Doctoral Dissertation

Investigating the Creative Cognition of Craftsmen for the Improvement of Design Education

Deny Willy Junaidy

Supervisor: Professor Yukari Nagai

School of Knowledge Science
Japan Advanced Institute of Science and Technology

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To my parents, my wife, and my daughter

Abstract

Keywords:
Creative Cognition, Cognitive Fixedness, Traditional Craftsman, Design Education and Training, Knowledge Contributor.

This study aims to reveal potential aspects of barrier in creativity (i.e., cognitive fixedness) in people who possess traditional/conservative viewpoints. We investigate the characteristic of craftsman's conceptual ideation process, namely, beliefs in prior knowledge, be it tradition, habit (belief in form, belief in perfection; belief in manner). Thorough knowledge about beliefs allow for the retention of prior knowledge without harm. Without sufficient knowledge to the beliefs, any attempt to introduce unconventional ways of thinking would encounter difficulty. Our goal is to provide resource for the development of design education delivery (a nationwide governmental Human Resource Development/HRD program that operates in developing countries) for traditional craftsmen to produce more desirable product.

For having basic understanding of craftsmen's beliefs in conceptual ideation process, we first focus at the origin of state of mind in which an object or situation are perceived in familiar way. We observe the creative learning process of children in traditional craft villages that internalised and deeply rooted in action and attitudes. This portrays how cognitive fixedness in conservative viewpoint is formed in childhood. We observe parent-child co-creative play experience and concluded that stronger role-taking behavior facilitates children's development of formative skills (i.e., craftsmanship) which seems to give apprentice-like experience, while independence leads to more exploratory thinking (i.e., creativity). This likely has been fostered since childhood stage that shapes Indonesian children in the craft villages become inter-dependence and maintain consistently the rigid practice of craftsmanship as a consistent belief.

As we understand the origin of cognitive fixedness of traditional craftsmen, furthermore we investigated the cognitive fixedness from the associative concepts of craftsmen and designers (design trainers) as they conceptualize their ideas at the early stage of idea generation. To capture associative concepts that occur at in-depth cognitive levels of imagination we conducted a think-aloud protocol. We employed a concept network analysis based on the associative concept dictionary to extract verbalized thoughts. We request, both the craftsmen and design trainers to imagine designing a fruit bowl. When imagine designing a fruit bowl, craftsmen's associative concept placed greater focus on product appearance and technical aspects, such as operation (i.e., replace, reduce, etc.) and shape (i.e., waist, body, etc.). In contrast, design trainers' associative concepts paid greater attention to the presence of issues related to surroundings, such as scene (silverware, norm, etc.) and appeal (fresh, dish, etc.). This study demonstrated that design trainers tended to use more remotely associated concepts (polysemous words) that have greater probability of achieving unconventional ways of thinking. While, traditional craftsmen tended to use more closely associated concepts that represent a narrow commitment to a particular issues they familiar with (cognitive fixedness in technical and object property).

To overcome craftsmen's closely associated concepts (cognitive fixedness) we conducted a design experiment for traditional wooden sandal craftsmen to create a new design of traditional wooden sandal. We observed two stages of idea generation, at the first stage, craftsmen were challenged to generate their conservative ideas at extreme level. Furthermore, conceptual sketches and frequently

verbalized thoughts related to unfamiliarity or skepticism were examined by design trainers. In all likelihood, the unfamiliar stimuli "painful," "broken," and "upside-down" were result of extreme level of cognitive fixedness. At the second stage, craftsmen redeveloped and were pushed to utilize this unfamiliar stimuli. The experiment demonstrated that the ability to capture and utilize unfamiliar stimuli during a challenge of extreme levels of cognitive fixedness might lead to unconventional idea, for example, an up-side down wooden sandal. We realized that craftsmen's unfamiliar stimuli that generated at extreme level of cognitive fixedness (i.e., broken shape, painful shape, upside-down shape) are remotely associated concepts that potential for unconventional ideas. This shows that in the state of extreme of cognitive fixedness, craftsmen unconsciously encounter dialectical belief, a state where their conservatism became less rigid. This means they are not just thinking of object properties and technical terms but also thinking more abstract and surroundings issues (appeal or scene).

To avoid narrow or closely associated concepts and produce more intrinsic experiences that access remotely associated concepts at the in-depth cognitive level, craftsmen must experience the dialectical belief in familiar way. Dialectical belief is a criticism phase where one begins to doubt his/her premature commitment (cognitive fixedness); consequently, the individual may become curious about different belief systems. The improved method to challenge traditional craftsman to generate their conservative ideas at extreme level is able to overcome cognitive fixedness. However, traditional craftsman's cognitive resource that has been fostered since childhood is apparently dependent. Therefore, we proposed an embedded design training program within a tourism-based craft workshop-like setting. The visitors, consumers are the knowledge contributors that co-create in design activity with the craftsmen. Challenges are result from the presence of knowledge contributors that brings episodic recreational behavior, i.e., stylistic, mood and curiousity. Ultimately, the knowledge contributors will constantly challenge cognitive fixedness to access remotely associated concepts.

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Chapter 1
Introduction

1.1 Governmental HRD Progam: Design and Creativity Training

To achieve a strong national industry, many developing countries, including Indonesian government have begun to focus on rural industry development because of its potential for new job creation and to maintain national and cultural identities. The government have begun to implement technical assistance programs (a nationwide governmental HRD program that operates in developing countries) in order to produce more desirable product) such as design training to improve traditional craftsmen's creativity levels. Government policies related to the future development of local craft industries are stated as follows:

- Indonesian Presidential Decree No. 6 Year 2007: Fast Growth of Real Sector Policy and Micro Business Development.
- Ministry of Industry Regulation No. 78/IND/PER/10/2007: the Increase of Small and Medium Development Industry Effectively through One Village One Product – OVOP.
- Indonesian Presidential Decree No.28 Year 2008 about the National Industrial Policy.

Crafts sector is a subsector within the Creative Industry category; it is divided broadly over 14 industry categories including advertising, fashion, design, music, etc. In terms of 2010 GDP, fashion industry has contributed 63.3% and followed by crafts sector at 33.2%. The sector is made up of thousands of SMEs at an estimated 6.74% of total companies in Indonesia. The creative industries has also contributed 9% of export value in 2010 [122]. This shows the importance of crafts sector in Indonesian economy. Over the past two decades, technical assistance programs (i.e design training) featured as routine strategic program. At some point, it becomes a joint inter-ministerial program, involving the Ministry of Industry, Ministry of Tourism and Creative Economy, Ministry of Cooperatives and Small and Medium Enterprises.

Design trainers involved at such program often reported that design training delivery encounters difficulties when the craftsmen are introduced to design process. Most of the craftsmen (participants) feel awkward and unfamiliar with design process that introduced. In fact, this is understandable, individual such as traditional craftsmen who reside in developing country are not literate in design, although they possess artistic skills. Design education is a recent phenomenon that follows the traditions of Western models; it is a rational method for identifying and solving design problems. Few studies have focused on curriculum design for craftspeople; in fact, the generic assumption is that

education needs to solve major problem, which is to meet market demand. Understanding the market involves providing information about the gap between users' affective preferences and needs; it is directed toward finding the goal of product design through the problem-driven phase. However, conceptualizing new ideas for products cannot be obtained simply by understanding the market; this process is a phase stemming from an inspiration or inner sense [1]. This study explores latent aspects of in-depth levels of cognition in design creativity, more specifically in conservative conceptualization which has never been explored.

To clarify the standing point of this study, two main issues are discussed. First, understanding current issues on problems of development of traditional craft. We overview the nationwide governmental HRD Progam: design and creativity training. Second, we review the effectiveness of the transfer of knowledge of design training delivery to the traditional craftsman. We emphasize on the investigation on cognitive aspect of creativity of craftspeople who hold strong beliefs or with conservative viewpoint.

1.2 Problem Statement

Very limited attention is given to examine the conceptual process of individual with conservative viewpoint or individual who hold strong belief of customs (i.e., traditional craftsman). An individual like a craftsperson is often recognized for his/her traditional viewpoints that may be structured by prior knowledge and typical features contained in familiar categories known as cognitive fixedness. Therefore, a design training program delivered to traditional craftsman that attempt to introduce unconventional ways of thinking would encounter difficulty. The conceptual design process conceptual design process that introduced is taken for granted from conventional design method in design school. The problem is the lack of understanding of the design trainer about the underlying forms of cognitive fixedness of the traditional craftsman, which essential to facilitate an appropriate design training delivery that fits craftsman's conservative viewpoint.

1.3 Terminologies

We used the following terminologies in this paper:

- *Creative cognition* covers processes and mechanisms that play an important part in many endeavors of human activity that incorporate creative activity. Creative cognition known as cognitive mechanisms combine experiments with existing work in cognitive psychology to provide the cognitive structures that contribute to creative thinking. Creative cognition studies cover concept, formation, categorization, memory retrieval, and problem solving [2].
- *Cognitive Fixedness* is most often demonstrated through functional fixedness, which is defined as the inability to think about something (typically an object) as having any other function outside of its intended use [121]. In design area, it is known as design fixation a commitment to a particular set of unchangeable decisions created by old ways of thinking and responding [7, 10].
- *Design Training* consists of a nationwide governmental HRD program that operates in developing countries. It provides in-studio type design and creativity training for traditional craft craftsmen. The aim of design training is to enhance Craftsmen's creativity and improve the quality of products.
- *A Craftsman* (hereafter referred to as 'Craftsman') is a traditional master craftsperson who resides in a developing country. He or she may possess limited formal education. However, he or she has acquired special craftsman skills and gained expertise in his or her local village's

traditional crafts that have been passed down from one generation to another.

- *A Design Trainer* (hereafter referred to as 'Designer') is an industrial or architectural design graduate who possesses work experience as an instructor in a design training program aimed at the promotion of traditional crafts.
- *Associative Concept Network Analysis (CNA)* CNA is a method of identifying inexplicit associative layer of the free verbalizations expressed. Such associative layer that underpin many free verbalizations. All free verbalizations are examined for words from which they are typically associated by menas of concept dictionary. Construction of concept network associative pairs are added to a network structure on the basis of the number of outgoing connections [3].
- *An Associative Concept* is a representation of an individual's expression. It is a stimulus that can lead to another associative meaning. It is comprised of six sub-types: connotative, collocative, social, affective, reflected, and thematic [4]. The conceptual network depicts human memory as an associative system, in which a single idea can contain multiple meanings (i.e., it is polysemous). A concept network employs a computational model to reproduce observable aspects of expressions associated with an individual's mental state. It is a suitable tool for associative analysis that can be used to explore latent links that exist among concepts.
- *The Concept Dictionary* utilized in conceptual networks originated at the University of South Florida Free Association Norms database (USF-FAN). It consists of free associations, rhymes, and a word fragment norms database. It is the largest database of free associations ever collected in the United States [5, 6].

1.4 Originality

Most studies in the field of creativity have focused on the role of stimulus freedom that leads to creative solutions rather than barriers. These studies have designated the conservative viewpoint and its cognitive fixedness as an undeniable mastermind of mental constructs that can impede our ability to develop creative ideas. Cognitive fixedness is a perceptual barrier created by old ways of thinking and responding [7, 8]. To date, a small number of studies attempt to identify and mitigate barriers in creativity, (i.e., cognitive fixedness or design fixation), and almost no attention has been given to examine the potentials hidden in barriers [9, 10, 11, 12]. Therefore, we will study the conservative viewpoint that has long been regarded as a perceptual barrier that tends to inhibit craftsman's mental set. Current conventional design education curricula strictly avoids perceptual barriers, however it is necessary to acknowledging the potentials of conservative viewpoint to be accommodated as a feature in design education curriculums, mainly for traditional craftsman.

We recognized that conventional design education is incompatible with the mindset of traditional craftsman who tend to hold strong and genuine beliefs. Thus, we create a model of design education delivery that fits craftsman's conservative viewpoint. To facilitate development of this model, we investigate knowledge acquisition of the conservative conceptualization. This feature utilizes craftsman's prior knowledge at extreme level to further experience dialectical-beliefs of unfamiliar values, at the same time allowing for the retention of prior knowledge without harm. The originality of this study lied on utilization of the potentials hidden in barriers (cognitive fixedness or design fixation) during transfer of knowledge of design training delivery to the traditional craftsman who hold strong beliefs or with conservative viewpoint (see, Fig. 1.1).

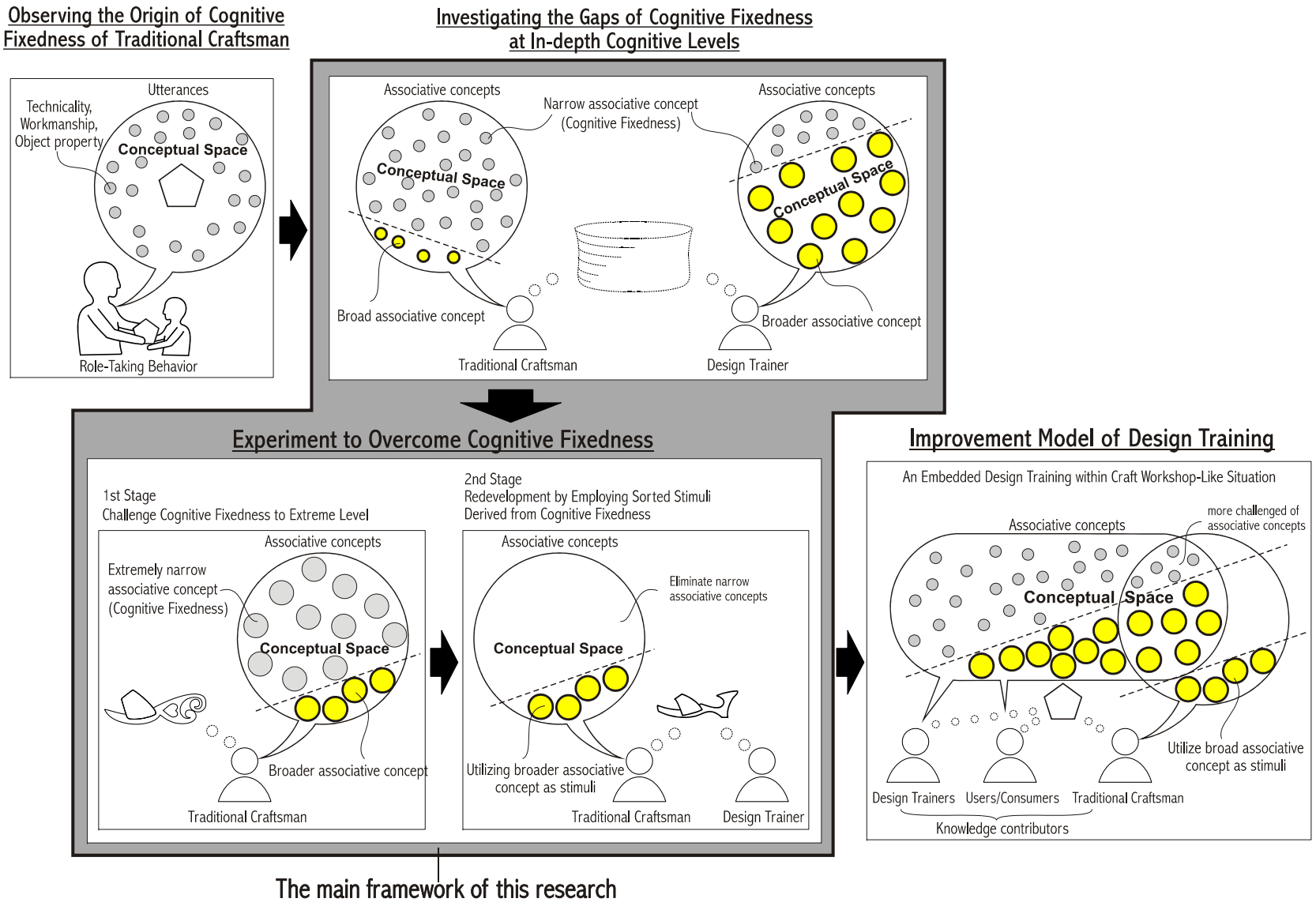


Figure 1.1: The framework of this research

1.5 Research Objective

This study aims to reveal potential aspects of barrier in creativity (cognitive fixedness) in people who possess traditional/conservative viewpoint (crafsman). We investigate how to overcome craftsman's cognitive fixedness in the conceptual ideation process. Our goal is to provide appropriate resource for the development of design education delivery for traditional craftsmen to produce more desirable product. We conduct two experiments of capturing and overcoming cognitive fixedness during conceptualization process. The first experiment is investigating the difference associative concepts of the in-depth cognitive levels at the early stage of idea generation of design trainers and traditional craftsmen. The first experiment demonstrate the characteristic of the cognitive fixedness. The second experiment is to overcome cognitive fixedness with case study of a design experiment to create new design of traditional wooden sandal.

1.6 Contribution of this Study

The contribution of this study is an improved model of design training for traditional craftsman to overcome their cognitive fixedness. This will be useful to improve creativity and design education delivery for people who possess conservatism in order to produce more desirable product. One of the government strategic program is the design and creativity training delivery to the craftspeople—a nationwide governmental HRD program. For the long-term impact, this improvement will foster rural economic growth in line with the effort of government in developing countries to develop rural craft industries. Contribution of this study to Knowledge Science is a knowledge creation of a new co-creation design education for people with conservative/traditional viewpoint (i.e., traditional craftsman) with involvement of knowledge contributors.

