# Game Based Sketching Practices for Architectural Design Education

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**ABSTRACT**
This study discusses the meaning of 'sketch' beyond drawing lines and theorizes it throughout several characteristics: '*Descriptive language, unique character, collaboration, simple and practical skill, intuitive tool, endless design'*. As an innovative and motivating way in design education field, this study develops six games for 'sketch education' and considers these characteristics to emphasize the strategy of them. The aim of this paper is to encourage architectural students to draw in an informal environment through the games based on the structural foundations of "sketch". The main goal of these games is to strengthen 'hand-eye-mind' coordination through social interaction in the way of design-learning. The games can be considered as training for developing and practicing ideas for design studios. By creating a social platform in the delivery of the thought, it is tried to gain a creative and flexible view by taking strategic decisions in limited time. The games are integrated with an elective course on sketching in architectural education. Every year they are regenerated in accordance with students' contribution. The designed games in the context of this study may be helpful for design educators or researchers from other relevant disciplines in developing strategies in sketch teaching and learning.
**Keywords:** Sketch, design education, drawing, game, hand-eye-mind coordination.

## 1. INTRODUCTION

*'Draw Antonio, draw…'*
*Michelangelo Buonararroti's biggest advice written on a piece of paper to his assistant who asked him about the right path to becoming a great artist (Belardi 2014, 37).*

The simplest way to do a job, just as it is in sketching, is to test it several times. While experiencing, the intention is to internalize the finest details about it. This sensibility is still alive in unexpected areas; Rijks Museum in Amsterdam had a campaign under a tagline 'you see more when you draw'. The Dutch national museum banned cameras in order to help visitors to discover art, architecture and beauty through drawing. (Foster 2015) Representation techniques has been changing and evolving in architecture over the years. In recent times hand and digital techniques tend to be more in relation. However, hand drawing never loses its priority due to its characteristic of being haptic and emotional. Pallasmaa, in his book about architectural theory, compares hand drawing with digital drawing and finds out that hand drawing-he calls it 'mediated construction'- enhance senses unconsciously by its haptic exercise. He mentions: 'As I sketch a contour of an object, human figure or landscape, I actually touch and feel the surface of the subject of my attention, and unconsciously I sense and internalize its character.' In contrast with this, while drawing by computer and a mouse, the hand usually selects the lines from a given set of symbols that are free from haptic or emotional senses (Pallasmaa 2005).

In architectural education, drawing by hand dominates but supported by computer technologies in different stages. Especially conceptual stage of a project always requires a creative process which has the highest density of eye-hand-mind

concentration. The main goal of these games is to strengthen 'hand-eye-mind' coordination through social interaction in the way of design-learning. In the context of this goal, the study aims to assist other relevant disciplines via games for 'sketch education' in order to make students draw more and to learn unconsciously.

## 2. SKETCH; BEYOND DRAWING A LINE

When famous painter Joan Miró Ferramet met with drawings of Paul Klee in his childhood, new doors were opened for his art life. Every ordinary line could have a possible meaning. As Paul Klee says;' A drawing is simply a line going for a walk'. Every line wants to be free in order to transfer the idea. Especially in early design phase, the borders of opinion are parallel with the freedom of lines. The way we represent our thoughts and actions while designing is an important topic in the research of the design process. (Bar-Eli, 2013). Sketches are 'a way of turning internal thought public, of making fleeting thoughts more permanent' and 'a sketch is a literal model of an idea, an existence proof (Tversky, 2002) Therefore, sketch is no longer just a bunch of dots, integrating with knowledge, should look like a shell of an idea beyond geometric expression.

Drawing requires a level of high concentration for hand-eye-mind coordination. However, there have also been serious attempts to weaken or eliminate this close circuit. Pallasma mentions: 'His professor and mentor Aulis Blomstedt liked to draw but with his eyes closed in order to eliminate the close coordination of the eye and hand. Plus Jackson Pollock and Morris Louis, had their colors spread on canvas by means of gravity and various process of pouring and throwing the paint rather than the visual guidance of the eye and muscular control of the hand' (Pallasmaa 2005). Looking from this perspective, speed-up exercises for hand- eye-mind coordination may be reasonable to eliminate irrelevant things between the drawing and mind (pen is just a tool).

