyond the

Table 13. *Interpreting the processes and outcomes generated by the participants at the training programme.*

Painting	Process	Outcome	Intra raters (4D)		Approach / Content
(a)			Strongly Agree	Folded and slanting planes, front and rear sides of the planes are visible	Very seamless & content rich (Very Good)
(b)				Degree of movement associated with the planes expressing the elevation	
(c)			Agree	Quadrilateral planes curved along an axis, front and rear sides of the planes are visible	Very seamless & content bound (Good)
(d)				Horizontal planes at different levels and angles along with a wire frame	
(e)			Moderate	Rings created with wires are linked linearly in the subtracted rectangular profile	Medium seamless & content bound (Above average)
Collective process and the outcome (a)'Castle' (b) 'Houses at L' Estaque' (c) 'Le Chemin' (d) 'Houses on the hill' (e)'Fruit dish glass					

Validating a direction adopted in a basic design studio based on the principles of constructivism

brief; documentation of the processes enabled a deeper understanding on the ideas evolved; experienced several other skills including presentation during the documentation process. The qualitative analysis of the outcomes at the faculty training programme is interpreted in Figure 4.

The task formulated for the faculty members adopted the principle of 'borrowing' from paintings and falling under the '4D to 3D'. It was about interpreting the fourth dimension predominant in 'cubism' art movement, translating and transforming in to a three dimensioned output. The process, outcomes exhibiting fourth dimension, the analysis by a pair of intra raters as well as ours based on the process and content are consolidated in Table 13. It was observed that the outcomes were classified as very seamless and content rich, very seamless and content bound, medium seamless and content bound which fall under very good, good and above average respectively.

Among the sixty eight items in the questionnaire (See appendix B), critical thinking, problem structuring, learning from peers under the skills to be fostered in basic design studio; 1D, 2D to 2D, 3D to 2D,
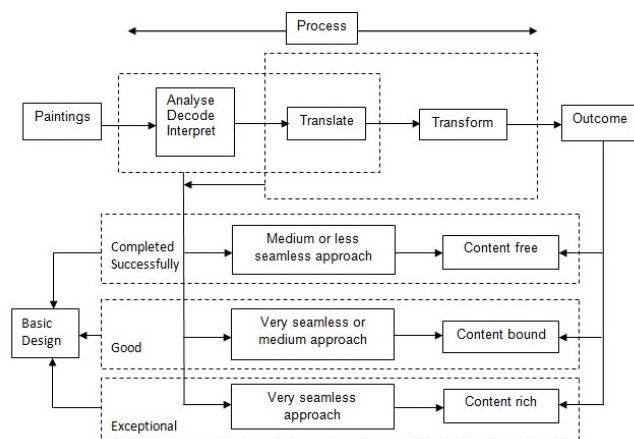

Figure 4. *Decoding the process and the outcomes.*

3D to 3D, 4D to 3D falling under the classification of tasks; puzzles, poems, dance, movies categorised under the sources of inspiration for framing tasks; dexterity and pragmatic grouped under the characteristics of the tasks; meticulousness under the evaluation are observed to be crucial. The calculated mean score for each item in post score display a stark increase when compared to the pre test score, an outcome of the lecture as well as active participation in the framed task. The overall performance of the students and the findings from diverse perspectives posit that