1.7 Organization of this Study

In order to reveal potential aspects of barrier in creativity (cognitive fixedness) in people who possess traditional/conservative viewpoints and to study more effective design training delivery, this study is divided into four parts, where the second and third part is the main study as shown in Figure 1.1. The first part contains a chapter (Chapter 3) focused on the origin of cognitive fixedness. We observe the creative learning process of children in traditional craft villages that internalised and deeply rooted in action and attitudes. On the second part of this study (Chapter 4) we investigate the cognitive fixedness from the associative concepts at the in-depth cognitive levels of craftsmen and designers (design trainers) as they conceptualize their ideas. On the third part (Chapter 5), to overcome craftsmen's cognitive fixedness we conduct a design experiment of creating new design of traditional wooden sandal. We challenge their conservative ideas at extreme level and utilize the obtained unfamiliar stimuli from the previous challenge. On the last part (Chapter 6 and 7) we discuss the improved model of design training that overcoming craftsman's cognitive fixedness and propose a co-creation design training as an event embedded within a tourism-based craft workshop-like setting that benefited from knowledge contributors. The organization of this study is as follow:

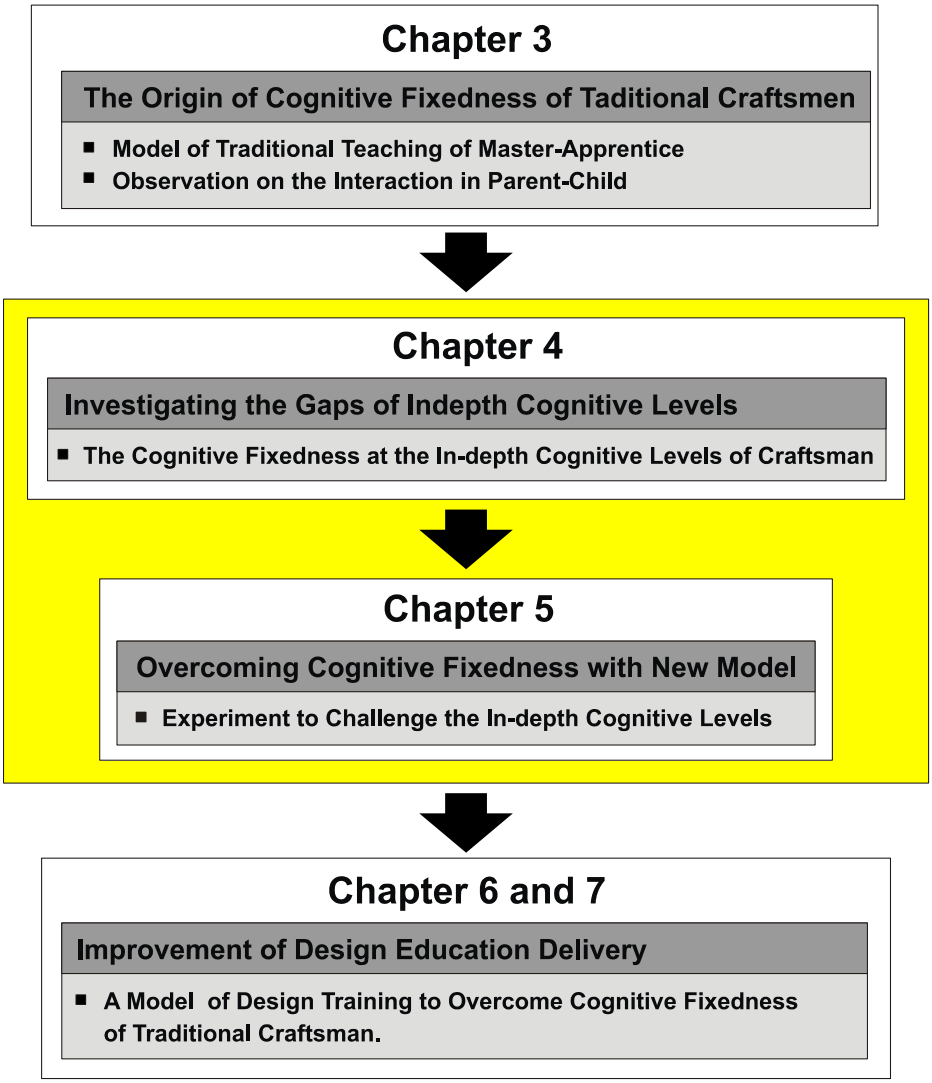


Figure 1.2: Organization of this study

- **Chapter 3 – Understanding the origin of cognitive fixedness by observing the creative learning process of children in traditional craft villages that internalised and deeply rooted in action and attitudes.**
  For having basic understanding of craftsmen's beliefs in conceptual ideation process we focus on the origin of state of mind in which an object or situation are perceived in familiar way. We observe the creative learning process of children in traditional craft villages that internalised and deeply rooted in action and attitudes. This portrays how cognitive fixedness in conservative viewpoint is formed in childhood. This study shows, the strong role-taking behavior of Indonesian parents appeared to reinforce intimacy in an apprentice-like, co-creative play experience to help the children gain formative skills. We concluded that the stronger the spoiling behavior (i.e., strong role-taking behavior), the greater the parent's contentment is in acting as a loving parent and satisfying the child's expectation for dependency. Over time, role-taking behavior facilitates children's development of formative skills (e.g., craftsmanship) which seems to give apprentice-like experience, while independence leads to more exploratory thinking (i.e., creativity). This likely has been fostered since childhood stage that shapes

Indonesian children in craft villages become inter-dependence and maintain consistently the rigid practice of craftsmanship as a consistent belief (cognitive fixedness).

- **Chapter 4 – Investigating the gaps of in-depth cognitive levels by focusing cognitive fixedness from the associative concepts of craftsmen and designers (design trainers) as they conceptualize their ideas at the early stage of idea generation.**
  We investigated the cognitive fixedness from the associative concepts of craftsmen and designers (design trainers) as they conceptualize their ideas at the early stage of idea generation. To capture associative concepts that occur at in-depth cognitive levels of imagination we conducted a think-aloud protocol. We employed a concept network analysis based on the associative concept dictionary to extract verbalized thoughts. We request, both the craftsmen and design trainers to imagine designing a fruit bowl. When imagine designing a fruit bowl, craftsmen's associative concept placed greater focus on product appearance and technical aspects, such as operation (i.e., replace, reduce, etc.) and shape (i.e., waist, body, etc.). In contrast, design trainers' associative concepts paid greater attention to the presence of issues related to surroundings, such as scene (silverware, norm, etc.) and appeal (fresh, dish, etc.). This study demonstrated that design trainers tended to use more remotely associated concepts (polysemous words) that have greater probability of achieving unconventional ways of thinking. While, traditional craftsmen tended to use more closely associated concepts that represent a narrow commitment to a particular issues they familiar with (cognitive fixedness in technical and object property).

- **Chapter 5 – Overcoming craftsmen's cognitive fixedness with a design experiment to challenge craftsman's conservative ideas at extreme level and utilize the obtained unfamiliar stimuli from the previous challenge.**
  To overcome craftsmen's closely associated concepts (cognitive fixedness). We conducted a design experiment for traditional wooden sandal craftsmen to create a new design of traditional wooden sandal. We observed two stages of idea generation, at the first stage, craftsmen were challenged to generate their conservative ideas at extreme level. Furthermore, conceptual sketches and frequently verbalized thoughts related to unfamiliarity or skepticism were examined by design trainers. In all likelihood, the unfamiliar stimuli "painful," "broken," and "upside-down" were result of extreme level of cognitive fixedness. At the second stage, craftsmen redeveloped and were pushed to utilize this unfamiliar stimuli. The experiment demonstrated that the ability to capture and utilize unfamiliar stimuli during a challenge of extreme levels of cognitive fixedness might lead to unconventional idea, for example, an up-side down wooden sandal. We realized that craftsmen's unfamiliar stimuli that generated at extreme level of cognitive fixedness (i.e., broken shape, painful shape, upside-down shape) are the remotely associated concepts that potential for unconventional ideas.

- **In Chapter 6 – Discussion on the improved model of design training that overcoming craftsman's cognitive fixedness and propose a co-creation design training.**
  To avoid narrow or closely associated concepts and produce more intrinsic experiences that access remotely associated concepts at the in-depth cognitive level, craftsmen must experience the dialectical belief in a familiar way. Dialectical belief is a criticism phase where one begins to doubt his/her premature commitment (cognitive fixedness); consequently, the individual may become curious about different belief systems. The improved method to challenge traditional craftsman to generate their conservative ideas at extreme level is able to overcome cognitive fixedness. However, traditional craftsman's cognitive resource that has been fostered since childhood is apparently dependent. Therefore, we proposed an embedded design training

program within a tourism-based craft workshop-like setting. The visitors, consumers are the knowledge contributors that co-create in design activity with the craftsmen. Challenges are result from the presence of knowledge contributors that brings episodic recreational behavior, i.e., stylistic, mood and curiousity. Ultimately, the knowledge contributors will constantly challenge cognitive fixedness to access remotely associated concepts.

- **In Chapter 7 – Conclusion**
  We claim that cognitive fixedness of individual who possess conservative viewpoint (i.e. craftsman) can be overcame with an improved model of design training program that challenge craftsman's conservative ideas at extreme level and utilize the obtained unfamiliar stimuli from the previous challenge. Furthermore, we propose a co-creation design education involving knowledge contributors (i.e consumers, visitors).

Chapter 2
Related Works

Besides artisanal wood-carving skills, Indonesia is also known for its outstanding array of traditional crafts ranging from potteries, to Batic fabric, etc. In addition, Indonesia's forest land that comprises 60 % of the country's land area makes it the third largest area of tropical rainforest in the world, which potentially provides strategic competitiveness allowing for a strong craft industry. However, due to over three and a half centuries of Dutch occupation and strong influence of the colonial era no indigenous traditions developed. With little innovation in local industry the local people are accustomed to only copying or modifying. Rural craft industries in Indonesia have strong historical backgrounds and at the same time encounter the problems to sustain the business. In the case of Indonesia, with its high level of woodworking skills being above average remains pointless as the ability for innovation and product development still remains a major obstacle.

2.1 Traditional Crafts

Suzuki (2005) an expert in regional development clasifies four different craft types, their category and attributes are as follow (see, Figure 2.1 & 2.2):

- *Fine art crafts* which is produced by master/artist. The entire production process is usually self-contained. Fine art craft masters tend to work by themselves to complete the entire production process. Some examples are ceramics and earthenware produced in artist studio and sell at exclusive gallery.
- *Traditional crafts* or often called *folkcrafts,* these traditional crafts are humble piece of work that maintained traditional elements without replacement of the original raw materials and of production technologies. These crafts were produced by minority tribal groups in rural villages and in remote mountainous areas and sold in traditional market at nearby town.
- *Innovative Handicrafts* are modified traditional handicraft with improvement in design. The modification applies either on the production technology, shape or materials to meet the dynamic market demand. The innovative handicrafts producers mostly have well inherited traditional skills or sometimes a graduate product design start up.
- *Manufactured crafts* are all intensive machine-made crafts produced by machine and do not require skilled craftspersons. The production facilities exist in urban areas and the production mechanism is identical with that of other industrial products. Daily use tablewares such as typical lacquer ceramics are the example.

a. Fine art craft

b. Traditional craft or folkcraft

c. Innovative handicraft

d. Manufactured craft

Figure 2.1: Examples of four different craft categories
(All images are copyrighted and property of their respective owners)

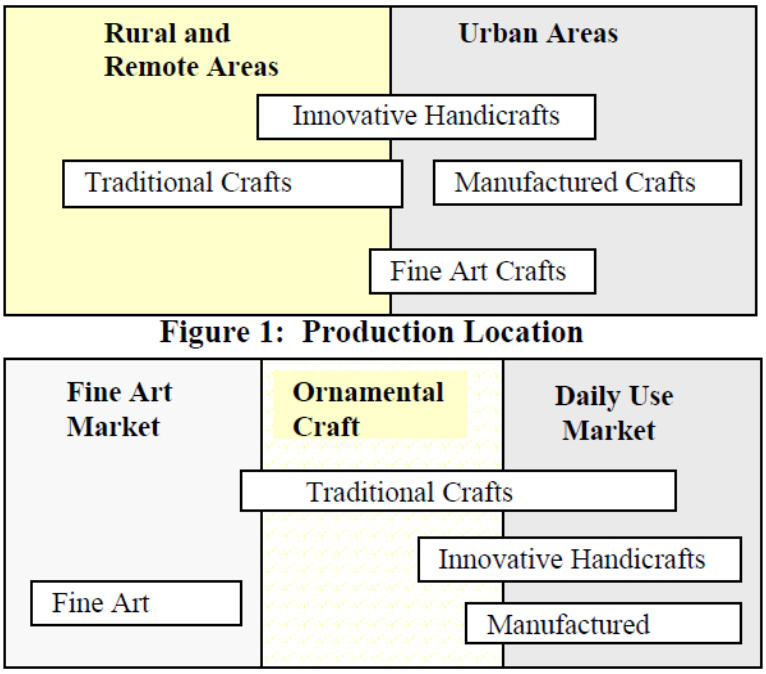


Figure 2.2: Market segmentation of crafts (Suzuki, 2005)

According Yanagi (1989) and Suzuki (2005), *fine art crafts* are highly specialized and individually inspired 'high' art which represent the wealthy people. *Manufactured crafts* require capital investment as a crucial development factor, and more importantly, those industries do not contribute significantly to the job creation in rural. *Innovative handicraft* exist only at spesific region of Indonesia, where some expatriats build their business in certain city with tourist destination, for example, Bali city and Yogyakarta city. Therefore, *Traditional craft* or *Folk craft*, which still maintain local resources and crucial to rural economic development activities is the focus of our study.

2.2 Nationwide Governmental HRD Program: Design Training

To achieve a strong national industry, many developing countries including Indonesian government have begun to focus on rural industry development because of its potential for new job creation and to maintain national and cultural identities. The government have begun to implement technical assistance programs (a nationwide governmental HRD program) in order to produce more desirable products) such as design training to improve traditional craftsmen's creativity levels. The scheme of the official program are as follows (see, Figure 2.3):

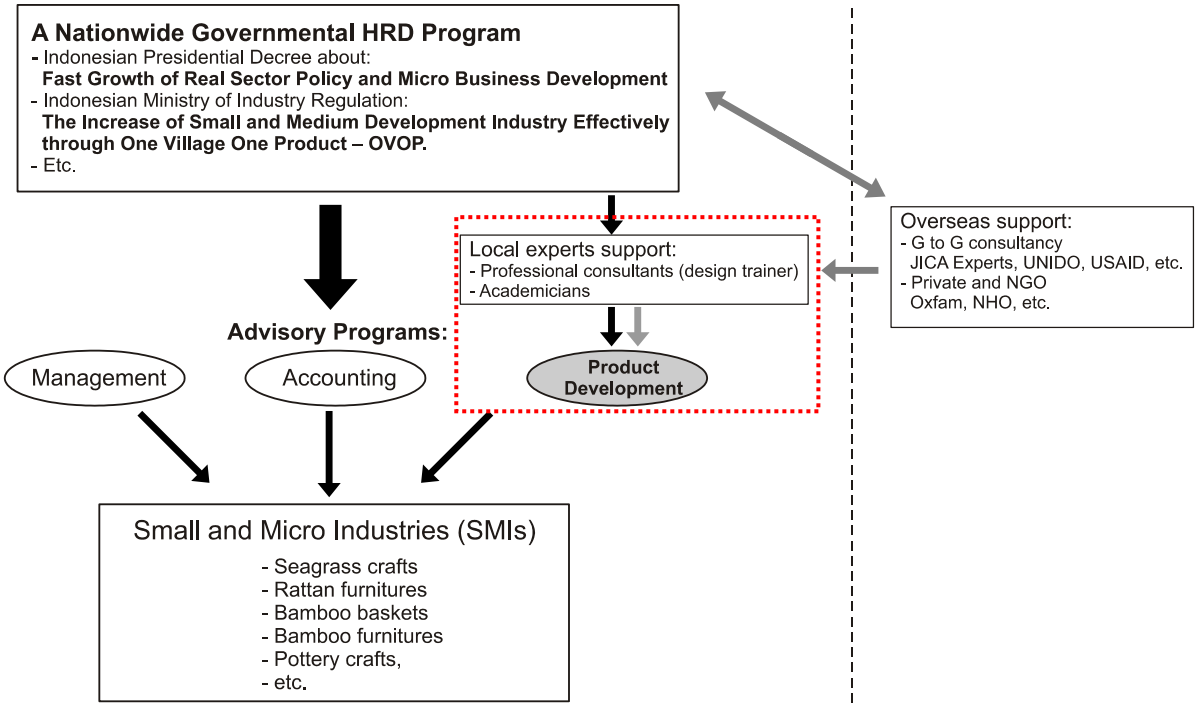


Figure 2.3: Scheme of Nationalwide Indonesian Governmental HRD Program.

To deliver technical assistance to the craftspeople in rural industry, the government, donors or private sector assign a team of design professional or design trainers. The assignment is based on the designated program, for example, to deliver a design training in rural textile craft village, a textile design graduate or textile designer will be comissioned. An industrial design or interior design graduate with their speciality in bamboo or natural material will be assigned to deliver a design training program to bamboo craftspeople. Most of the programs are arranged in a half or one year program scheme, as a package of various trainings. This training package addresses on capacity building and technical assistance with following activities, i.e., product development, packaging design, management and marketing. Government, donors or private sectors will setup the program by considering the blue print of the local regional development. This means the craftspeople in targeted rural area are addressed by purpose. The selection of targeted craft village is based on the economic development planning of the local region including to increase human resource capacity.

Design Training (a nationwide governmental HRD program) is an event to introduce design and creativity practice. The activity mainly concerns of product development widely operated in rural crafts industries in Indonesia. It provides in-studio type design and creativity training for traditional craftsmen with aims to improve design or product quality. At a basic level, creativity and design

training hopes to introduce widely known the design method. During training class, craftsmen receive an introduction to Design Principles (e.g. balance, proportion, and so on). Craftsmen are also engaged Creativity in Icebreakers. They then participate in design exercises and develop prototypes. A typical design training program may takes five to seven days.

Idea generation is an essential step in the design thinking process. It involves the interplay between cognitive and affective skills that leads to the resolution of recognized difficulties. It also involves iteration, a cyclical process of idea generation, evaluation, and design improvement to gather and filter information during the stage of generating and evaluating possible solutions. The general steps of design thinking introduced commonly in a design training are listed below (see, Figure 2.4):

1. Early stage of idea generation: during which participants finding problems.
2. Later stage of idea generation: during which participants reframe and redefine.
3. Later stage of idea generation: during which participants develop and finalize the idea.
4. Final stage: during which participants realize the ideas concretely.

One session of a design training normally comprised of 5-7 days (8h/day), the curriculum is structured of three major sessions:

- The Design Principles (balance, proportion, etc.).
- Creativity Icebreaker games/exercises for habituation.

b. Second session of design practice: Preliminary ideas, developing ideas and evaluation.

a. First session of theory:

c. Third session of design practice (prototyping): Foam modeling, mock-up and finishing system.