Bilda, Gero, and Purcell (2006) claim that sketching is a learned procedure during design education where architects learn to think with drawings, develop their ideas and solve complex problems with them. (Bilda et al. 2006) Design is a kind of problem solving beyond dealing with shapes, drawing lines and contours. Sketch as a tool to solve problems in design can be defined in the context of the following criteria:

### 2.1. Descriptive language

'Sketching is a quick, readily available, dense, self-generative and above all, extraordinarily communicative notational system' (Belardi 2014: 32). Sketch can be fed from many different languages; it doesn't only utilize drawing, but also talking or writing. The research which examines how novice and advanced design students perceive different things from conceptual sketches showed that performance is relevant to the designers rather than their physical skill to draw. Advanced architectural students used more verbal cognitive actions (Menezes & Lawson, 2006).

Also sketch can be a magical mediator for conveying student thought. "Graphic, verbal, written, and gestural design process is important for communication of information, not merely production of artifacts to meet an educational requirement." (Orthel & Day 2016:15) In architecture every design is accepted as a problem. Behind a design, there is always a hidden team of powerful collaboration. Being part of a team needs coordination skills such as using language of sketching. Identifying the types of sketches and how they serve designers in different ways can assist in identifying the differences between designers. Ferguson (1992) mentions three kinds of sketches (thinking-talking-prescriptive), that have particular purpose: *Thinking sketch* supports the designer's thinking activity in support of their individual thinking processes, the *talking sketch* occurs in group discussions, plays with words and *prescriptive sketch* refer to the designers who communicate design decisions to people who are outside the design process. Van der Lugt argues that 'Ferguson's sketching type has its limitations, as each type of sketch solely

covers one type of design activity' and that 'in practice, a single drawing can have various functions at different moments in the process' (Bar-Eli et al. 2013: Van der Lugt 2001) With the varied uses of sketches for inspiration and design thinking, communication, recording, evaluation and testing, analysis, visualization and understanding, together with a passion to create images, architects depend upon a representational medium to facilitate the dialogue of these functions. Primarily visual rather than verbal or written, design requires a projection for this conversation. These visual tools help architects communicate with colleagues or engage a personal discussion with their images. (Smith 2008, 2)

**2.2. Unique character**

Albert Einstein says: 'The true sign of intelligence is not knowledge but imagination.' A line does not always have to express a specific idea and perceived as the same by everyone. It may have a special meaning which can only evoke different feelings to its owner. Sketch is a unique way as thinking rather than drawing. Every designer can get different results from lines for the same design problem. Sketch tells what it is much more than it by presenting original idea behind the design. Sketch also tells about its owner via unique character of lines. Architects employ sketches in many stages of the design process. These uses may fall into several areas that could be grouped as *discovery, communication, visualization, recording* and *evaluation*. These groupings may be typical, but not necessarily all-inclusive, as each individual architect manipulates sketches in his or her own unique way. (Smith 2008: 18) Thus, sketch can be both communal and individually at the same time.

**2.3. Collaboration**

Collaboration is a key skill for designers and a critical component for functioning product teams. Regular collaboration in different departments not only enables a faster and smoother process, but also helps to eliminate risks. (Follett,2017) Sketch has a power of collaboration in itself. Most of all, 'Sketching technique is essential for architecture, embracing two distinct but complementary fields: one on the path of knowledge, approaching something that already exists, and the other on the path of conception, concerning what one has in mind to create' (Belardi 2014:33). The sketch, which is nourished by brainstorming and criticism in the process of meeting with the idea of knowledge, is actually an intellectual activity. Mutual exchange of ideas, as well as sketches, encourages creativity in design.