Table 14. *Fit of data integration.*

| Analysis	Exploratory phase		Confirmatory phase	Findings
Participants	Novices (Studio)		Teachers (training programme)	Knowledge constructed through experiential learning, facilitator's involvement is directly proportional to the participants' involvement
Participants' perspective	active agents in learning, design process, developed multiple perspectives, importance of peer learning		Documentation of design processes and outcomes are interesting; working in groups is difficult	
Source of inspiration in framing the tasks	Alphabets, Fibonacci series, materials, puzzle, paintings, nature, geometry		Cubism paintings by Georges Braque & Albert Gleizes	Broadened the channels to frame generative tasks
Pearson's correlation coefficient	continuous assessment and total creativity		'interpretation', '2D to 3D', '2D content in 3D' and total creativity	An insight to foster diverse thinking skills, problem structuring along with creativity in a basic design studio.
	0.72	strong relationship	>0.65	strong relationship	
Overall performance	Nearly 45% of students performed well		All the groups completed the task successfully within the time frame	
Skilled assessors	Presented the ideas and approaches well		An insight to process oriented outcome	
Authors	Framing informal activities and tasks, sequential planning of tasks follows the kind and level of knowledge to be constructed by the novices/ Assessment based on approach and the degree of content			A strategy towards a constructivist pedagogy
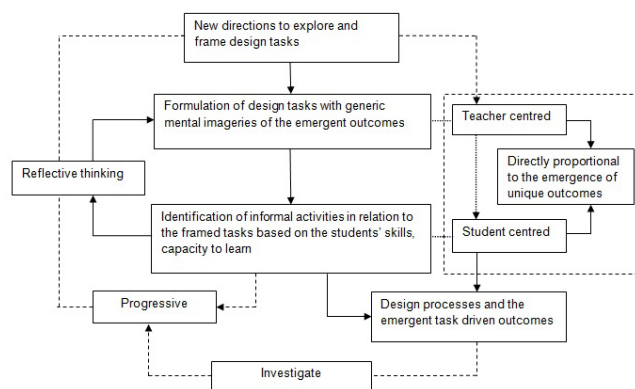
Figure 5. The interpretation.

the constructivist methodology, experimental in nature adopted in the studio is a directive to foster logical thinking skills and creativity in basic design studio as in Table 14.

5. Discussion

Examining the outcomes along with the processes and the total creativity improved the reliability between two groups of skilled assessors, reducing the degree of subjectivity. It is observed that appropriate problem structuring right from decoding the task yield task specific creative outcomes. Findings from skilled assessors and the novices display the principles of constructivist pedagogy reinforcing 'levels of participation in learning process are inextricably linked to their teachers' level of participation in their own learning processes' (Cormu & Peters, 2005).

In this design studio, the design tasks were planned sequentially. The tasks in the initial phases were predominantly two dimensional, whereas the degree of complexity was very high. In addition we also observed the importance analyzing the knowledge constructed for both the learners as well as ourselves. From the study, we posit that the methodology adopted at the studio to be an effective method to foster creativity and thinking skills. The approach adopted is observed to be student or learner centred as well as teacher centred as interpreted in Figure 5. Framing informal activities in association with the design task serve as the base to explore new directions. We posit that with the experienced constructed in this approach, the tasks can be integrated with the architectural

drawing as well as the art studio.

The outcomes display a deeper understanding of design principles, construction of knowledge through participation and an insight to the inner potentials; the documented processes enabled the novices as well as the participants at the training programme to present the ideas effectively and dynamically. Logical reasoning with preliminary mental imageries of the emergent outcomes plays a significant role in framing and sequential planning of design tasks in a basic design studio.

While adopting the principles of constructivism in pedagogy, one has to be cautious as it yields poor results if not taken in an appropriate direction. We observed that the levels of inputs given and the students in the studio are directly proportional to the emergence of unique outcomes. Findings display that 'constructivism' has numerous potentials to develop new directions in architectural education. We strongly posit that introducing an informal activity prior to the formal task is recognized as a direction which adopts principles of constructivism in basic design studios. In future, design tasks based on music, movies, dances and association with other arts can be explored and experimented to augment the thinking skills and creativity studios.

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Appendix A

Sathyabama Institute of Science and Technology
Department of Architecture
Architectural Design I
Batch: 2016-2021

Name :   Age:

What is creativity?	
How do you interpret 'Processes'?	