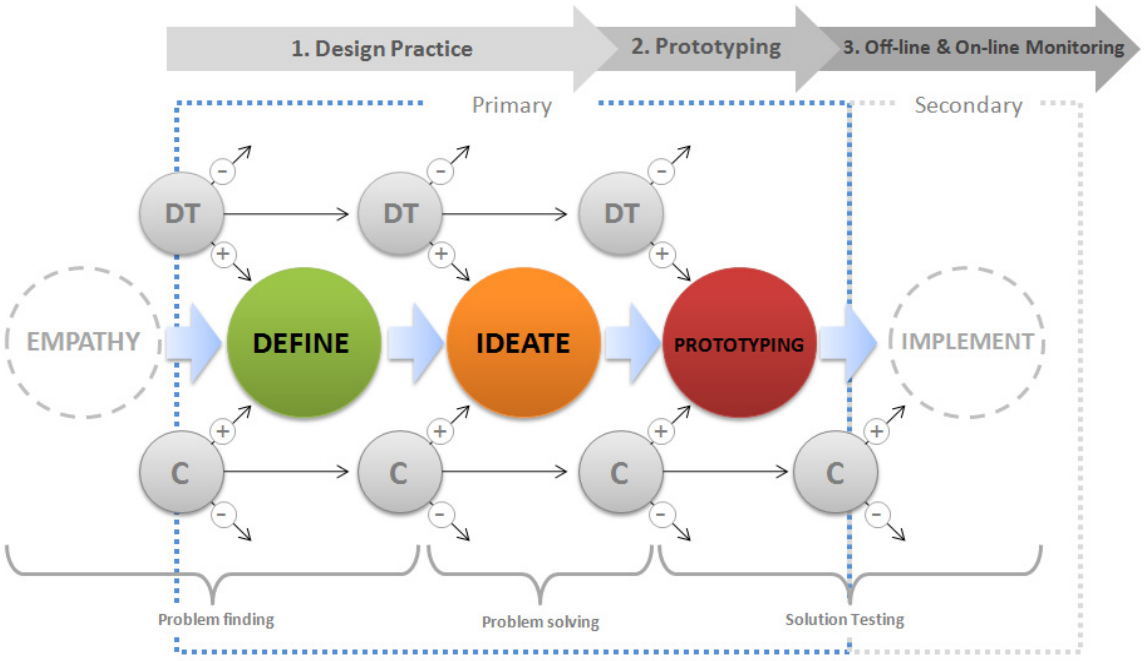


Figure 2.4: Typical design thinking process that delivered by design trainer to the craftsman in design training program (modified from Didactic Design Thinking Process Model (Plattner et al. 2009)).

Followings are some examples of design training conducted in rural craft industries in Indonesia (see, Figure, 2.5; 2.6; and 2.7).

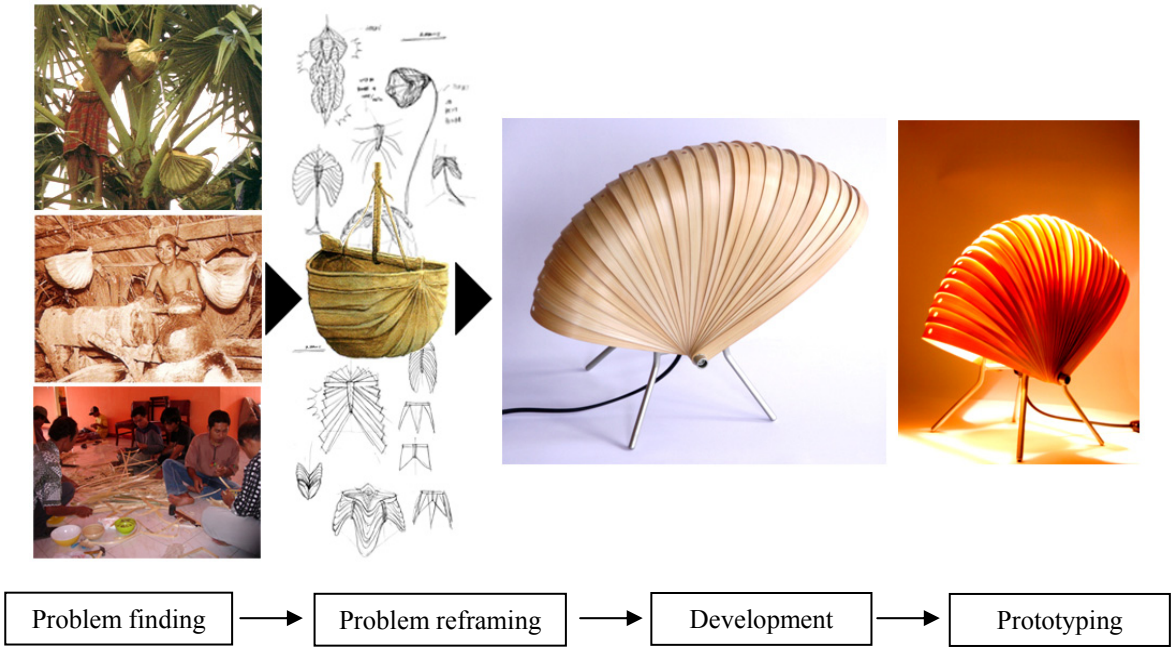


Figure 2.5: A design training for bamboo craftsmen in Situbeet, City of Tasikmalaya, West Java, Indonesia. Annual program of the office of Industry, year 2007, PPK-IPM (Author, 2007).

Figure 2.6: A design training for bamboo craftsmen in Parakan Honje, region of Tasikmalaya, West Java, Indonesia. Annual program of the office of Industry, year 2007, PPK-IPM (Author, 2007).

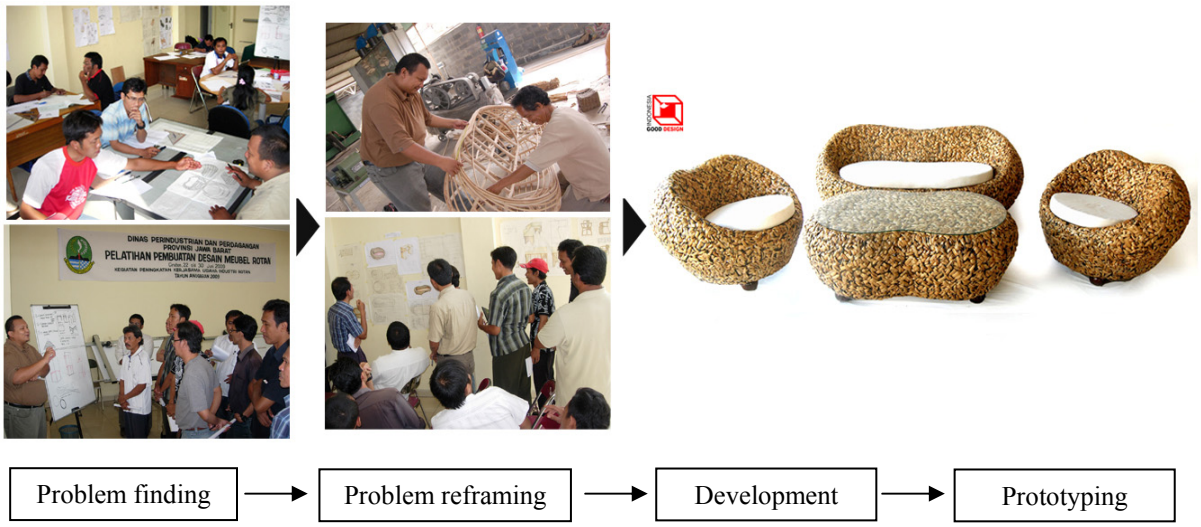


Figure 2.7: A design training for rattan furniture makers and craftsmen in Cirebon, West Java, Indonesia. Annual program of the office of Industry, year 2009 (Author, 2009)

2.2.1 Craftsman and design trainer

In Indonesia, a rural master craftsman is a traditional master craftsperson who resides in a rural area. He or she has acquired special craft skills and gained expertise in his or her vernacular traditional crafts that have been passed down from one generation to another often through an apprenticeship system. Yanagi Soetsu a Japanese craftsman and philosopher asserts a true craft is a non-individually-inspired 'high' art, which is widely known as folk craft, used in people's everyday lives, unpretentious, pure and simple created by craftsman, to distinguish it with the craft artist [13, 14]. Pye (1965) provides an improved definition of craftsmanship as 'workmanship of risk,' where risk represents a piece of work which could be unexpectedly defective during the working process, can be a result of any tools, such as chisel, hammer; or a result of improper treatment, where this risk can be advantegous, unique or even failure [15]. This means either techniques or processes are considered conservative, however, it exceptionally offers unconventional process to be present. Despite a presumption that a craftsman thinks in a conventional manner he or she is often aware of being unconventional.

During a design training, there are two parties involved, one party as the participant and the other party as the trainer, the definitions are as follow:

- A Craftsman or a Master Craftsman (hereafter referred to as 'Craftsman') is a traditional master craftsperson who resides in a developing country. He or she may possess limited formal education. However, he or she has acquired special craftsman skills and gained expertise in his or her local village's traditional crafts that have been passed down from one generation to another. In some countries they are awarded as as National living treasure.
- A Design Trainer (hereafter referred to as 'Designer') is an industrial or architectural design graduate who possesses work experience as an instructor in a design training program aimed at the promotion of traditional crafts.

2.3 Problems and Development Issues of Traditional Craft

Suzuki (2005), an expert in regional development has reported on problems and development issues for craftsman's craft promotion [16]. Many parties engaged in local craft development process have identified number of problems of the implementation of the program. The problems varies from lack of promotional policies, supporting istitutions, low craft quality, poor managerial skills, business access also lack of capable development designers, etc.

Problems and development of traditional craft are divided as problems at policy level, problems at institution level, and problems at craft producers level. Those problems comprised of technical issues such as lack of support facilities focusing on HRD, lack of awareness for traditional values and future potential, also lack of challenging mind (see, Figure 2.8 and 2.9). As generally known, most of the traditional craftsman fail to develop new and innovative ideas because there is no challenge and they lack of creativity. Due to their conservative nature, this makes difficult to develop new ideas with their own initiatives. Suzuki (2005) points out that:

> *"Design development is often understood as a means to develop crafts to meet the consumers' needs which covers only exterior appearance."* Again, he underlines that *"Design improvement covers wider aspects including the living environment and culture indigenous to the crafts. Interestingly, the notion to interpret living environment and culture indigenous to be valued in design improvement is missing among policy makers and often among designers in developing countries."*

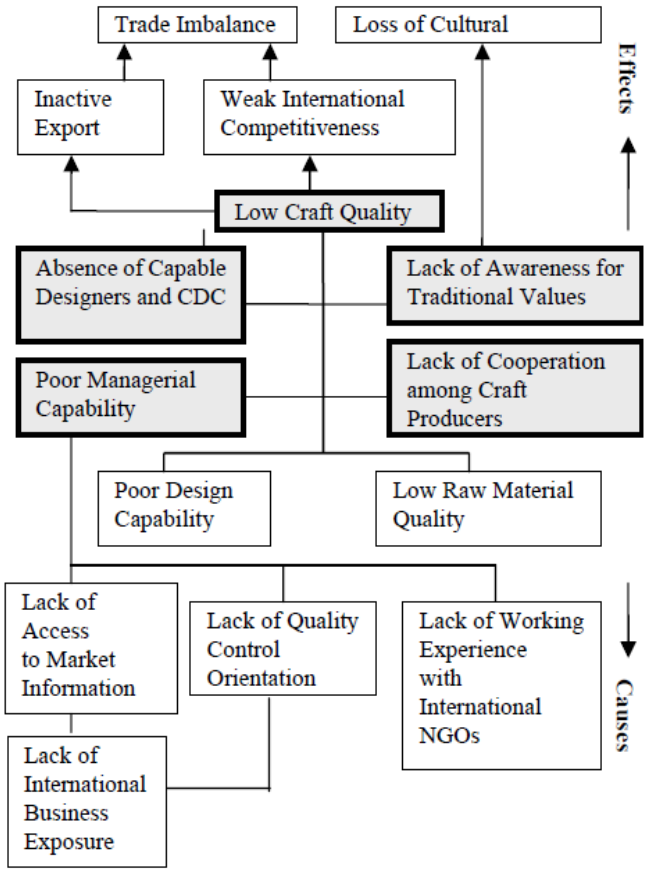


Figure 2.8: Identified problems at producers level (Suzuki, 2005).

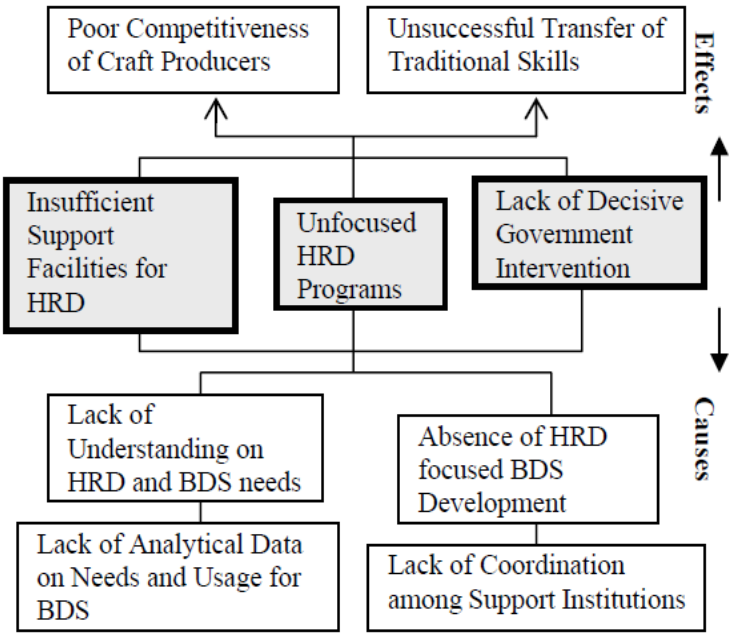


Figure 2.9: Identified problems at institution level (Suzuki, 2005).

However, apart of the ability to interpret indigenous value, more importantly there are absolute gaps in the design thinking process during the idea generation stage can occur between traditional craftsman and designers. Previous research suggests that design trainers failed when they attempted to introduce an unconventional design domain to inspire traditional craftsman to develop unconventional ideas [17]. This may have occurred because of differences in the nature of creative cognition that influences the respective designers' and craftsman' design thinking processes. This leaves a fundamental question that, is there any concrete guideline or study reference describing the nature of the creative cognition of traditional craftsman available for design trainers to use as material during training? Design education is a recent phenomenon that follows the tradition of Western model; it is a rational method for identifying and solving design problems, there is lack of studies have focused on creativity enhancement of people that hold strong beliefs and conservative viewpoint as craftspeople (see, Figure 2.10).

Scholars of modern studies of craftsmanship recognize a crucial point that craftsmanship is a mastery of doing and making involving beliefs and conservatism. These aspects in many studies of craftsmanship is frequently discussed as a representation of technical processes and skills. Sennett (2008) argues that a craftsman is a know-how of "mind," "hand," between ideation and practical execution, which represents the special human condition of being engaged. To date this statement is the most pertinent definition which reflects the craftsman's conceptual ideation process [18].

Conceptual ideation is generating and developing new ideas where an idea is understood as a basic element of thought that can be either visual, concrete, or abstract [19]. The ideation state defines one's current location in the design space where one gets deeper insight, discovery and conflicts. It is generally known that traditional people think in a conventional manner. Gero (2011) affirms that conventional ways of thinking is when one is trapped at a general fixation and premature commitment. A premature commitment refers when someone appears trapped to a particular set of design decisions that they familiar with [10]. With a high level of mastery, an individual like a craftsperson is often recognized for his/her traditional viewpoints that may be structured by prior knowledge and typical features contained in familiar categories [2]. The recent study of Nagai et al. (2013) demonstrated that the craftsmen's conceptualisation at the early stage of idea generation

experiences a fixation that disables them to explore the abstract realm which normally occurs at the early stage of idea generation. This explains that the craftsman's conceptualisation seen at the early stage has evidently occured at the later stage, as a proof of experiencing fixation [12].

We recognize that conventional design education is incompatible with the mindset of traditional craftsman who tends to hold strong beliefs (see, Figure 2.10). Craftsmen's conceptualization at the early stage of idea generation experiences a fixation that disable them to explore more abstract realm which normally occurs at the early stage of idea generation. With a high level of mastery, an individual like a craftsperson is often recognized for his/her traditional viewpoints that may be structured by prior knowledge and typical features contained in familiar categories (see, Figure 2.11) [2, 12]. Thus, to facilitate the development of design education delivery that fits craftsman's conservative viewpoint. It is important to investigate the typical mindsets that affect creative cognition during conceptualization. With sufficient understanding of the thought process during conceptualization we can manage the mindsets in order to stimulate positive creative cognition.