**2.4. Simple and practical skill**

Sketching is a visual thinking process; designers sketch their ideas, inspect their sketches and perceive new possibilities, generating more creative ideas. (Sun,L. et.al 2014) "The look of the sketch is not as important as the role it plays in the design process. As an architectural representation, its physical appearance is irrelevant. It is valued for quality other than its beauty. Ambiguous and tentative, it easily carry emotions and subtleties of illusion and allusion." (Smith 2005: 19) Hence, main aim of the sketch is to transfer an idea step by step in an easy way like a visualization of an idea. When sketch-as a painting- is handled as an independent and finished product from design process, it can be faced with the danger of becoming like the imitation of product or design. It doesn't have to be difficult and long to be able to get rid of an imitation and perform its originality. When most popular architects' sketches are examined, it can be observed that the essence of the design is represented in a simplest way. In this simple attitude, the design focuses certainly on the eye-catching and accentuated details desired.

**2.5. Intuitive tool**

Sketching builds conversation between the internal mental and external materializing activities. (Sun,L. et al, 2014) Since its being both a thinking and communication tool, sketching enables people from different domains to use a shared language. It can be in various industries apart from architecture such as, web engineering as *data sketching*,

visual arts as *graphic design*, law as *face identification* and psychoanalytical studies as a *view of emotion*. In the section titled: 'Sketches are the DNA of an idea' Belardi points out successes from different branches (writer, poet, scientist, and architect) linked with sketch (Belardi 2014: 24-34). In their research, Ekman et all point out that voice is used as a sketching tool for addressing sounding design.

### 2.6. Endless design

Lastly, sketching is to generate new ideas as it leads to further ones. (Börekçi et al. 2016:Tovey 2003). It can be described as a method for thinking rather than drawing. Goldschmidt (1991:130), points out that sketch may be transformed by adding to it, by deleting parts or by drawing over it. She claims that the designer is not confined to a single sketch and a series of sketches may be produced as a continuum or as a spotty collection of diverse images. This kind of exercise is not an improved or finished work instead; it is part of a preparation process. As Ching (2006:10) stated: 'Drawing is beyond ability of a hand, not just visually but envisaging the images again'. By drawing new items can be noticed and new possibilities can be faced with (Ching 2006: 31). This feature privilege sketch to be endless.

## 3. DESIGNING GAMES TO ENHANCE SKETCH LEARNING

'Heidegger considers teaching even more difficult than learning: Teaching is even more difficult than learning (..) Not because the lecturer must have a larger store of information, and have it always ready. Teaching is more difficult than learning because what teaching calls for is this: to let learn. The real lecturer, in fact, lets nothing else be learned than-learning. "The difficulty of teaching concerns especially the task of teaching existential wisdom" (Pallasmaa, 2011). So teaching needs high level of concentration for learning. In a study investigating what the teachers were actually doing in the classroom during drawing courses finds the most important thing commented (Coutts & Dougall, 2005): 'The role of the teacher is to learn from pupils… I don't want to be there as the instructor who has all the manuals and will pass on the skills to them. I'm learning from them.'

Architectural education, which is a hardworking experience, needs an intense process for learning (for students and lecturers). Like design process, architectural education cannot remain static, but technical courses are so intense that students sometimes get bored. In this period of time, courses especially elective ones may be joyful, energetic, interesting that will be the tasteful part of design education. For instance, a sketching course can be composed of formal and an informal part. While the formal part aims to transfer the theoretical and practical knowledge under the direct supervision of the lecturer, the informal part will be a more democratic and spontaneous one. Knowledge is produced by self-learning through conversations, self-experiences, free acts and different ways of working. At this point, games can be used as an informal education tool for making the course motivating and interesting. Not like practicing, but more like playing a game, pretending to be a player helps to forget that you are in the course, and to forget the lecturer. Furthermore, as everyone agrees, people of all ages love playing a game. 'A survey of some 650 MIT freshmen found that 88 percent of them had played games before they were 10 years old, and more than 75 percent of them were still playing games at least once a month. Sixty percent of MIT students spend an hour or more a week playing computer games.' (Squire & Jenkins, 2003: 11) Welcoming students to play is easier than to provide them to attend the course. These emotional, perceptual and cognitive processes - mentioned below- are connected in a way of playing games. This method is called 'Unconscious learning' in literature of education. Literature shows that the role of unconscious learning enhances the understanding of how students form or activate mental associations between verbal and pictorial information (Kuldas, 2013). Moreover, forms of mental representations –that can be gained by means of games- representing and communicating feelings, thoughts, ideas and personal experiences, images, concepts, schemata enable individuals to process information, understanding experience and events (Kuldas, S., *et al.* 2013 :

Mayer *et al*.1999).