Your perspective on the framed tasks (Tick your options)

Task	Thought provoking	Enjoyment	Curiosity	Playfulness	Peer learning	Challenging
Word art						
Grids & illusions						
Figure & ground						
Built with a single line						
Tan-a-morph						
Decode, abstract, model						
Model with planes						
Nature						

Task	Describe your outcomes
Word art	
Grids & illusions	
Figure & ground	
Built with a single line	
Tan-a-morph	
Decode, abstract, model	
Model with planes	
Nature	

Your experience	
Signature with date	

Appendix B

'4ᵗʰ DMN' 2 '3D'	
Objective	To foster the need for adopting 'constructivism' in basic design
Framed task	Interpreting the 'fourth dimension' three dimensionally
Tool	Paintings
"Fourth dimension"	Simultaneous revelation of more than one aspect of an object in an effort to express the total image.
	By breaking objects and figures down into distinct areas or planes, the artists aimed to show different viewpoints at the same time and within the same space and so suggest their three dimensional form. In doing so they also emphasized the two-dimensional flatness of the canvas, instead of creating the illusion of depth.
Artist	Georges Braque
Painting	Houses at L'Estaque, 1908
Style	Cubism: An early 20th-century style and movement in art, especially painting, in which perspective with a single viewpoint was abandoned and use was made of simple geometric shapes, interlocking planes, and, later, collage
Description	Color has been reduced to a severe combination of browns, dull greens and grays The curving rhythms have given way to a system of verticals and horizontals, broken only by the forty-five degree diagonals of roof-tops and trees. All details have been eliminated and the foliage of the trees reduced to a minimum to reveal the geometric severity of the houses. These are continued upwards almost to the top of the canvas so that the eye is allowed no escape beyond them. The picture plane is further emphasized by the complete lack of aerial perspective (the far houses are, if anything, darker and stronger in value than the foreground house), and by the fact that occasionally contours are broken and forms opened up into each other. There is no central vanishing point; indeed in many of the houses all the canons of traditional perspective are completely broken.
Source	http://www.cc.utah.edu/~jtw5817/5780/braque.htm, Accessed on 19ᵗʰ November 2016.
Georges Braque (other paintings)	Fruit dish glass (1912); woman and guitar (1913); Castle (1912), Harbor at Normandy (1909); Houses at L'Estaque (1908)
Albert Gleizes	Houses on the hill (1912)

Appendix C

Council of Architecture
Regional Faculty Induction Programme for Teachers and to-be Teachers of Architecture
(0 to 5 years of teaching experience)
Vellore Institute of Technology (21st November 2016)
Basic design

Name   :   Age   :   Session:
FN
Mobile number: e mail id:
(Note: Tick the relevant options)

Objectives
Classification of tasks

Classification of tasks	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
One-dimensional					
Two dimensional					
Three dimensional					
Translations or Transformations — 1D to 2D					
2D to 2D					
1D to 3D					
2D to 3D					
3D to 2D					
3D to 3D					
4D to 3D					

Various channels to frame tasks

Sources of inspiration	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
Geometry					
Materials					
Paintings					
Sculpture					
Nature					
Origami					
Puzzles					
Poems					
Dance					
Music					
Movies					

Characteristics of framed tasks

Characteristics of tasks	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
Composition					
Dissection					
Extrusion					
Interlocking					
Folding					
Modular					
Intricate					
Dexterity					
Addition					
Subtraction					
Movement					
Pragmatic					
Transformation					
Material property					
Should it be integrated with architectural drawing and art studio					

The outcomes

The outcomes	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
Visual experience					
Auditory experience					
Tactile experience					
Multiple experiences					
To unravel the mental imageries of novices					

Evaluation criteria

Evaluation criteria	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
The outcome					
Process					
Clarity in interpreting the problem					
Degree of participation					
Origin of ideas					
Logical development of ideas					
Creativity					
Composition					
Meticulousness					
Graphical or three dimensional presentation					
Communication					

Suggestion:
Signature with date

Validating a direction adopted in a basic design studio based on the principles of constructivism