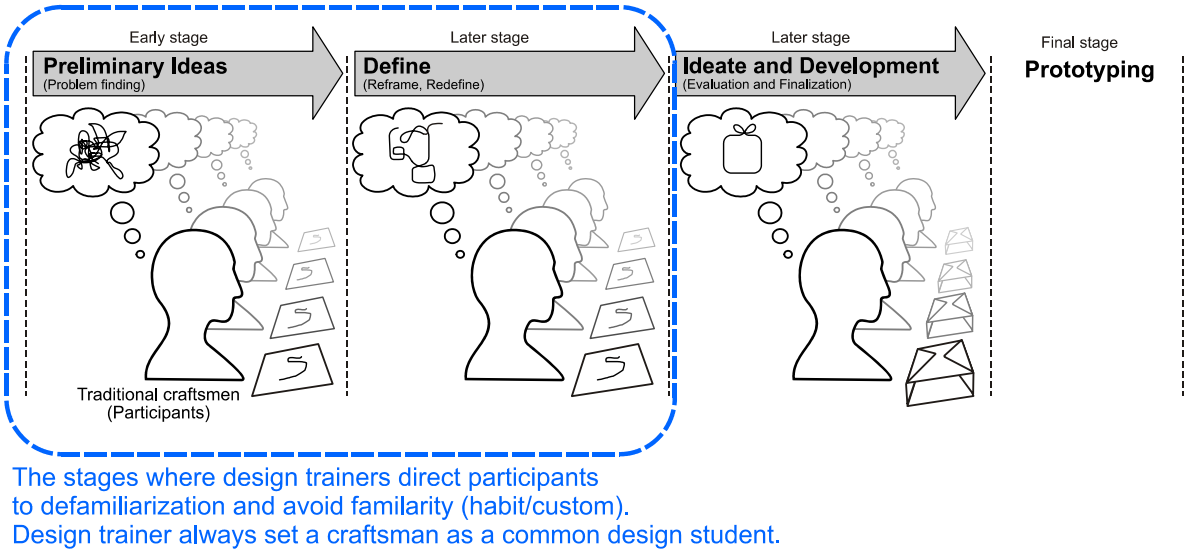


Figure 2.10: Craftsmen are treated as design students

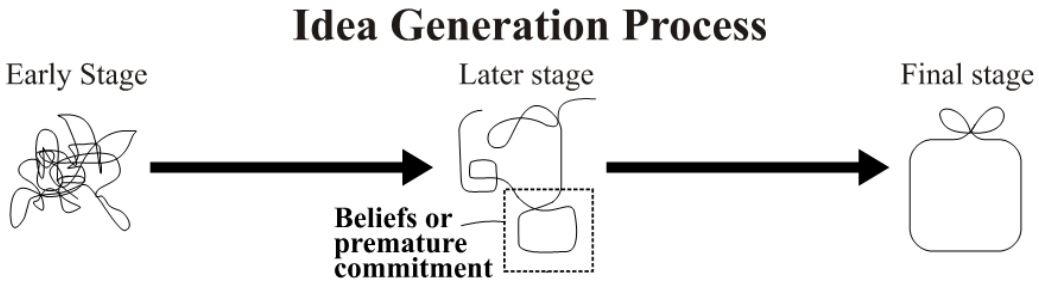


Figure 2.11: Recognized of premature commitment of individual with traditional viewpoint at the idea generation process

2.4 Issues in Creative Cognition

Creativity is a very difficult subject in which to be precise. Some creativity researchers describe creativity is “living things moving in a field.” Engagement is highly necessary to understand “living things moving in a field.” One can observes “living things” by video or photo, however, the “living things” are no longer “moving in a field.” Such approach is totally reducing all of the facts. Another approach known as research, a reliable process of describing accuracy of the “things”, but it missed to describe the natural movement. By moving along with "the living things" is a good way to deeper engage and learn the nature. When we record and describe this "living things," however we can not be accurate since we detach from the true experience. Another method is to raise "living things" and observe them, this experience may discover a complete experience, when the "living things" exhibit their wild instincts, and our control is an apriori and unfair manner in doing an observation. The most appropriate approach is design research approaches in a laboratory setting, a demonstrative experiment. It must shows the “living things” animatedly running about the field; the subjects and experimenter need to be enthusiastic and passionate, but then again, the research objectivity is questionable, such enthusiastic and passion might be unfair in the judgement [20]. These difficulties have push researchers to find more appropriate methodology to reveal the cognitive structures and processes that are involved in creative thinking and cognition.

In general, cognition is considered a major factor in the creative process [21]. Most of the conceptualization of creativity in the design process is based on exploration of the cognitive aspects of creativity [22]. Extensive studies have been conducted to capture the cognitive levels of creativity used during the design process. These studies attempted to understand users’ affective preferences, such as taste, and the feelings they may experience that can result in successful impressions of products [23, 3].

Creative cognition covers processes and mechanisms that play an important part in many endeavors of human activity that incorporate creative activity. Finke, Ward and Smith (1992) who first coined the term creative cognition, to affirm the boundary of an area of study within cognitive science that focus on the creative processes. Creative cognition known as cognitive mechanisms combines experiments with existing work in cognitive psychology to provide the first cognitive structures that contribute to creative thinking. Creative cognition studies cover concept, formation, categorization, memory retrieval, and problem solving [2]. It has been studied in the past by various researchers, followings are few majors different labels [24]:

Making the Familiar Strange

Gordon and his colleagues (1961) explicate the concept of “trust things that are alien, and alienate things that are trusted.” Making the familiar strange is defamiliarisation to have new resources we can use to think with and to go about changing our behavior. It is a juxtapose the target problem or object with a completely unrelated object or situation [25].

Displacement of Concepts

Schön (1963) explains how new ideas may result from new ways of seeing new things in the manner of the old. For example, in order to get a new insight about a concept, it needs to be displaced, that is, put in the context of other unrelated concepts [26].

Bisociation

Koestler (1964) coined this term to illustrate the combinatorial nature of creativity to distinguish the type of metaphoric thinking that leads to the acts of great creativity from familiar associative thinking. As such, means to join unrelated, often conflicting, information in a new way [27].

Lateral Thinking

Edward de Bono (1971) contrasted vertical thinking with lateral thinking. It is a new concept by looking at the logical (vertical) thinking carries a chosen idea forward, the sideways (lateral) thinking provokes fresh ideas or changes the frame of reference. [28].

Estrangement

Rodari (1996) proposed many practical methods that stimulate imagination and creativity in children through random juxtaposition of concepts. One mechanism he emphasizes is to consciously block the evocation of familiarity and try to view an object as if it is a strange object you are seeing for the first time [9].

Conceptual Blending.

Fauconnier and Turner (2008) analyzed how people combine perceptual, experiential and conceptual aspects of different concepts subconsciously to generate new insights. Conceptual blending is a deep cognitive activity that "makes new meanings out of old" [30] for example: Design idea for an art knife by combining two concepts—broken glass and chocolate segments [31].

The cognitive capacity to behave creatively is a normative characteristic of humans. One's cognitive capacity is greatly influenced by their attributes, such as culture, beliefs, and insights. At some point, this attributes is regarded as an advantage or even barrier. This study seeks to advance our understanding of barrier in creativity through precise characterization of the cognitive processes that lead to creative enhancement. Only a limited number of studies have explored the creative cognition that occurs during design process at the very early stage of idea generation, a stage associated with a greater diversity of ideas [32].

2.4.1 Creativity enhancement

There is an increasing trend of research on creativity, more spesifically research on the creative process, which is likely to continue as a major design research area. Design and creativity is relatively a new subject in science, for years design and creativity reserch borrows theories from cognitive science and psychology. However, design creativity is a developed research area that has potential to contribute to the foundations to our cognitive understanding. Therefore, it is a challenge for the design creativity research community to unveiling the true nature of creative processes in design. Over the last fifty years of research on creativity is partly found to be speculative [33]. Besides, there are gaps between the amount of studies on creativity and the relevance in terms of transfer into practice [34]. Therefore, a concrete and empirical evidence in the occurence of creative cognition will be valuable for the practice of design education, particularly for inclusive design education.

The implementation of technical assistance programs in developing countries (e.g., design training) to improve craftsmen's skills and creativity levels has been implemeted for over decade. Apparently, such programs were unsuccessful at introducing an unconventional design domain to inspire craftsmen to develop progressive ideas [16]. Differences in the nature of creative cognition, which influence craftsmen's design thinking processes, may have contributed to program failure. A conventional mindset was evident from gaps associated with in-depth cognitive levels of craftsmen and designers during the early stages of concept generation [17].

2.4.2 Cognitive fixedness

Numerous published studies have described how stereotypical or conventional thought may lead to decreased creativity [35, 36, 37, 8]. To date, most creativity studies have focused on stimuli, rather than barriers [7, 9, 10, 11]. Limited attention has been given to exploration of potential hidden in barriers [12]. Current conventional design education curricula avoid perceptual barriers; thus, traditional craftsmen appear trapped by a general fixation and commitment to a particular set of unchangeable design decisions [10]. Therefore, the cognitive fixedness will be investigated in this study because it has been regarded as a perceptual barrier to be accommodated as a feature in design education curriculums for craftsmen.

2.4.3 Situated creativity

Besides the importance of empowering cognitive fixedness, a circumstance or situation that facilitate cognitive fixedness to thrive is also never been studied almost entirely. A classic study from Schon (1999) about reflective practice as a process of learning through *'reflection in action'* and *'reflection on action'* experience is a significant gateway to understand the cognition behind the process of thinking [38]. The study on reflective practice indicates how a 'situation' becomes a fundamental factor that affect the process of human's cognition. The two terms *'reflection in action'* and *'reflection on action*' has lead to understanding in capturing experience, skill or knowledge. However, again, the approach to explain to the notion of cognitive experience is still speculative. Csikszentmihalyi (1988, 1990) suggests a system view where three dimensions of interaction within the creativity process: *a domain* that provide information to the person, *a person* who does the act of variation which seemingly may or may not be selected by the field, and the last, *a field* that incorporates the variation into the domain. His study suggests a condition of co-development as an agency element [39, 40].

Gero (2002) describes designing is an activity during which designers perform actions in order to change the environment. Their reflection in/on their own practice will allow them interpreting the results of their actions, they hold control to manipulate the environment. This experience is defined as of a recursive process, an "interaction of making and seeing" [41, 42] (See Figure 2.12). This circumstance is a unique situation with rich of unconscious and unexpected possibility in interpreting issues. A dialectical beliefs within one's fixed original experience is being challenged and receives advantage through each situated creativity to be presented. A 'situated' provide access to a dialectical mental state which known as a *constructive memory*. As Gero stated:

> *"The main idea of constructive memory is that memory, instead of being laid down and fixed at the time of the original experience, must be newly constructed every time there needs to be a memory. ...Each memory, after being constructed, is added to the experience and thus becomes part of the situation, which affects the kinds of further memories that can be constructed."*

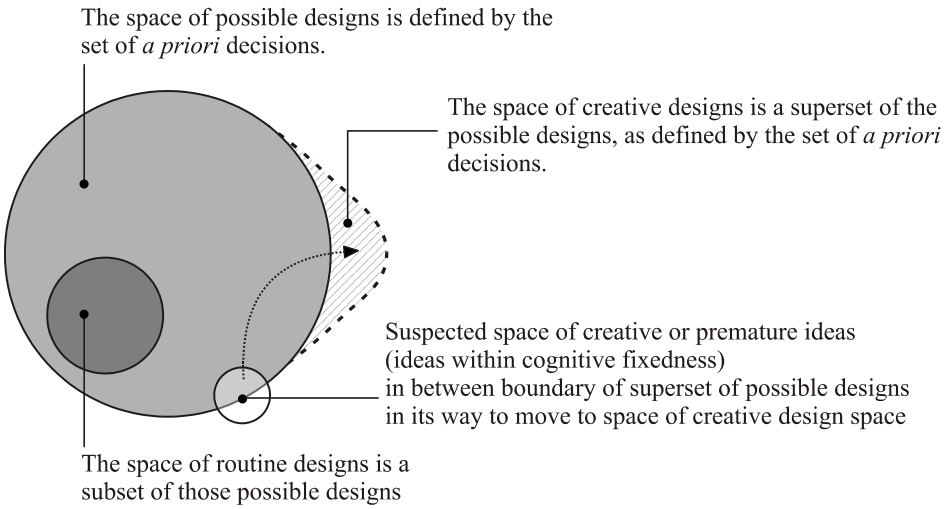


Figure 2.12: The spaces of creativity and possible designs (Adapted from Gero, 2002).

Further, Sosa (2003) present a model called design situation (DS) as an alternative methodological basis of a model of situated creativity [43]. He stressed that:

> *"Design Situation model (DS) takes place within the situated interaction of individuals in a social environment trascending its conventional characterization as purely a cognitive process. It was claimed as an experimentation with the causal relation between change processes of design behavior at the individual and the collective levels of a society*."

From above studies, a situated creativity is a meaningful agency to affect cognitive processess of design behavior, and the point is how technically we utilize it in the context collective levels of a society. Design trainers have confirmed about difficulty encounter when conduct a design training. Participants do not realize their premature commitment and cognitive fixedness, therefore, a situated creativity will plays important role to facilitate the process. To overcome these challenges some design methods is widely used, i.e., participatory design, collaborative design, co-design (See Figure 2.6). A relatively new branch of user-centered design approaches is Empathic design to helps designers to build creative understanding of users and their everyday lives [44, 45, 46, 47, 48, 49]. The empathic design approach is a handy tool at the early stages of new product development, when product concepts developed [45]. However, as many user-centered design approaches, i.e., participatory design, collaborative design or emphatic design which successfully embedded within an industrial organization, nevertheless emphasize aspects of product opportunities rather than the cognitive aspect. (see, Figure 2.13).

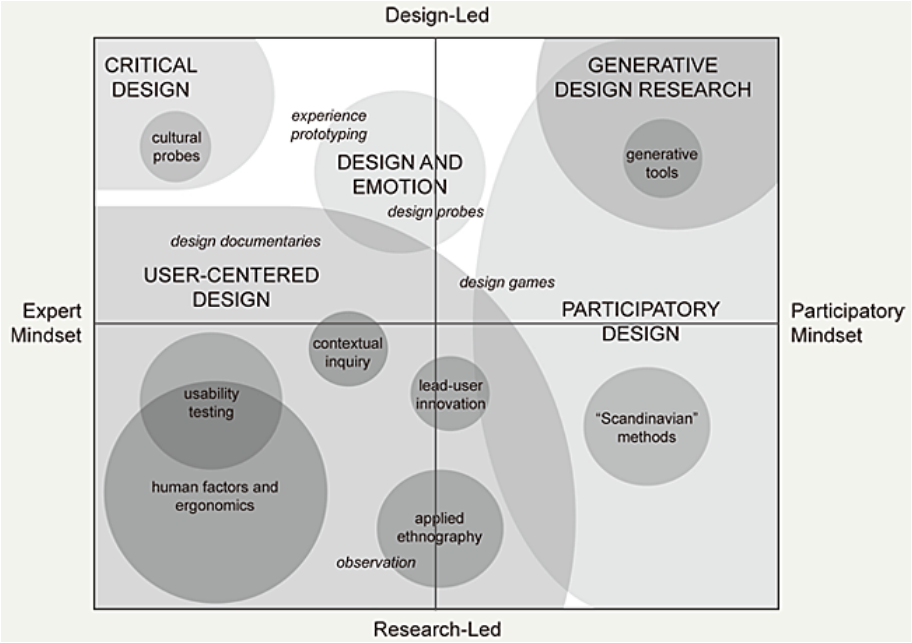


Figure 2.13: Topography of design research from Postma, 2012
(adaptation from Sanders, 2008).

2.4.4 Co-creation through knowledge contributor

Candy's model (1999) of cognitive modelling of creative knowledge work describes the model of the main process involved to support co-creation. It is based on three primary activities that occur during the creative process: problem reframing (constraints and requirements), idea generation (generation and exploration), and evaluation (test). These creative activities combine with a set of Contributors to become essential parts to support co-creation. The Contributors are referred to as Knowledge Contributors. They involved and contributed, directly or indirectly, during the creative process. Knowledge contributors can be divided into three knowledge categories (actors), *Domain Knowledge, Context Knowledge,* and *Strategic Knowledge* [50]. We realized that actors contributed in these three knowledge may provide circumstances that allowing the unconventional ways of thinking happens. For example, a role to challenge cognitive fixedness of craftsmen would be ideal through the contribution of the users or consumers. The contributors have capacity and are based on the same desire with craftsmen to obtain good and desirable artifacts. Thus, the contributors will share their insights to challenge craftsmen's cognitive fixedness.

Candy's model (1999) indirectly brought a nature of mutual work of creative knowledge work. Knowledge contributors are the actors that co-create in obtaining a result that meets users' preferences. Candy's model is a knowledge distribution with common goal of getting a satisfactory result to everyone who participated. Contributor from *Domain Knowledge* is one who competent about local or design knowledge that applies to a particular product area. Contributor from *Context Knowledge* is one who competent about statutory regulations, organizational, macro/micro economics. Furthermore, Contributor from *Strategic Knowledge* is one who represents the consumers, it includes understanding in users' preferences, marketing strategy, cost issues, etc.

2.5 Conceptual Ideation Process of A Craftsman

Traditional crafts are deeply rooted in the culture and characterized with its rich variety of intangible values. In many traditional crafts villages, there are noble messages of how traditional wisdom is keep maintained. The way craftsmen work has inspired many to applying wisdom in work and in balance with nature. Klamer (2012) describes a set of values of craftsman's traditional wisdom, such as harmless production, minimal waste, natural material, emotional needs, humanizing consumption, and dexterity. This explains that the craft culture promotes and maintains a set of shared values other than mere attention to the practice of economic [51].

Yanagi (1989) describes two kinds of craftsman, the first one is an artist which often wrapped up in individual expression that goes against the laws of nature. The latter type is folkcraft craftsman, with their humble piece of work that are far finer than the work of clever individuals that contains no signs of egotism [13]. Folkcraftsman or traditional craftsman is the subject of this study.

As a traditional craftsman skill developed to a high degree quality-driven craftsmanship, at the level of mastery, technique is no longer a mechanical activity; people can feel fully and think deeply what they are doing once they do it well [52]. As Sennet (2008) describes:

> "*At this level, technical skill is gradually removed by dimensions of commitment and judgment in a particular way. It focuses on the intimate connection between hand and head. Every good craftsman conducts a dialogue between concrete practices and thinking: this dialogue evolves into sustaining habits, and these habits establish a rhythm between problem solving and problem finding".*

Referring to many significant classic to modern studies of craftsmanship, all experts and researches agreed to one crucial point that the craftsmanship is an artistic process of technical that involves beliefs, habit and conservatism. Over all of the studies on the craftsmanship, none of them discuss that aspects such as belief, habit and conservatism as the main part of the conceptual ideation process. Aspect of beliefs, habit and conservatism in many studies of the craftsmanship is more discussed as a representation of the technical process and skills [13, 15, 51, 52, 53].

Some classic redefinition proposed by Pye (1965) clarifies better the definition of craftsmanship. He uses term of workmanship instead of craftsmanship, and divided into *'workmanship of risk'* and the *'workmanship of certainty'*. Certainty represents a knowledge of completion process as it is intended, typical in mass manufacture. Risk represents a chance of piece of work could be unexpectedly damaged or defective during the working process, can be a cause of any tools, such as chisel, hammer where this risk is can be advantages, uniqueness or fail [15]. This leads to an understanding that even that both techniques and processes characterized with conservatism value, it exceptionally offers unconventional to present, which have never been realized before. The unconventional state of mind apparently always there in the mind of traditional craftsman, 'near' and' 'ready' to utilized.