Games are also supportive materials for high concentration and motivation in unconscious learning. Kapp (2012) described ***Gamification*** as 'simply the use of game mechanics to make learning & instruction more fun. Plus, games are ideal environment with their built-in permission to fail, encouragement of out-of-box thinking, and sense of control' (Kapp, 2012). This study motivated the author to produce games as a pedagogical strategy. By using the advantage of interactive and collective potential, games enhance design thinking, drawing, problem solving by building relationships.

The study consists of designed games played with students in the 'Sketching Techniques Course' in Department of Architecture, Yıldız Technical University. The games can be formatted for single or multi players. (Table 1) Every game can be considered as training for developing and transferring the knowledge for design studios. By creating a social platform in the delivery of the thought, it is tried to gain a creative and flexible view by taking strategic decisions in limited time. Every game needs a design solution of its own and various kinds of skills such as drawing, talking or writing which can be developed by playing these games. In architectural education, these games can be related to other courses in terms of practice, presentation, expression and creativity;

*Practice*: Enhancing fast thinking through strategic, flexible and analytical thinking, supports feedbacks in the process especially in design studios,
*Presentation:* Seeking ways of expressing thought in the shortest way develops expression techniques in architectural drawing courses,
*Expression*: The authenticity of designs can also be inspired by philosophy of sketch. The uniqueness of individual thought and its awareness can be read in the expression of sketch and this doctrine will be helpful in courses based on individual performance.
*Creativity*: To make sense of the lines, considering them such relative perspective will directly contribute to the lessons in the overall education of architecture.

Table 1: Game types according to way of playing

| **SINGLE** | **MULTIPLAYER** |
|---|---|
| DRAW WHAT SHE TELLS | HAND SKETCH AROUND |
| LEAST LINE WINS | GUESS WHAT? |
| WHAT DO YOU SEE | |
| WHICH SONG? | |

In addition to this, every game has been designed relating to seven principles for sketch as shown in the following Table 2.

Table 2: Principles and game relationship

| Games / principles | Descriptive Language | Unique character | Collobora tion | Simple and practical skill | Intuitive tool | Endless design |
|---|---|---|---|---|---|---|
| ***DRAW WHAT (S)HE TELLS*** | ✓ | | | ✓ | | |
| ***LEAST LINE WINS*** | | | | ✓ | | |
| ***WHAT DO YOU SEE?*** | | ✓ | | | | ✓ |
| ***HAND SKETCH AROUND!*** | | | ✓ | | | ✓ |

| | | | | | | |
|---|---|---|---|---|---|---|
| ***GUESS WHAT?*** | ✓ | | ✓ | | | |
| ***WHICH SONG?*** | | | | | ✓ | |

### 3.1. "Draw what (s)he tells"

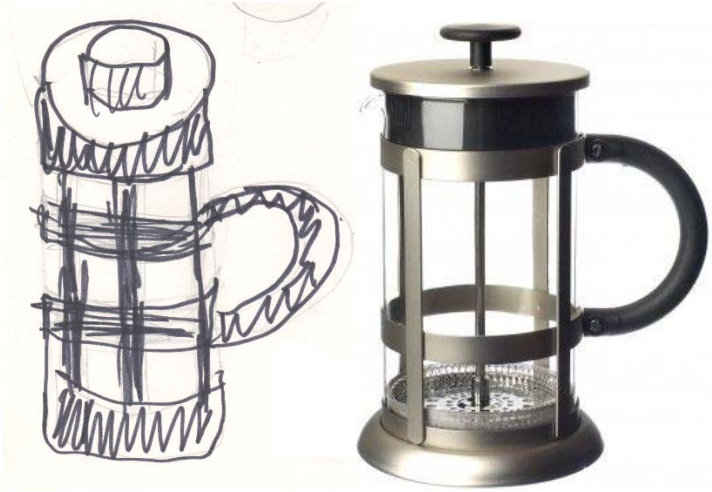

Image 1: student drawings from the game "Draw what (s)he tells"