2.6 Method to Capture Conceptualization Process

An associative concept is a representation of an individual's expression. It is a stimulus that can lead to another associative meaning. It is comprised of six sub-types: connotative, collocative, social, affective, reflected, and thematic [4]. The conceptual network depicts human memory as an associative system, in which a single idea can contain multiple meanings (i.e. it is polysemous). A concept network employs a computational model to reproduce observable aspects of expressions associated with an individual's mental state. It is a suitable tool for associative analysis that can be

used to explore latent links that exist among concepts. The concept dictionary utilized in conceptual networks originated at the University of South Florida Free Association Norms database (USF-FAN). It consists of free associations, rhymes, and a word fragment norms database. It is the largest database of free associations ever collected in the United States [5, 6].

It can be difficult to explicitly describe our thoughts. Our explicit expressions and/or words may result from shallow analysis. Therefore, these expressions and/or words are referred to as being on the surface cognitive level. However, the term implicit impression refers to that which is not explicitly recognized or verbalized [54]. This underlying form of cognition may be difficult to express. Thus, it is referred to as the in-depth cognitive level (e.g. feelings, tastes, and impressions) [55, 3, 56]. Implicit impressions are implied beneath explicit impressions that are related to deep impressions. This process establishes extremely rich metaphorical concepts that become key features of cognition that occurs during the creative design process. Additional studies have focused on the use of metaphors to enhance creative design solutions. These studies hoped to discover how rich metaphorical words formed the basis of creative design [57, 58, 59].

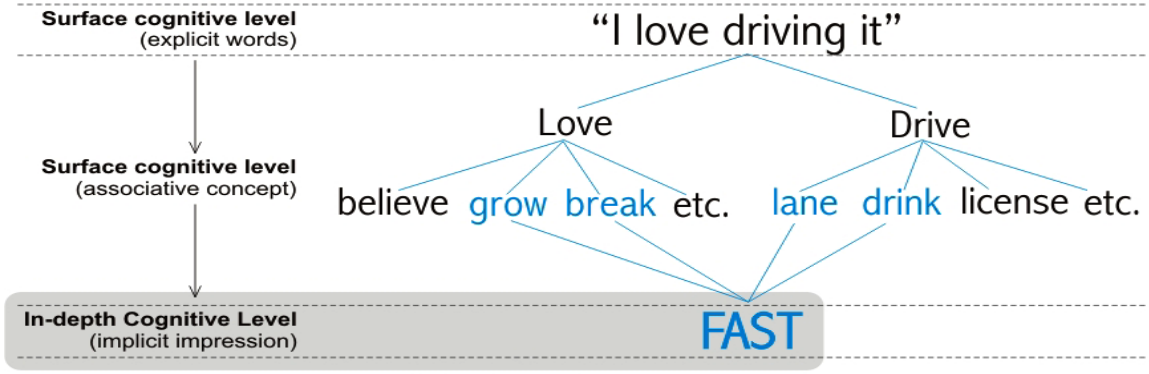


Figure 2.14: Capturing the in-depth cognitive level using an Associative Concept Dictionary

To examine cognitive levels based on subjective experiences, researchers may employ think-aloud method as part of protocol analyses that can be applied to produce verbal reports of thinking processes (See Figure 2.14) [60].

2.7 Summary

- **The conceptual design process that introduced is taken for granted from conventional design method in design school.**
  Indeed, local government have given attention to the importance of preserving traditional skills (craftsman), this can be seen from various assistance programs aimed at the development of the sustainability of the rural industry. Nevertheless, both, neither the official department or professional (designers) are unaware of evaluating the effectiveness of the knowledge transfer process, particularly during the design training. Until today, craftspeople which appointed as participant in a design training in rural area are treated as if a design students which deemed ready to learn the unconventional way of thinking.

- **Almost no attention to examine the conceptual process of individual with conservative viewpoint.**
  Apparently no attention is given to examine the conceptual process of individual with

conservative viewpoint or individual who hold strong belief of customs (i.e., traditional craftsman). An individual like a craftsperson is often recognized for his/her traditional viewpoints that may be structured by prior knowledge and typical features contained in familiar categories known as cognitive fixedness. This means the lack of understanding of the design trainer about the underlying forms of cognitive fixedness of the traditional craftsman, which essential to facilitate an appropriate design training delivery that fits craftsman's conservative viewpoint.

- **Most creativity studies focuses on stimulus not the barriers.**

Most studies in the field of creativity have focused on the role of stimulus freedom that leads to creative solutions rather than barriers. To date, a small number of studies attempt to identify the role of barriers in creativity, (i.e., cognitive fixedness or design fixation), and almost no attention has been given to examine the potentials hidden in barriers.

Chapter 3

The Origin of Cognitive Fixedness of Traditional Craftsmen

3.1 Model of Traditional Teaching of Master-Apprentice

Environment is one of the main factor affecting cognitive development of individuals. Place and people as part of the environment deeply contribute to our cognitive resources. The cognitive resources has developed naturally or intentionally grown in the form of a doctrine or belief. In a case of traditional craftsmen in rural Indonesia, a variety of variables such as, workmanship culture, village environment, locality, beliefs, system value had significantly shaped the group member's cognitive resources. The above factors including the protection and preserving the system value construct typical mindset within their cognitive resources. Such construction is generally regarded as conservative and rigid thinking. Thus, conservatism within traditional viewpoint creates a cognitive fixedness. Numerous studies have affirmed that reliance on past experience is a type of cognitive fixedness in which an individual remains stuck with one perspective and struggles to find new alternatives [61]. Cognitive fixedness is understood as a state of mind in which an object or situation are perceived in familiar way that convenient for him/her. It excludes of any alternative. In creative process this is considerd as premature commitment when someone appears trapped to a particular set of design decisions that they familiar with [10]. This limits our ability to break free from our routine habits and avoid radical thought.

Traditional craftsmen in rural Indonesia are individuals that inherited special craftsman skills and gained expertise in his or her local village's traditional crafts that have been passed down from one generation to another. The inheritance process mainly throughout an individual's lifetime that shaped through close interaction and special attachment. This traditional way of inheritance represent a unique transfer of knowledge. The close attachment between the master and the apprentice or novice has preserve the existance of traditional teaching method. Historically, the transfer of knowledge involving myth, legend, and folktale to be essential in the process of learning and making [62]. Folklore can contain mythic elements and tied to the religious practice as part to build a discipline, moral and proper mastery.

Some of the oldest well-known craftsmanship in Indonesia are *Wayang Kulit* (shadow puppet), *Keris* (an asymmetrical dagger), Batik (wax rest-dyeing) that represent a long history of cultural transformation. Either the story of the puppet show, the theme of Batik drawing and the mastery were consistently kept in certain manner. This old manner derived dates back from the presence of beliefs

and religion in Indonesia throughout history, namely animistic practice, Hinduism, Bhuddism, and Islamic practice [63]. This particular craftsmanship skill is known as intangible cultural heritage. The practice of producing craft is related to life learning process, where the master craftsman inheriting to young apprentice. Religiousity very much affect the process of craft teaching, one of the example is in Islamic way that prohibit to draw or create shape of life creature, instead of floral decoration. Such belief portrays the conservatism that inherited from master craftsman to the apprentices, which clearly affect the thought process of the apprentice.

Islam as a dominant religion in Indonesia, historically known for their Islamic informal education that establish and spread throughout the country. Islamic boarding school (*pesantren*) is intended to keep the moral code and religious law (*sharia*) implemented. The student namely *santri* must respect and follow the teacher, namely *kyai* as the source of knowledge. This practice is similar to what to practice in the master-apprentice learning process, which hold strongly the beliefs and conservatism.

3.1.1 Traditional crafts villages

Over 60 percent of the population of Indonesia live in villages that spread throughout Indonesia. Village is an important part of Indonesian culture.Villages are comprised of *kampungs* where smaller groups of people working as a group. The villagers are the fishers, farmers, and also craftspeople. The villagers are traditional community who still practice and hold firm their ethnic rituals and customs. As a country with over 350 different ethnic groups, Indonesia is undoubtly reach with cultural diversity. These cultural resources are maintained and inherited to generations. In areas where craft is the primary activity, children are taught of craftsmanship by daily basis by helping their parents.

Followings are some of well known traditional craft that still maintan to be preserved in many villages in Indonesia. *Batik*, a wax and dye traditional technique for fabric, has been practiced for centuries mainly produced in many villages in Java island. Indonesian *Ikat*, Indonesian *Songket*, Indonesian *Ulos* are an ancient type of woven fabrics that popularly still produced in many villages in Sumatera island. Mas village in Bali island focuses on meticulous wooden sculpture. A complex wood carved furniture and craft are produced in Jepara village. Traditional earthenware and pottery craft that has been practiced at many parts of Indonesia. Various natural fibre woven , i.e., seagrass and bamboo also practiced scattered throughout villages at Java island, Bali, Sumatera, Kalimantan and Sumatera (see, Fig. 3.1).

Figure 3.1: Local wood carving village in Ubud, Bali (left); wooden furniture and sculpture village in Jepara, central Java (right).

3.1.2 The influence of cultural and spirituality

Culture and spirituality has greatly influenced the life of the people in past era, including the master craftsman that recognized as a holy man. The culture and spirituality in a form of sytem value is infused to every young apprentices, which it was taken for granted because a lot of positive aspects in it. In the early development of Indonesian education, a public institution such as islamic boarding school flourished in many villages in Indonesia. Islamic boarding schools or *pesantren* in Indonesia is a system originated from traditional Javanese *pondokan*; dormitories; *ashram* for Hindu or *viharas* for Buddhists to learn religious philosophies, martial arts and meditation. Pesantren aim to deepen knowledge of the Qur'an. Although master-apprentice relation is not directly connected to the practice in the pesantren, however the system and the method of quasi-parental nature is quite similar as has been practiced in the *pesantren*. As social institutions, *pesantren* have played a major role over the centuries. Pesantren emphasise cores values of sincerity, solidarity and self-control. The curriculum found in contemporary *pesantren* can be divided into four basic areas: religious education, character development, vocational skills training, and general education. Religious education involves studying texts, which are Qur'an, Hadith, and the classical texts that include commentaries on scripture, expositions on mysticism [64].

The process of acquiring knowledge of young apprentices from the master craftsman is not merely a technicality, but also the wisdom, character development that obtained through strict discipline pthat time-taking. Therefore, the influence of cultural and spirituality internalised and deeply rooted in action and attitudes of the young apprentices.

3.1.3 Parent-child relationship in Javanese cultural context

With over 350 cultural ethnics, Indonesia has broad range of cultural diversities. Javanese is one ethnic group with the largest population which receive alot of attention in the ethnograhy studies [65, 66].The parent-child relationship in Javanese ethnic has been studied and stressed in the principles of child nurturance. The term of *ngemong* or *among* refers to taking care of, guide, and educate a child with full affection. Concept of Javanese *ngemong* or *among* in child nurturance are divided into three namely; asih, asah, and asuh implies to loving, guiding, and caring. The attention and affection that incorporate *asih*, *asah* and *asuh* are quite often noticed as overly intervene to the children personal lives However, this concept of nurturance have facilitated the establishment of a unique Javanese Indonesian child-parent attachment relationship: a Javanese child's (i) sense of indebtedness, and (ii) affectional dependency on their parents,. For Javanese Indonesians, these two factors of attachment and indebtedness are important to form a strong child-parent bond [67]. Ultimately, the key to creating conducive circumstance to a child as a learner is to building a trust for facilitating the children's growth. The feeling of trust and intimacy as a father-son relationship in education is useful for character building [64, 68, 67]

3.1.4 Master-apprentice relation

All experts once were novices. As beginners, novices learnt from seniors or masters. Learning process which time-consuming and requiring a close attachment of experienced person and inexperienced person. This is called apprenticeship. The master-apprentice relation is known as a method where a novice is placed in the vicinity of an expert, the novice learn by first-hand and be trained in practice by the expert. The master-apprentice relation is a transfer of knowledge with discipline to gain mastery in workmanship that has been practised in the history of craftsmanship [69].

Apprenticeship is a learning to internalize a process of work by observation, practice and watching

the master. It requires repeatedly practices to advance to more difficult and complete levels. The master-apprentice relation is still practised in many traditional craft villages in Indonesia (see, Fig. 3.2 and 3.3). The master-apprentice relation sometimes reflected a quasi-parental nature, with a close emotional tie [70]. The emotional tie of master-apprentice relation is rather similar to Japanese *sempai-kohai* relation ship [71].

Figure 3.2: An old picture of a master and an apprentice were making traditional Indonesian *Kris* dagger (circa 1940s). Source: van Duuren, D. A. (1996). De kris: een aardse benadering van een kosmisch symbool. Koninlijk Instituut voor de Tropen, Tropenmuseum. http://www.the-javanese-kris.com/.

Figure 3.3: A picture of the present time of a master (*The Pande)* and a young apprentice are making a traditional Balinese spear (circa 2000s). Copyright of Mio Cade Photography. http://50.19.218.192/photos/ramdiboy/tags/pande/

In the case of Indonesia, a traditional sacred rule in Balinese culture demonstrate a rigid, conservatism and strict deal of code of conduct. For example, only those born as an exclusive *Pande* caste may forge the magically charged daggers, called Keris. This is called a sacred birthright is only one of the factors making the Keris so unique and precious. This ancient techniques were passed from father to son [72]. Another example is a strict master-apprentice relation as a spiritual leader that strictly follow Islamic rule. As it is performed in many traditional islamic boarding school (*pesantren*), a *kyai* or spiritual leader that is considered as a knowledgeable individual and believed for his/her mystical ability [64]. A novice is always in the position as receiver and take all knowledge for granted, for example, according to particular exegesis of islamic way, it is not allowed to produce life creature at any form, where it is believed as a derogatory of omnipotent of God. Such things are still practiced until now. Therefore, confirms what is conveyed by Boon (1977) and Brockmöller (2008), the master-apprentice relation often reflect a traditional vertical relation through quasi-parental nature or father to son relation.

A master craftsman, especially in the Javanese keris's blacksmith known as *Empu* or *Guru*, in Bali known as the *Pande* or, in Sundanese known as the Master Teupa. the *Empu* is considered as holy man who has a high degree in society [73]. An *Empu* derived from the sect of Brahma, a high degree sect back in those days. The *Empu* is someone with high talent and exceptional mastery of craftsmanship. The skill of an *Empu* of Keris making covers some of the following [74] :

- Expert in the field of religion and spiritual that having true understanding of life.
- Expert in the field of weaponary and also self defence.
- Ability to understand the psychological character.
- Expert in measurement of human anatomy.
- Nobility in the field of politic.
- Expert in the literature.
- Expert in artistic fields.

With such ability and expertise the master craftsman or Empu back in the old days was a role model in the society. Therefore, young apprentices deeply respect and obediently follow the whole direction given by the master craftsman in his or her life-time learning process. The process of knowledge transfer of this tacit experience is characterized with a complex mix of long history of religious aspect such as Hinduism, Buddhism and Islamic practice. Through the time, religious practices accommodated the local culture and transform as a system value that followed and preserved consistently. As a rigid practice of applying this system value, it becomes a consistent beliefs among young apprentices. This is a commitment to particular beliefs, such as belief to create a proper form; belief to maintain perfect balance; belief to create a standard dimension according to their understanding of beauty towards culture and religion and within quasi-parental nature. This internalization becomes unique experiences to every young apprentice, the tacit experience is filled by a belief in conservatism. It resides in the unconscious mind and highly personal, internalised and deeply rooted in action and attitudes (see, Figure 3.4) [75, 72, 70].

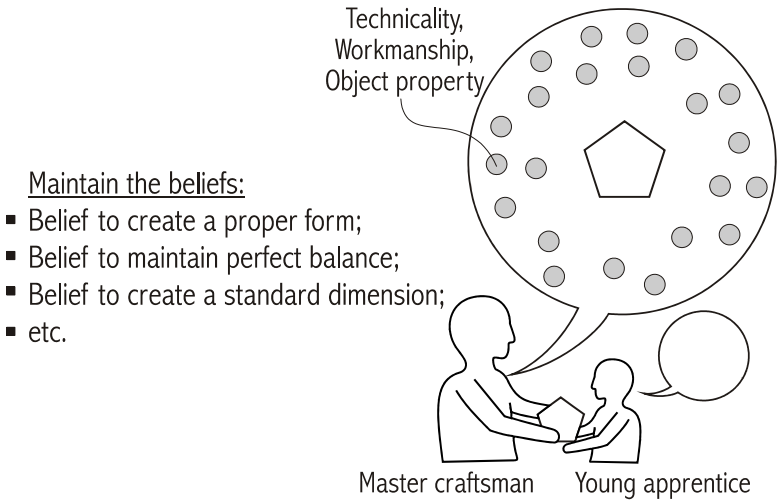


Figure 3.4: A typical knowledge transfer from master craftsman to young apprentice.

3. 2 Model of Traditional Teaching of master-apprentice

In order to have deep understanding on basic creative cognition of traditional craftsmen is shaped, we need to slightly shift the focus from adult experience to childhood experience. More spesifically, we need to study co-creative development in childhood. A number of studies have been conducted that reveal playing shows its relationship to the development of children's thinking and more sophisticated classification skills and the ability to use what they already know to construct new knowledge [76, 77. 78]. Studies affirm that play is essential for all children's healthy development and learning develops language and literacy skills and concepts [79, 80, 81]. Furthermore, our study focused on parent-child interaction, specifically, formative-skills and communication in stimulating co-creative play.

3.2.1 Parent-child role in master-apprentice relation

Previous literature has identified the qualities of parent behavior linked to positive child developmental outcomes such as affection (warmth, care), responsiveness (sensitivity), encouragement (scaffolding, autonomy support), and teaching (language and literacy support, cognitive stimulation) [82, 83, 84]. Parent-child attachment relationships in Asian countries are also considered valuable, as they affect the children's social development in their next phase of maturity [85]. The unique interdependent relationship between Asian parents and their children is an indigenous concept characterized by motivation to be guided by others [86]. In this research, we explore phenomena that can be clearly recognized as intimate expressions during role-taking behavior, acts of devotion, and habits of demonstrable affection that contribute to children's development of creative and formative skills. Specifically, we investigate communication during a parent-child creative play activity in Indonesia, a country with 500 living languages, and Japan.