- *Principle: Descriptive Language, Simple and practical skill*

This game can be played with 2 players one by one. The daily life objects that are chosen by the lecturer will be drawn. One player will define the object to the other player orally (only teller can see the object). It is forbidden to give clues about the object (what it is used for, etc). After all is done, the drawing player will guess what it is. Then players change.

Table 3: Aim-goal-skill for "Draw what (s)he tells"

| | aim | goal | skills |
|---|---|---|---|
| ***Draw what (s)he tells*** | -to speak by means of geometry<br>-choose the right words to define the object given<br>-find original (specific, realistic) ways to understand design geometry | -to improve verbal communication in design, -to emphasize verbal language in early phase of design | -drawing technique<br>-giving a meaning to geometry<br>-oral presentation<br>-imagination |

### 3.2. "Least line wins"

- *Principle: Simple and practical skill*

This game is played individually. A volunteer chooses his/her card from the box so that nobody can see it. Then tries to describe others a'well known structure' (given with an image card by the lecturer) by a minimum number of a line. Maximum number of the lines is 6 while minimum number is 1. The class audience tries to guess the structure after one line is drawn. Players take points, up to winning number of defining lines.

Table 4: Aim-goal-skill for "Least line wins?"

| | aim | goal | skills |
|---|---|---|---|
| ***Least line wins*** | - to transform the shown images in a simple way - to define the striking lines of the structures | - to improve abstraction | - graphical expression<br>-identifying main points / first thoughts of a design<br>-to read a building<br>-fast thinking<br>-to be simple, solution-oriented |

### 3.3. "What do YOU see?"

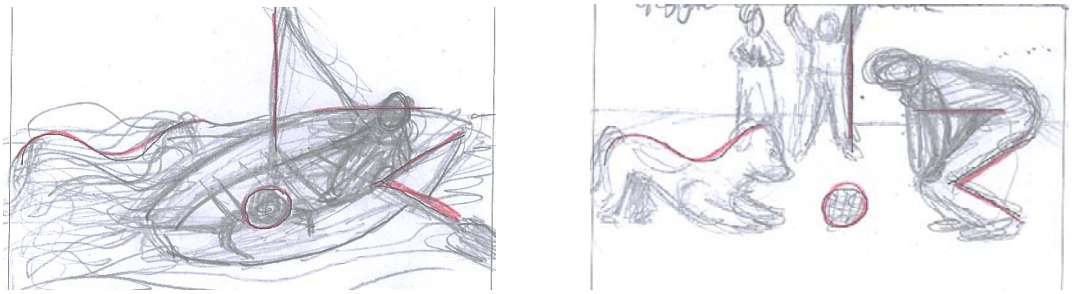

Image 2: Design variations through same lines

- *Principle: Unique character / Endless design*

This game can be played with 2 players. Lecturer divides the board vertically into two parts and put a separator between them. Then he / she draws undefined lines in one part synchronized with other part. Each player tries to complete these lines up to their creative imagination in 3 minutes. The class audience gives points to each player up to their own judgement.