3.2.2 Cognitive resources development in traditional teaching

Parent-child interaction provides resources for the child's individual development, while at the same time, it may also implies constraints for each other's need fulfillment [87]. Recent studies on parent-child interaction supporting a creative environment have focused on technology, such as electronic toys or interaction devices that supports a remote communication system [82, 88]. Few studies have sought to clarify the important role of caregivers in a child's play experience [89, 90]. Lizuka et al.'s

(2012) study on factors related to co-creativity in human-to-human non-verbal interaction focused on the information system [91]. However, none of the above studies have discussed the indigenous Asian characteristics of interaction and communication to stimulate co-creative play; therefore, we explore this aspect of communication in two Asian countries, Indonesia and Japan. In Asian culture, individuals are not always required to be independent and autonomous; rather, interdependence is emphasized [92]. This unique interdependent relationship is an indigenous concept that is characterized by motivation to be guided by others [86]. The behavioral pattern is typically found in mother-child relationships characterized by role-taking behavior: one person is the requester, and the other is the provider [93]. In Indonesian culture, a care-giver always considers three principles of child nurturance: *asih* (showing affection), *asah* (stimulating potentials), and *asuh* (fulfilling needs) [94, 95, 96, 97]. These principles are internalized to children's character and incorporate spoiled behavior—called *kolokan* in Indonesian. Similarly, in Japanese, *amae* refers to inappropriate behavior or requests made with an expectation of acceptance by the person to whom they are directed [98]. This behavior tends to be reciprocal, depicting interdependence rather than dependence in the roles of the requester and provider [99]. When it takes the form of role-taking, such behavior mimics the over-protective and over-indulgent interaction and attitudes of parents toward children that might provide resources or imply constraints on the child's development. We focus on recognizably intimate behavior, that is, habits of demonstrable affection that contribute to parent-child co-creative play.

3.3 Research Aim

We aim to identify the intimate interaction and acts of devotion on Indonesian and Japanese parent-child living in local craft village. We want to observe the origin of cognitive fixedness in conservative viewpoint shaped in childhood that contribute in the rigid practice of craftsmanship.

3.4 Study Design

3.4.1 Method

We conducted three experiments in each of three local craft villages in Indonesia and one village in Japan. The three experiments are as follows:

- Experiment A: Making a Japanese ceramic whistle (陶笛) to observe children's formative play skills (craftsmanship).
- Experiment B: Making a musical instrument that produces three tones to observe group work and parent-child communication.
- Experiment C: Making a musical instrument that produces sound as a result of the player's body action observing children's exploratory thinking and parent-child communication.

We aim to gather data on the following:
(1) Children's formative play skills (craftsmanship)
(2) Parent-child communication structures

To investigate (1) "Children's formative play skills," we analyzed the results of Experiments A and C, focusing on evaluations of the object (ceramic whistle) and activity. We considered the task completion time, accomplishment, accuracy, functionality, and uniqueness (non-similarity). Then, to explore (2) "Parent-child communication structures," we analyzed data from Experiments B and C, focusing on the intimate cross-communication that occurred in the form of role-taking behavior. Network Analysis was employed to evaluate the content and number of utterances in communication.

The data on the object and activity were evaluated by six experts in craft and design. The data on parent-child communication structure were transcribed and analyzed through text and network analyses. Out-Degree Centrality (ODC) scoring was used to describe the role of intimate expressions and acts of devotion in parent-child communication to stimulate co-creative play.

3.4.2 Participants

The Indonesian participants comprised 15 children from three different regions. The Japanese participants comprised 4 children from one region. The gender of the subjects was random, and the age range was 7 to 12 years. Each child was paired with one of his/her parents (i.e., mother or father). Thus, the total number of participants included 19 children and 19 parents. All the participants lived near the local craft village in their region, and most did not know each other.

3.4.3 Procedure

Each experiment (A, B, and C) was conducted separately in each town and was completed within a period of one hour. The parents sat next to their children at a U-shaped table. The children were asked to complete three tasks on their own, but the parents were allowed to assist if the child needed help. The participants were free to communicate with each other. Two video cameras were set up to record their interactions.

- Statistical data of skill/formative skills derived from the objects of Experiment A and Experiment C were evaluated by six design experts through 3 Likert-scale rating evaluation.
- Statistical data of parent-child interaction derived from the video recording of Experiment A and Experiment C were evaluated by six design experts through 3 Likert-scale rating evaluation.
- Parent-child utterances or verbalization were transcribed and sorted by context. The sorted transcriptions (words) were then evaluated by Network Analysis.

The objects made by the children (Experiments A and C) and recorded activities were evaluated as the assessment of the children's formative play skills. The evaluation employed a three-point Likert-scale and was rated by six experts in craft and design. Next, the parent-child communication structures were analyzed using Network Analysis derived from video transcription that covered the communication between five children and their parents (pair, inter-, and cross-communication) in each town. The number of utterances in communication was counted using Pajek 2.05 and based on 2D layers in the Y direction.

3.4.4 Definition and types of communication

Communication is defined as conveying messages, ideas, or feelings through verbal communication (i.e., Talking, teasing, joking, etc.). The following types of communication were analyzed:

- Child-Child (C-C) communication (bi-directional)
- Parent-Child (P-C/C-P) communication (bi-directional)
- OtherParent-OtherChild (Parent(x)-Child(y)) communication and vice versa (multi-directional/ cross-communication)

The following types of communication were excluded from the analysis:

- Communication/instructions given by the facilitator, parent-parent communication, children's self-communication (i.e., singing, mumbling, screaming, yelling, or talking to oneself), and communication with unexpected guests.

3.5 Formative-Skill

3.5.1 Experiments in Indonesia

Experiment A. Making a Japanese ceramic whistle (individual task)

Our observations in the activity evaluation showed that 87% of the Indonesian parents engaged in strong role-taking behavior by offering direct and close guidance throughout the experiment. These parents took over the task given to their children (see, Figure. 3.5). During the parents' role-taking behavior, the children acted passively; however, afterward, they followed their parents' example to remake their own whistle independently. On average, the children demonstrated quicker progress when they remade the Japanese whistle. They received positive evaluations on their accomplishment and accuracy, with an average score of 6.16 points on proportion and an average completion time of 00:21:10 (see, Table 3.1).

Figure 3.5: Experiment A. Making a Japanese ceramic whistle (陶笛).

Experiment B. Making a three-tone musical instrument (group task)

The children had a difficult time staying focused in the group task. Sometimes they worked together, and at other times, one child would suddenly begin to work independently. Seventy-three percent of the parents exhibited role-taking behavior during this task and gave many instructions to the children. The role-taking behavior, which is also known as spoiling behavior, was a strong trend. Instead of allowing the children to act independently, the parents acted as partners to teach the children step by step. The parents and children made quick decisions, and most of them seemed to make things that were familiar using the materials they were given (see, Figure 3.6). For example, they produced musical instruments that were closely associated with the tubular character of the PVC pipe. The data of Experiment B were evaluated in terms of the communication contents. Both the parents and children showed intense communication, including P-C/C-P communication and P(x)-C(y) communication or vice versa, as indicated by the higher ODC score (≥ 33 and ≤ 56; shown by a single asterisk; see, Figure 3.7). The intense communication consisted of 13.4% utterances showing affection, 81.1% utterances stimulating potentials, and 5.5% utterances off-topic (i.e., jokes, side talk) (see, Tables 3.4b and 3.5).

Figure 3.6: Experiment B. Making a musical instrument that produces three tones.

Experiment C. Making a body-action musical instrument (individual task)

As mentioned, 87% of the Indonesian parents performed role-taking behavior. These parents guided their children as if they were co-workers completing a task in tandem. The parents gave strict orders to the children to pay attention to their instructions. Both the parents and children tended to make quick decisions without spending too much time discussing the assignment. They appeared curious about the given materials; however, they put aside the main question to focus on completing the assigned task. Their quick decisions could be easily recognized in their work, as they only applied familiar shapes to the aluminum pipe by bending and pulling straight or backward. They did not seem to discuss the objective of the task, which was to produce an instrument that would make sounds as a result of the player's body movement. This corresponded to lower scores in the evaluation of the use of materials, movement, and non-similarity, as compared to the scores of the Japanese children (see, Table 3.2). The parents and children once again showed intense communication, including P-C/C-P communication and P(x)-C(y) communication or vice versa, as indicated by the higher ODC score ($\geq$ 33 and $\leq$ 56; shown by a single asterisk; see, Figure 3.7). The intense communication consisted of 9.5% utterances showing affection, 64.7% utterances stimulating potentials, and 25.8% utterances off-topic (see, Tables 3.4b and 3.5).

Figure 3.7: Experiment C. Making a musical instrument that produces sound as a result of the player's body action

3.5.2 Experiments in Japan

Experiment A. Making a Japanese ceramic whistle (individual task)

The Japanese children tended to accomplish the task slower, with an average completion time 00:26:40. No Japanese parents performed role-taking behavior; all the children made the whistle by themselves. Therefore, the children did not have an apprentice-like learning experience during the experiment. All the children completed the entire process independently. They received lower evaluation scores in the accomplishment and accuracy assessment (see, Table 3.1).

Figure 3.8: Experiment A. Making a Japanese ceramic whistle (陶笛)

Experiment B. Making a three-tone musical instrument (group task)

The children focused well to complete the given task. All the group members spent time exploring and discussing how to produce a three-tone instrument. The children did trial-and-error by creating different kinds of shapes and models to identify clear sounds. It took time for them to obtain the best tones from the created form. Their careful quest to produce a three-tone instrument showed a systematic process. Meanwhile, the parents engaged in very limited role-taking behavior, intervening only if the activity looked difficult or harmful to the children. Finally, each group produced a musical instrument that clearly produced three tones. The parents and children showed intense communication; however, very little cross-communication (OtherParent to OtherChild) occurred. The communication consisted of 0% utterances showing affection, 100% utterances stimulating potentials, and 0% utterances off-topic (see, Tables 3.4b and 3.5). Parents' communication directed toward their children had a constant ODC score of 0.28. This means each parent consistently communicated bi-directionally with her child and within the group (shown by double asterisks; see, Table 3.3 and Figure 3.11a and 3.11b).

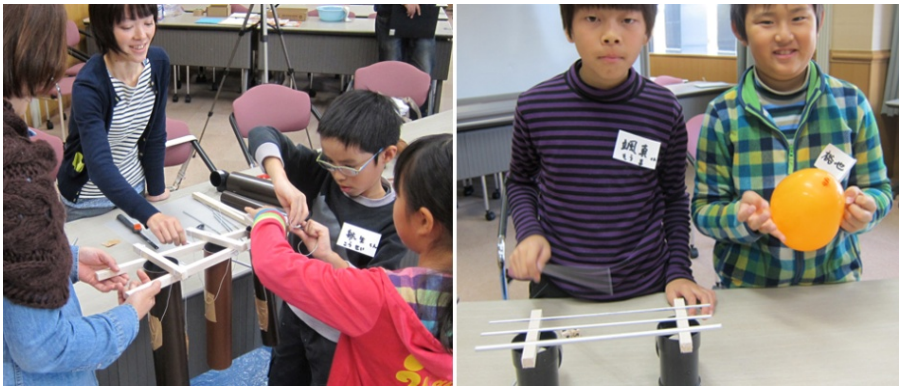


Figure 3.9: Experiment B. Making a musical instrument that produces three tones

Experiment C. Making a body-action musical instrument (individual task)

The children focused well on completing the assignment. Each child considered how to produce good pitch by exploring various body actions. They did not make quick decisions, and they explored the issue of body action. In addition, the children tested several different models they made. Besides focusing on tones, they paid attention to body movement. The object and activity of Experiment C were given high evaluations on the use of materials, movement, and non-similarity, as shown in Table 3.2. The parents and children engaged in intense communication that consisted of 0% utterances showing affection, 83.4% utterances stimulating potentials, and 16.7% utterances off-topic (see, Tables 3.4b and 3.5). Most of the communication was P-C/C-P communication, and a small amount was P(x)-C(y) communication or vice versa, as indicated by the high ODC score (shown by a single asterisk; see, Table 3.3 and Figure 3.11a, 3.11b).

Figure 3.10: Experiment C. Making a musical instrument that produces sound as a result of the player's body action.

3.5.3 Object and activity evaluation in Experiment A and C

Table 3.1: Experiment A. Making a Japanese ceramic whistle.

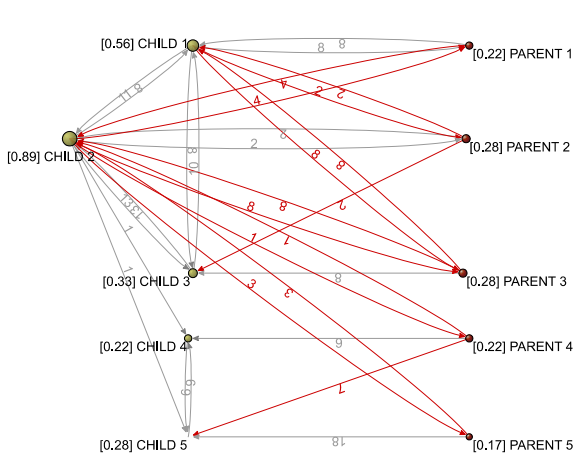
Location	Accomplishment and Accuracy				
	Amount	Completion (Average)	Proportion (1-10)	Process (1-10)	Function (0/1)
Giriloyo, ID	2	0:22:19	5.56	7.33	0
Kasongan, ID	2.2	0:17:10	6.59	6.81	0
Mas, ID	1.6	0:26:20	633	7.26	0
Nomi, JP	2.8	0:26:40	5.42	7.18	0

Table 3.2: Experiment C. Making a body-action musical instrument.

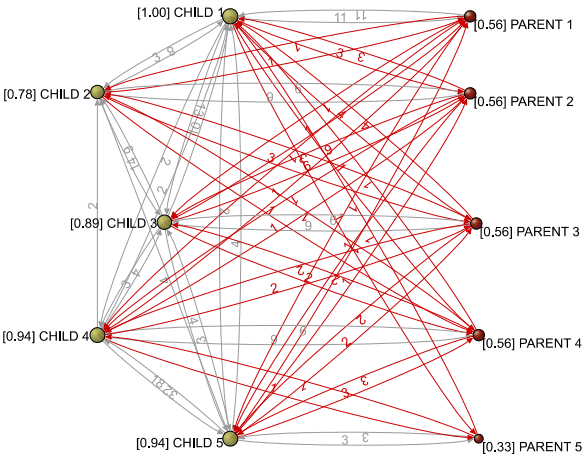
Location	Idea Exploration			
	Material (n) (1-10)	Movement (1-10)	Sound (n) (1-10)	Non-Similarity (1-10)
Giriloyo, ID	8.7	2	6.4	6
Kasongan, ID	10	4	10	4
Mas, ID	7.5	0	8.2	2
Nomi, JP	9.4	7.5	8	7.5

3.6 Communication Network Analysis

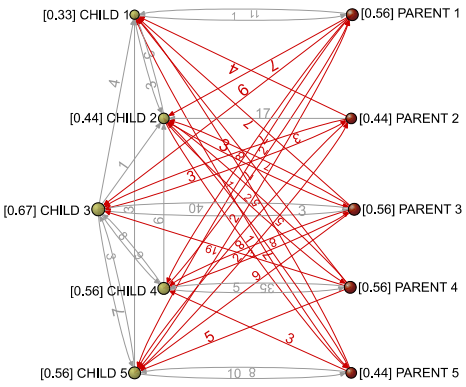
In this research, parent-child verbal communication that occurred during the experiments was the key point to identify interpersonal ties. The events of Experiments B and C were analyzed. We collected and implemented a method to obtain the number utterances representing C-C, P-C/C-P, and P(x)-C(y) (or vice versa) communication. The number of utterances in P-C/C-P communication were transcribed and translated into English and plotted on network graphs using Pajek 2.05, based on 2D layers in the Y direction. The nodes on the left Y-axis represent the children, and the nodes on the right Y-axis, their parents. Each communication network represents the location where the research was conducted. The type of communication structure and its degree of gregariousness were easily identified. For example, Figure 3.11a (for Experiment B) shows that the Indonesian parent-child communication networks performed 100% strong cross-communication (OtherParent-OtherChildren), which included inter-group communication. In contrast, the Japanese parents engaged in little cross-communication that occurred only within the group, and only one such interaction was recorded between a child and a parent from a different group. Figure 3.11b shows that 80% of the Indonesian parents and children, respectively, engaged in cross-communication. Meanwhile, only 50% of the Japanese parents and children engaged in cross-communication, and these interactions took place only within the same group.



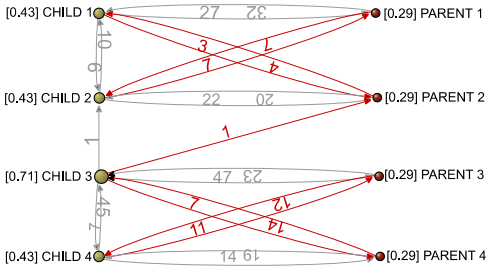
Exp. B (Group) - **Giriloyo, Indonesia**



Exp. B (Group) - **Kasongan, Indonesia**



Exp. B (Group) - **Mas, Indonesia**



Exp. B (Group) - **Nomi, Japan**

Figure 3.11a: Parent-child communication networks in Experiment B (Red arc represents cross-communication of OtherParent-OtherChild (P(x)-C(y) or vice versa)).