Table 5: Aim-goal-skill for "What do YOU see?"

| | aim | goal | skills |
|---|---|---|---|
| ***What do YOU see?*** | -to draw more in a limited time | -to enhance creativity<br>-to think in a different way | -holistic view<br>- to develop alternatives<br>- abstract perception<br>- improving alternatives |

### *3.4. "Hand sketch around!"*

Image 3: An example of a Collective monster

- *Principle: Endless Design – colloboration*

This is a simple adaptation of 'Chinese whispers'game. Also this game was inspired by 'sketchbook circle' in TEA Thinking-Expression-Action Project developed in UK (Brass & Coles 2014). This game is creating a space for design to interact. After forming teams, first player begins to draw a monster. Then every player adds lines to this monster one by one without seeing each other. The last player gives a name to the monster. Then the teacher sticks the monsters on the board and starts brainstorming by asking questions to the team players about the life of the monsters. (Where it is living, How old is it, what does is it like to do, how tall is it? Etc) According to the answers, the teacher asks the players to think again and starts the game again. This time, the players try to design an environment for the monster by the same way they did before.

Table 6: Aim-goal-skill for "Hand sketch around!"

| | aim | goal | skills |
|---|---|---|---|
| ***Hand sketch*** | - To able to continue someone's drawing without speaking with him / her. | - To decide individually and have a common product in a collaborative way | Collaborative design<br>Creating context<br>Communicating in creative ways |

### *3.5. "Guess what?"*

Figure 5 teams are playing "guess what" in the clasroom

- *Principle: Descriptive language, colloboration*

This game is a simple adaptation of ***'taboo'*** game. Only difference is that, while Taboo uses verbal language, 'Guess What' uses drawing language. While describing the 'word', each player has to avoid drawing five related keywords on the card. Other team players can see the card so that they can control the game. Each team consists of 3 players. Each team is supposed to guess two concrete and two abstract words.

Table 7: Aim-goal-skill for "Guess what?"

| | aim | goal | skills |
|---|---|---|---|
| ***Guess what*** | - To describe the 'Word' by sketching. | - Enhance abstraction and drawing language with line exercises. Helps to find different ways logically to describe something. | -to describe abstract ideas<br>-creativity in defining something<br>-verbal communication<br>-helping eachother |

### *3.6. "Which song?"*

- *Principle: Intuitive tool*

This game is played with two players. Lecturer make players listen to 3 different audio tracks. Each player chooses one of them and draw lines according to it. Then each player tries to guess the audio track from line drawings.

Table 8: Aim-goal-skill for "Which Song?"

| | aim | Goal | Skills |
|---|---|---|---|
| ***Which song?*** | - To transfer feelings extracted from music by lines. | - Enhance hand-ear-mind connection. | -visualization of feelings<br>-relating to art branches for design. |

All of the games are played face-to-face but in further time, these ones can be upgraded as online video and computer version. But as a start, these physical face-to-face gaming is expected to have more social aspects such as verbal potential, cognitive experiences and spontaneous outcomes.

## 4. CONCLUSION

As a consequence, games are innovative methods for design education to enhance creative thinking and high motivation. It is a known fact that there can be numerous appropriate solutions for design problem. If design is considered as a problem solving practice, the principles on which the games in this study are based (*Descriptive language, unique character, collaboration, simple and practical skill, intuitive tool, endless design)* support the production process of an idea in design education. The aim of the sketch games as visual and verbal thinking exercises in this study, constitutes ways of design through strengthening hand-eye-mind coordination. All of the games suggested above have serious contributions to design education around such main following headings:

-designing more while expressing less
-generating more creative ideas
-perceive new possibilities

But most important of all, sketching games encourage students to experience over and over without the risk of boring exercises, strict frames and ability requirement.

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## REFERENCES

Bar-Eli, S. (2013). Sketching Profiles: Awareness To Individual Differences In Sketching As A Means Of Enhancing Design Solution Development, Design Studies 34, PP.472-493

Belardi, P. (2014). Why Architects Still Draw, MIT, USA.

Bilda, Z. Gero, J. S., & Purcell, T. (2006). To Sketch Or Not To Sketch? That Is The Question, Design Studies, Vol 27, I:5 pp:587-613.

Börekçi, N.A.G.Z (2016). *Visual Thinking Styles And Idea Generation Strategies Employed In Visual Brainstorming Sessions* : Tovey, M., Porter, S., & Newman, R. (2003). Sketching, Concept Development And Automotive Design, *Design Studies*, 24, Pp 135–153.

Brass, S. & Coles, S. (2014). *Artist Teachers Exchange: Reflections On An Collobrative Sketchbook Project For Secondary School Art Teachers*, Jade, Nsead/John Wiley & Sons Ltd.

Ching, C.K. (2006). *Drawing A Creative Process*, (Turkish), Yem, İstanbul.

Coutts G. & Dougall P. (2005). *'Drawing In Perspective: Scottish Art And Design Teachers Discuss Drawing'*, Jade, Nsead / Blackwell Publishing Ltd.

Ferguson, E.S (1992). *Engineering And The Mind's Eye,* MIT, Cambridge**.**

Follet J. (2017). "*Collaboration And The Designer's Mindset, A Look At Real-World İnstances Where Design Collaboration Has Achieved Excellent Results*." Available At:Https://Www.Oreilly.Com/İdeas/Collaboration-And-The-Designers-Mindset (29.03.2018)

Goldschmidt, G (1991). *The Dialectics of Sketching,* Creativity Research Journal, Vol 4 I 2, pp:123-143.

Karl, M. Kapp. (2012) *The Gamification Of Learning & Instruction –Game Based Methods And Strategies For Training And Education*- Pfeiffer, USA.

Kuldas, S., Ismail H. N., Hashim S. & Bakar Z. (2013). *Unconscious Learning Processes: Mental Integration Of Verbal And Pictorial Instructional Materials.* Springerplus. Available At: Http://Springerplus.Springeropen.Com/Articles/10.1186/2193-1801-2-105 .

Mayer, Re., Moreno, R., Boire, M. & Vagge, S. (1999). *Maximizing Constructivist Learning From Multimedia Communications By Minimizing Cognitive Load.*, J Educ Psychol.

Menezes, A. & Lawson, B. (2006). *How Designers Perceive Sketches*, Design Studies, Elsevier, Vol:27 I:5, PP:571-585.

Orthel, B.D. & Day, J.K (2016). *Processing Beyond Drawing: A Case Study Exploring Ideation For Teaching Design*, Sage Open, July-September 2016: 1–16

Pallasmaa, J. (2005). *The Thinking Hand Existential And Embodied Wisdom In Architecture*, Wiley Press.

Schutze, M., Sachse, P., & Romer, A. (2003). *Support Value of Sketching In the Design Process*. Research In Engineering Design-Theory Applications And Con- Current Engineering, 14, 89-97.

Smith, K.S. (2008). *Architects' Sketches - Dialogue And Design*, Architectural Press, Elsevier.

Smith, K.S. (2005). *Architects' Drawings – A Selection Of Sketches By World Famous Architects Through History*, Architectural Press.

Soygenis S., Soygeniş M. & Erktin E. (2010). *Writing As A Tool In Teaching Sketching: Implications For Architectural Design Education*, International Journal Of Art & Design Education, Vol 29, Issue 3.

Squire K. & Jenkins H. (2003). *Harnessing The Power Of Games In Education*, Insight, Vol 3 Vision 5,

*Sun,L., Xiang, W., Chai,C., Yang, Z., Zhang,K. (2014). Designers' Perception During Sketching: An Examination Of Creative Segment Theory Using Eye Movements, Elsevier, Design Studies Vol 35 No. 6 November 2014.*

*Taboo: Party game published by Parker Brothers in 1989 (subsequently purchased by Hasbro)*

*Taylor-Foster,J. (2015). Amsterdam's Rijksmuseum 'Bans' Cameras to Encourage Sketching, Http://Www.Archdaily.Com/776643/Amsterdams-Rijksmuseum-Bans-*Cameras-To-Encourage-Sketching)Accessed 6 November, 2015.

Tversky, B. (2002). *What Do Sketches Say About Thinking*. Aaai Technical Report Ss-02-08.

Van Der Lugt, R. (2001). *Sketching In Design Idea Generation Meetings*, Delft University of Technology. Doctoral Dissertation.