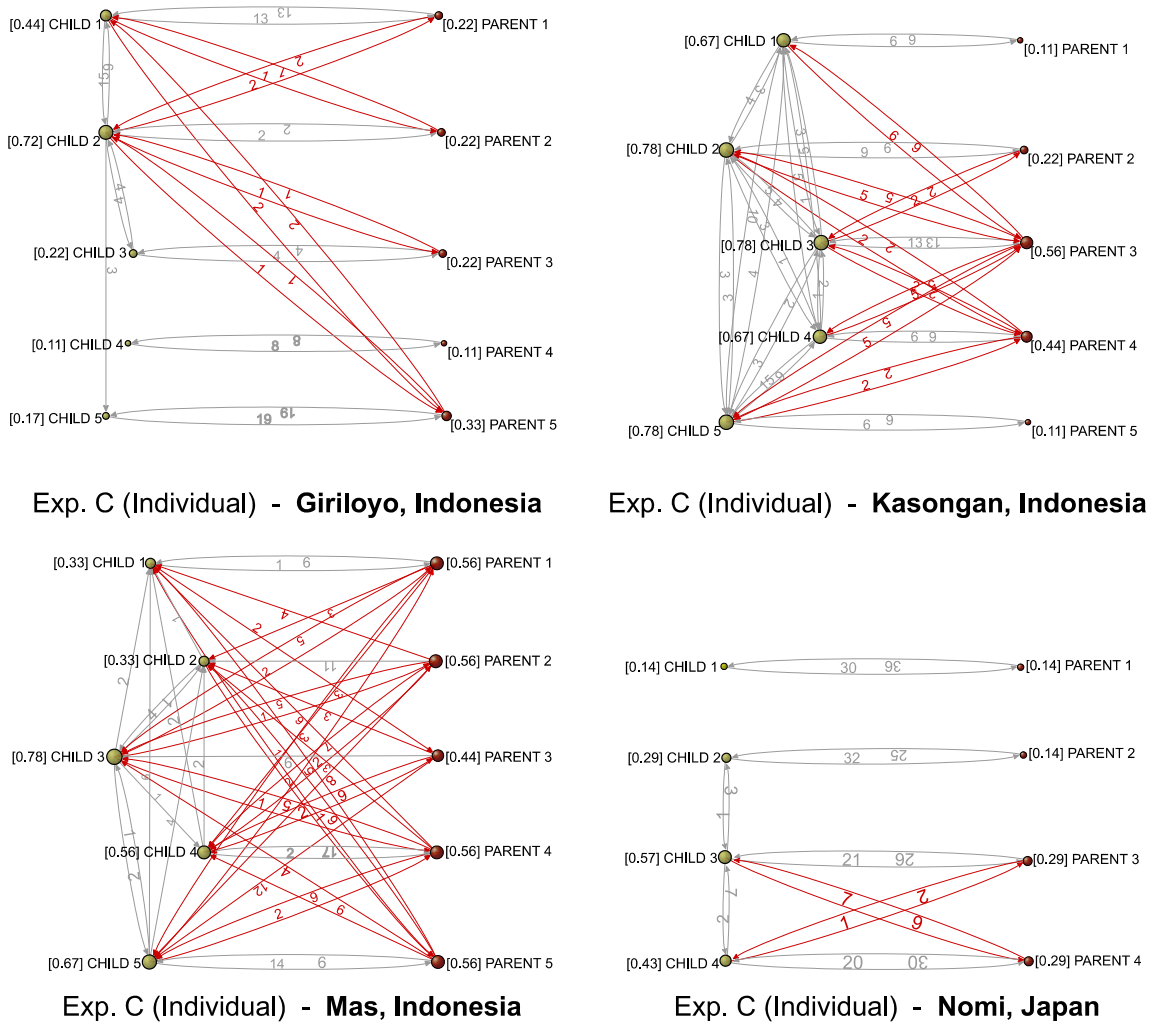


Figure 3.11b: Parent-child communication networks in Experiment C (Red arc represents cross-communication of OtherParent-OtherChild (P(x)-C(y) or vice versa).

Primarily, parent-child cross-communication related to the context of co-creative play. Most of the utterances stimulated potentials or showed affection. Parent-child cross-communication mainly consisted of utterances stimulating potentials, for example, "*Pull this out to make it tidy*" and "*Apply some glue on this part*." Some country differences were found in the collected utterances. For example, the Indonesian parent-child utterances included top-down commands, as if the child were a younger co-worker. This experience resembled an apprentice-like experience in which the child was treated as a young craftsman apprentice by their senior (parent). In contrast, such commands were not found in the Japanese parent-child communication. Their utterances stimulating potentials took the form of an exploratory question-answer discussion: for example, "*What about the balloon? What happens if you put it in?*" and "*Ah, perhaps you opened it too much*."

Table 3.3: ODC scores representing gregariousness behavior.

Participant	Giriloyo, Indonesia		Kasongan, Indonesia		Mas, Indonesia		Nomi, Japan	
	Exp. B	Exp. C	Exp. B	Exp. C	Exp. B	Exp. C	Exp. B	Exp. C
C1	0.56	0.44	1.00	0.67	0.33	0.33	0.43	0.14
C2	1.00	0.78	0.67	0.78	0.44	0.33	0.43	0.28
C3	0.22	0.22	0.89	0.78	0.67	0.78	0.71	0.57
C4	0.11	0.11	1.00	0.67	0.56	0.56	0.43	0.43
C5	0.11	0.11	1.00	0.78	0.56	0.67	-	-
P1	0.22	0.33*	0.56*	0.11	0.56*	0.56*	0.28**	0.14**
P2	0.33*	0.22	0.56*	0.22	0.44*	0.56*	0.28**	0.14**
P3	0.33*	0.22	0.56*	0.56*	0.56*	0.44*	0.28**	0.28**
P4	0.33*	0.11	0.56*	0.44*	0.56*	0.56*	0.28**	0.28**
P5	0.22	0.33*	0.33*	0.11	0.44*	0.56*	-	-

Table 3.4a: Parent-child utterances in cross-communication in Experiments B and C (Indonesia).

Showing Affection	**Stimulating Potentials**	**Off-Topic**
"*Shall I help you? Please don't cry.*"	"*All right, that's enough.*"	"*Well, work until it's dry.*"
"*Don't get mad. Do not get angry. That's not good.*"	"*Bond it first, bond it first, there.*"	"*Boys should be handy.*"
"*Don't be shy. What makes you shy?*"	"*That's OK. Be crammed and pressed.*"	"*You look like 'A' with a bigger body.*"
"*Shall we… Shall we help him?*"	"*Cut it right away!*"	"*Feels like a midget!*"
"*Let's help, what a pity, watch out for your hand.*"	"*Follow this, stab! stab!*"	"*Feels like being shot.*"
"*Don't fight. Just request one only.*"	"*Apply some glue on this part.*"	"*You are reckless!*"
"*Help out, help each other out, together, [you] need to cooperate.*"	"*Pull this out to make it tidy.*"	"*Telephone… whoa… what a strange telephone look.*"
"*Be slow, so your hand won't get tired.*"	"*Scissors. Put the scissors on here!*"	"*That one is for making a call.*"
"*Please be careful, dear Let me help you.*"	"*Do it the same way. Do it.*"	"*Snake! It's a snake… yayy*"
Etc.	"*Roll it up. Roll that one up. Create a hanging chime.*"	"*The round part looks like a stickhead.*"
	"*Flip it, flip it, great.*"	Etc.
	Etc.	

Table 3.4b: Parent-child utterances during cross-communication in Experiments B and C (Japan).

Showing Affection	**Stimulating Potentials**	**Off-Topic**
	"*What about the balloon? What happens if you put it in?*"	"*Hands come out just like the Ultraman… seems like an alien from Balkan.*"
	"*Hang it? Like this… Does it work?*"	"*Is that an alien from Balkan?*"
	"*We'd better fix it here.*"	
	"*Ah, perhaps you opened it too much.*"	
	"*Is that length OK?*"	
	"*The different length is...*"	
	"*This brown one is…*"	
	"*So, what it should be like…*"	
	"*Try... in here, yes, it's soft.*"	
	"*Oh, it was opened. Cut where? How to cut it? Are you both thinking about the same plan? Right? But I guess you each have different plans. You want to cut from here to here, right?*"	
	"*The gong sounds more beautiful.*"	
	"*One of you hold it and tap it.*"	
	"*It's only one sound. You need to create three sounds.*"	
	Etc.	

Table 3.5: Cross-communication utterances (OtherParent-OtherChild and vice versa)

	Location	Showing Affection (%)	Stimulating Potentials (%)	Off-Topic (%)
INDONESIA	Giriloyo (Exp. B)	16.7	72.2	11.1
	Giriloyo (Exp. C)	0	73.9	26.1
	Kasongan (Exp. B)	18.4	76.3	5.3
	Kasongan (Exp. C)	0	77.3	22.7
	Mas (Exp. B)	5.1	94.9	0
	Mas (Exp. C)	28.6	42.9	28.6
		11.5	**72.9**	**15.6**
JAPAN	Nomi (Exp. B)	*0**	100	*0**
	Nomi (Exp. C)	*0**	83.3	16.7
		0	**91.7**	**8.4**

Some of the utterances appeared to show affection, indicating caring and a close attachment performed by disallowance, approval, support giving, and kind nurturance: for example, "*Don't get mad. Do not get angry*," "*Don't be shy. What makes you shy?*" and "*Let's help, what a pity, watch out for your hand*." In addition to the related topics (i.e., showing affection and stimulating potentials), some off-topic utterances were also found (e.g., jokes, side talk). Some of the jokes were related to the work, but others were completely off-topic. This shows a loose situation in which interactions were sometimes out of focus. Utterances showing affection and off-topic utterances mainly were found in the data from Indonesia.

In Experiments B and C, the Indonesian parent-child cross-communication included 11.5% utterances showing affection, 72.9% utterances stimulating potentials, and 15.6% utterances off-topic. Meanwhile, the Japanese parent-child communication included 0% utterances showing affection, 91.7% utterances stimulating potentials, and 8.4% utterances off-topic. Overall, both the Indonesian and Japanese participants emphasized the property of stimulating potentials. The Japanese participants had a higher percentage of utterances stimulating potentials compared to their Indonesian counterparts, and only the Indonesian participants showed affection in their cross-communication.

3.7 Craftsman's Cognitive Fixedness Development in Childhood

In the three experiments, both the Japanese and Indonesian participants' verbal communication consisted of intense communication during the creative play. Almost all the Indonesian parents performed strong role-taking behaviors in two experiments, whereas the Japanese parents engaged in much less role-taking behavior. Role-taking behavior, acts of devotion, and habits of demonstrable affection occurred mainly when the parents were acting as providers, even without their children performing the role of requesters. Role-taking behavior such as *amae* or *kolokan* showed that Indonesian children completely positioned themselves as passive requestors, and their parents became very active providers. This demonstrates that the parents were authoritarian in providing support in a top-down, apprentice-like situation that involved the child's own beliefs, attitudes, and values. This act constituted the basic component of the children's early experience of training on structuring competency of a basic set of skills, known as apprenticeship. The active role-taking behavior was supported by strong orders and commands that likely stimulated the children's formative skills. During the role-taking behavior, parents confirmed their control as proxies controlling the situation. At the same time, the children were recipients whose dependency was confirmed, as they received close guidance. Such episodes appeared to create a value to establish co-creative play between the

parents and their children. By over-indulging in role-taking behavior (i.e., taking over the task), the parents felt content in acting out their role as loving parents. At the same time, their role-taking behavior satisfied the child's desire for dependency. This means that the parents (providers) and children (recipients) co-created value during the creative play activity. Stronger role-taking behavior by the parents led to an apprentice-like experience in which the children acquired a formative skill (craftsmanship), whereas weaker role-taking behavior by the parents stimulated the children's independence. We found that some of the utterances stimulating potentials contained commands and orders rather than discussion. Utterances showing affection were a form of spoiling behavior that was performed even from different proxies to different recipients.

Japanese parents' behavior in co-creative play was characterized by low interdependence in the experiments. Although their role-taking behavior was limited compared to their Indonesian counterparts, the Japanese parents showed intense verbal cross-communication. Similar to the Indonesian parents, 91.7% of their OtherParent-OtherChild utterances stimulated potentials. The contents of these utterances were quite different, reflecting an exploratory way of thinking. The participants' focus on completing the assignment was likely the reason or their lack of any utterances showing affection and small percentage of off-topic utterances. This explains why focus appeared to stimulate exploratory thinking within the co-creative play (see, Figures. 3.12 and 3.13).

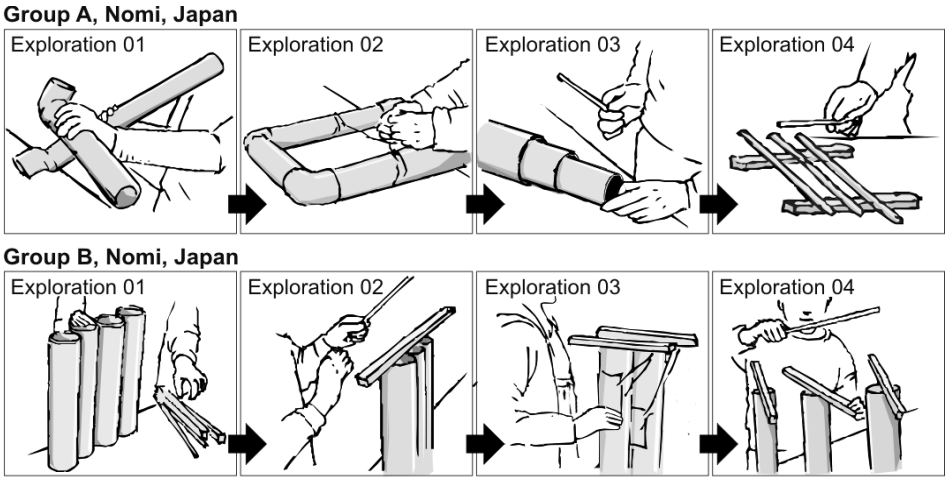


Figure 3.12: More systematical and exploratory thinking to resolve the given task performed by Japanese children (Experiment B. Making a three-tone musical instrument).

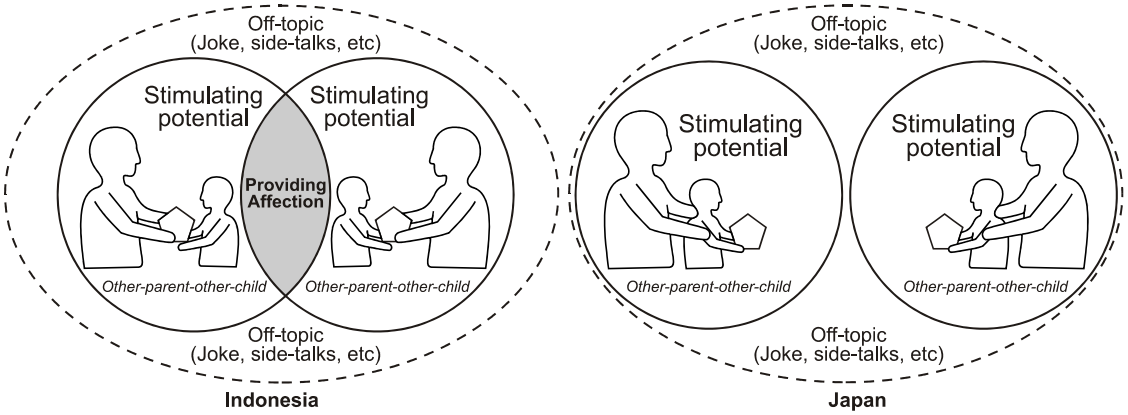


Figure 3.13: Properties of OtherParent-OtherChild cross-communication in co-creating value and creative play

3.8 Findings

All parents in the study exhibited strong spoiling behavior, indicated by the number of ODC of communication. This spoiling behavior (strong role-taking behavior) was also marked by over-instruction in stimulating potentials. The strong role-taking behavior of Indonesian parents appeared to reinforce intimacy in an apprentice-like, co-creative play experience to help the children gain formative skills. Somehow, strong role-taking behavior during creative play, in either utterances or body involvement, satisfied both the parents and the children. We concluded that the stronger the spoiling behavior (i.e., strong role-taking behavior) is, the greater the parent's contentment is in acting as a loving parent and satisfying the child's expectation for dependency. Over time, role-taking behavior facilitates children's development of formative skills (e.g., craftsmanship) by providing an apprentice-like experience, while independence leads to more exploratory thinking (i.e., creativity).

The findings indicate that indulging in role-taking behavior (i.e., taking over a task for their child) gave parents a feeling of contentment as they performed the role of loving parents. At the same time, the behavior satisfied the child's desire for dependency. In this study, the parents (providers) and children (recipients) co-created value during creative play activities. Stronger role-taking behavior by the parents offered the children an apprentice-like experience that allow them to acquire a formative skill (i.e., craftsmanship), whereas weaker role-taking behavior stimulated the children's exploratory thinking (creativity). By having deeper understanding of craftsmen's creative cognition formed in childhood we realize the necessity of knowledge contributors to be involved in creativity proccess. This likely has been fostered since childhood stage that shapes Indonesian children in craft villages become inter-dependence and maintain consistently the rigid practice of craftsmanship as a consistent belief (the origin of cognitive fixedness).

Chapter 4

The Gaps of Cognitive Fixedness at In-depth Cognitive Levels

Numerous international forums and official reports of local governments have identified the existence of main problem in the design and implementation of training programs in developing countries. The gap that exists between designers and craftsmen primarily results from conservative viewpoints and limited understanding of the creative process by the craftsmen. Moreover, no concrete curriculum reference is available for designers to use as material during training.

A conservative or conventional viewpoint is a traditional viewpoint that invariably arises as an issue during discussions of creativity. The term is used to describe the quality of being governed by custom. Alternatively, it can refer to an opinion that is subject to the control of social agreements [100]. Therefore, teaching design and creativity to craftsmen can be a difficult task. However, scholars believe that creativity can be taught by instruction and training. Efforts have been made to provide direct instruction that involves students' cognitive abilities and processes [101]. At a basic level, creativity and design training hope to introduce widely known design methods. These methods hope to encourage creativity. During training classes, craftsmen are given an introduction to Design Principles (e.g. balance, proportion, and so on). Initially, they engage in Creativity Icebreakers. Then, they participate in design exercises and develop prototypes. A typical training program may last between five and seven days. craftsmen were given the options to use their existing craft skills or traditional styles, however, this gesture is more or less an appreciation of craftsmen's culture, because the fact that design trainers do not have adequate knowledge on the craftsmen's distinctive creative cognition and how to empower it.

We assume that differences in creative cognitive abilities exist between craftsmen and designers. Perceptual barriers or fixations are obviously rooted in each individual's unique experiences, interests, biases, and values [102]. Gaps that may develop in the conceptual design process between craftsmen and designers during design training programs may correspond to the most obvious barrier to creative thinking: habit. The term, habit, refers to an individual's well-learned ways of thinking and responding [103]. At the same time, a design training program cannot simply rely on the typical conceptual design process because this process may become another fixation. Hence, we believe that an investigation of cognitive levels of creativity that operate in craftsmen's design processes can provide fertile ground for the development of more effective teaching methods for design training programs.

4.1 Cognitive Aspects of Creativity

It is difficult to find scientific references that focus on traditional craftsmen's distinctive creative cognition, including design training that respond that issue. Little is known about the way in which knowledge and skills within domain-specific knowledge are actually acquired and used [104]. Design training programs are frequently devised to develop crafts that will meet consumers' needs. Trainers are often solely concerned with the appearance of these crafts. Strong evidence has revealed that when designers create design training programs, they tend to recycle whatever information they learned at university. Many designers report a lack of clear understanding of the tasks involved. Thus, they may miss opportunities to enhance creativity [13].

In general, cognition has been recognized as a major factor in the creative process [21]. Most of the conceptualization of creativity in the design process is based on an exploration of the cognitive aspects of creativity [22]. Extensive studies have been conducted to capture the cognitive levels of creativity used during the design process. These studies attempted to understand users' affective preferences, such as taste, and the feelings they may experience that can result in successful impressions of products [23, 3]. However, only a limited number of studies have explored the cognitive levels of creativity that occur during the design process at the very early stage of idea generation.

4.1.1 Early stage of idea generation

Idea generation is an essential step in the design thinking process. It involves the interplay between cognitive and affective skills that leads to the resolution of recognized difficulties [105]. It also involves iteration, a cyclical process of idea generation, evaluation, and design improvement to gather and filter information during the stage of generating and evaluating possible solutions [106]. The general steps involved in design thinking are listed below. The most discussed step is the early stage of idea generation.

1. Imagination (early stage of idea generation): The stage during which craftsmen and designers observe and reframe the design problem.
2. Ideation (later stage of idea generation): The stage during which craftsmen and designers employ sketches, graphs, or paper models to generate visual ideas.
3. Prototyping: The stage of making rough models to convey ideas concretely.
4. Evaluation: During this stage, users' feedback is acquired by evaluations of affective preferences. (The step that occurs after the design thinking process consists of realization or production for commercial purposes.)

The early stage of idea generation involves observations by craftsmen and designers based on first-hand experiences. This stage is associated with a greater diversity of ideas [106]. In particular, this stage of imagination is associated with differences in creative cognition. Therefore, it is reasonable to assume that an individual's fundamental thoughts are captured to a fair degree at this point. This is an appropriate stage to examine craftsmen's and designers' first-hand experiences as they observe and reframe design problems.

4.1.2 Surface and in-depth cognitive levels

Our explicit expressions and/or words may result from shallow analysis. During the early stage of idea generation in design training, individual's explicit expressions and/or words may result from shallow analysis, which occurred from immediate interpretation when imagining a product. The

impression serves as a basis for activating explicit expressions. Therefore, in all likelihood, these expressions and words operate on the surface cognitive level. However, the term implicit impression refers to that which is not explicitly recognized or verbalized [54]. This underlying form of cognition may be difficult to express. Thus, it is referred to as the in-depth cognitive levels (e.g. feelings, tastes, and impressions) [55, 3, 56]. Implicit impressions are implied beneath explicit impressions that relate to deep impressions. This process establishes extremely rich metaphorical concepts that become key features of cognition during the creative design process (see, Figure 4.1). Additional studies have focused on the use of metaphors to enhance creative design solutions. These studies hoped to discover how rich metaphorical words formed the basis of creative design [57, 58, 59]. To examine cognitive levels based on subjective experiences, researchers may employ think-aloud methods as part of protocol analyses that to produce verbal reports of thinking processes [60].

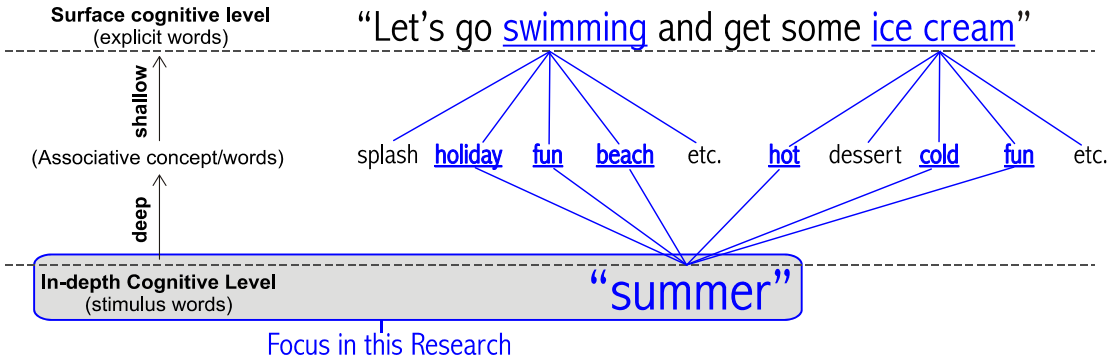


Figure 4.1: Capturing in-depth cognitive levels by the use of the associative concept dictionary

4.1.3 Associative concept network analysis

To examine the structure of thoughts collected from subjective experiences, a think-aloud, as a part of protocol analysis, was employed to produce verbal reports of the thinking process [60]. Subjects were instructed to describe their thoughts and observations and reframe design problems by verbal expression. Verbalized thoughts reflect some aspects of the regular cognitive process that can be investigated by the use of the concept network method that is based on the associative concept dictionary.

An associative concept is a representation of an individual's expression. It is a stimulus that can lead to another associative meaning. It is comprised of six sub-types: connotative, collocative, social, affective, reflected, and thematic [4]. The conceptual network depicts human memory as an associative system, in which a single idea can contain multiple meanings (i.e., it is polysemous). A concept network employs a computational model to reproduce observable aspects of expressions associated with an individual's mental state. It is a suitable tool for associative analysis because it can be used to explore latent links that exist among concepts. The concept dictionary utilized in conceptual networks originated at the University of South Florida Free Association Norms database (USF-FAN). It consists of free associations, rhymes, and a word fragment norms database. It is the largest database of free associations ever collected in the United States [5, 4].

4.2 Research Aim

We aim to understand the different characteristic of the cognitive fixedness of craftsmen and designers. We investigate the cognitive fixedness from the associative concepts of craftsmen and designers that occured when they conceptualize their ideas at the early stage of idea generation.

4.3 Research Method

To capture associative concepts that occur at in-depth cognitive levels of imagination at the early stage of idea generation, we conducted a think-aloud protocol in which craftsmen and designers were instructed to freely express their ideas verbally. We employed a concept network analysis based on the associative concept dictionary to extract verbalized thoughts. The framework consisted of the steps listed below (see, Figure 4.2).

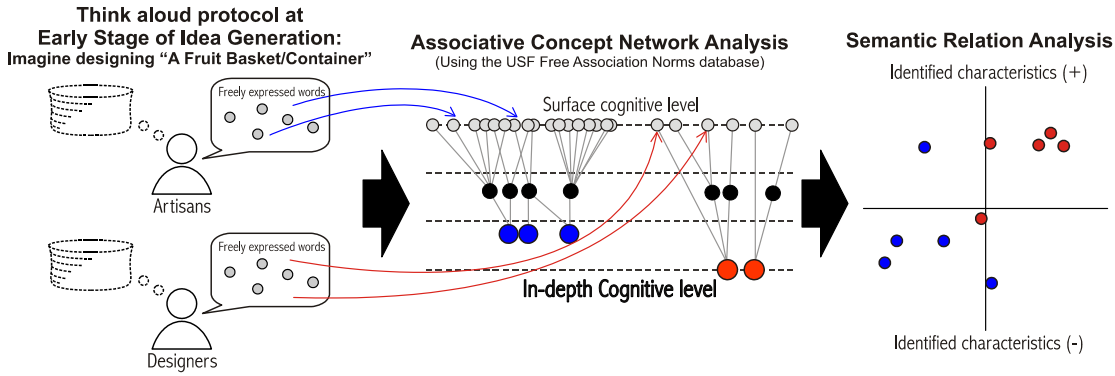


Figure 4.2: Research framework: Identification of the different characteristics of in-depth cognitive levels

4.3.1 Participants

We chose eight participant subjects for this experiment: Four craftsmen were widely known as master craftspeople who possessed special skills in artistry. Their special expertise in their local village's traditional bamboo crafts has been passed down from one generation to another. An additional four participants were designers. They were graduates of industrial design programs. Each had experience as an instructor in several design training programs that focused on the utilization of natural materials.

4.3.2 Procedure

The participants (craftsmen and designers) were not required to engage in specific activities, such as drawing or observation of stimuli. In this experiment, participants were conditioned not to engage in specific activities, such as drawing or observation of stimuli. We provided only the instructions required to understand fundamental associative concepts. We avoided rigid instruction about determinations of design themes, market segmentation, or design functions because we believed that the provision of excessive information might be unfair and misleading. The provision of a minimum of instructions created a fair playing field. It allowed us to observe craftsmen's and designers' responses and motivations on their very early attempts in reframing design problems. The think-aloud protocol experiment was carried out separately with each participant to avoid copycat thinking. We

placed no constraints on the subjects when they verbally expressed their ideas and engaged in spontaneous thinking that mirrored their process when they searched for new design ideas.

The main instructions for the think-aloud protocol experiment asked participants to imagine designing a fruit basket/container. We encouraged free expression of their ideas. The direct instructions are listed below:

'Please imagine designing a fruit basket/container.'
'Please freely express any ideas that arise.'

No time limits were imposed on participants during the think-aloud protocol experiment. On average, participants took about six minutes to express their imaginative thoughts. All procedures were recorded as verbal data that would be sorted later.

Data was sorted based on grammatical rules that addressed connecting words, such as prepositions, a few general verbs, articles, and pronouns. We omitted other less relevant explanations. Finally, we transcribed the sorted verbal data, which was comprised solely of nouns, adjectives, adverbs, and verbs, into English. Furthermore, the data was visualized by the use of Pajek 2.05 software based on 2D layers in the Y direction. The data was analysed according to the concept network method, which was based on the USF Free Association Norms database. The resulting visualization presented an observable conceptual network that displayed low or highly weighted associative words as indicated by the out-degree centrality score (ODC). The concept network depicted the structure of participants' surface and in-depth cognitive levels. Next, we identified the concept network by analysing semantic relationships.

4.4 Analysis of In-Depth Cognitive Levels at The Early Stage of Idea Generation

During the first stage of the analysis, we obtained 201 sorted verbalized thoughts (i.e., nouns, adjectives, adverbs, and verbs) from craftsmen, and 213 sorted verbalized thoughts from designers. At that point, it was difficult to identify the tendency of these expressions (see, Table 4.1).

Table 4.1: Sorted verbalized thoughts (shown in part and in alphabetical order)

Craftsmen (201)	Designers (213)
above, abundant, add, adjust, angle, appear, apple, apply, artistic, asia, attach, ball, bamboo, base, basic, basket, beak, between, big, body, booming, boss, both, box, businessman, buy, buyer, capable, capacity, capital, category, centimeter, ceramic, choose, circle, coating, color, combine, concern, consistent, consumer, contain, container, corner, correspond, cost, count, cover, craftsman, curve, cut, dark, decor, delivery, demand, depend, design, develop, diameter, dice, differ, different, difficult, dimension, duck, easy, economy, edging, egg, end, europe, experience, extraordinary, five, flat, flower, food, form, frame, free, fruits, fulfill, function, gambier, general, glue, good, goods, grape, grip, handle, head, height, heron, high, hobby, idea, ideal, imagine, income, increase, insert, international, joint, leaf, leg, light, living, local, long, loose, made, main, make, mark, ...etc.	accommodate, according, added, aesthetic, age, appeal, appear, apple, apply, appreciate, artificial, attention, attractive, available, bamboo, banana, base, basket, big, bowl, box, bread, break, buy, ceramic, chance, character, children, clean, clear, coating, coiling,color, combine, commercial, community, concern, consider, contain, container, conventional, craft, craftsman, create, crowd, crush, culture, curve, cute, cutlery, damage, decorate, delicious, design, develop, different, dignity, direct, display, distinct, durian, dust, dye, easy, eat, environment, everyday, example, expensive, experience, explore, extraordinary, facilitate, factor, first, frame, fresh, fruits, function, general, grape, habit, hand, hang, hoe, hygiene, idea, identical, imagination, imagine, immediate, impressive, inform, inside, instance, interaction, interesting, invite,.... etc.

The sorted verbal data was transferred onto a vector graph (concept network structures), based on the generated calculated weights of the detected stimulus words. The vector graph was used to display Out Degree Centrality Scores (hereafter, 'ODC'), which indicate the number of connections one node possesses with other nodes [107]. The centrality of the ODC scores detected all nodes that demonstrated the number of associated words connected with stimulus words (see, Figure 4.1).

$$A = (a_{ij})$$

$$\begin{bmatrix} a_{11} & \cdots & a_{1j} & \cdots & a_{1n} \\ \vdots & & \vdots & & \vdots \\ a_{i1} & \cdots & a_{ij} & \cdots & a_{in} \\ \vdots & & \vdots & & \vdots \\ a_{n1} & \cdots & a_{nj} & \cdots & a_{nn} \end{bmatrix} \qquad a_{ij} = \begin{bmatrix} \text{associative word rate} & i \to j & \text{In} \\ 0 & i \to j & \text{None} \end{bmatrix}$$

$$\text{Out - degree centrality} : D_i = \frac{\sum_{i=1}^{n} a_{ij}}{n-1} \quad (\text{Note} : n \text{ is the number of nodes})$$

Further, all generated associative words were visualized as graphs of the conceptual network (see, Figure 4.3). Craftsmen generated 2991 nodes/vertices (associative words) and designers generated 2760 nodes/vertices (associative words).

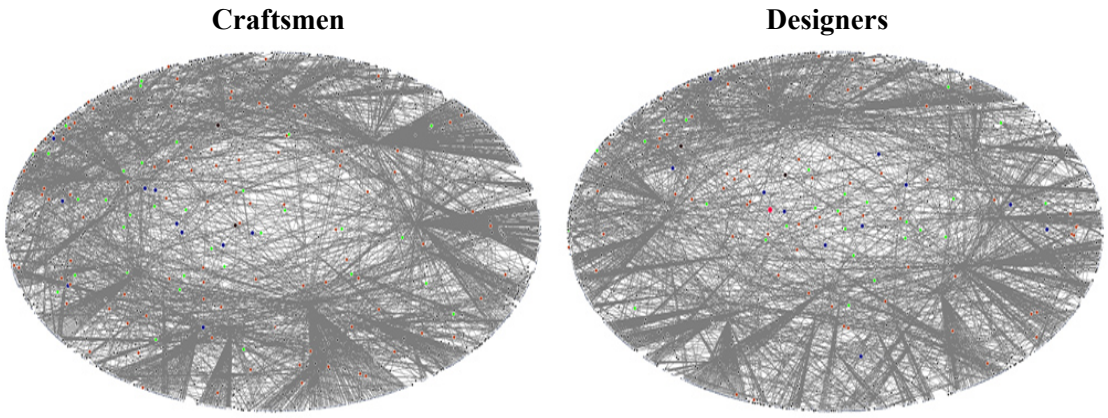


Figure 4.3: Craftsmen's and designers' associative concept networks (prior to simplification).

Because the generated networks were too dense, it was necessary to simplify the created networks by the use of a reduction method. Systematic reduction was based on the consideration that not all words extracted from verbalized protocols contributed to in-depth cognitive levels. Surface-level cognition was overemphasized. Application of this simplified concept reduced the number of words with low number connections in the networks so that extraction of associative concepts located within in-depth cognitive levels were perceivable (see, Figures 4.4 and 4.5). This reduction deleted more than 50% of words that received lower ODC scores and resulted in the creation of an observable network diameter [108]. The reduction was applied independently to each group. Ultimately, craftsmen generated 278 associative words and designers generated 140 associative words.

A T-test was applied to determine whether the *two data sets* (craftsmen's and designers' associative concept networks) statistically differed from each other. We discovered that both datasets were statistically different. The absolute value of the t-Stat was greater than t and the critical two-tail

and the probability revealed that the null hypothesis were smaller than alpha. $t=t_{5741} = 3,494$; P-value .0002 < .05; therefore, we rejected Ho. Thus, a significant statistical difference existed between craftsmen's and designers' associative concept networks.

Table 4.2: T-test: Two-Sample Assuming Unequal Variances

	Craftsmen	**Design Trainers**
Mean	0,008793412	0,008287308
Variance	3,14298E-05	2,88755E-05
Observations	2991	2760
Hypothesized Mean Difference	0	
df	5741	
t Stat	**3,494923012**	
P(T<=t) one-tail	**0,00023889**	
t Critical one-tail	1,645119089	
P(T<=t) two-tail	0,00047778	
t Critical two-tail	1,960377232	

4.4.1 Craftsmen's associative concept network

Table 4.4 reveals that the craftsmen's highest score for ODC was 0.0530 with a total of two words. If we consider the range from 0.0500 up to 0.1000 as a representation of highly weighted associative words located within in-depth cognitive levels, we can see that craftsmen generated only two associative words, or 0.7% of the total number of associative words (indicated by a red-dotted square). These highly weighted associative words exemplified their in-depth cognitive levels during imaginative approaches (see, Figure 4.4).

Table 4.3: Distribution of Craftsmen's ODC scores

Craftsmen				
No.	**Range**	**ODC Scores**	**(n)**	**Associative Words**
1	**≤ 0.1000**	**-**	**-**	**-**
2	**≤ 0.0900**	**-**	**-**	**-**
3	**≤ 0.0800**	**-**	-	-
4	**≤ 0.0700**	**-**	-	-
5	**≤ 0.0600**	**0.0530**	**2**	**clothes, shape**
6	≤ 0.05000	0.0454	10	body, common, curve, grow, line, product, stereo, etc.
7	≤ 0.0400	0.0378	33	bond, chest, cloth, corner, creation, creativity, etc.
8	≤ 0.0300	0.0303	101	advertisement, alike, amount, attitude, bag, basket, etc.
9	≤ 0.0200	-	-	-
10	≤ 0.0100	-	-	-
11	0.0000	0.0000	132	add, apple, angle, artistic, asia, ball, bamboo, base, etc
Total			278	

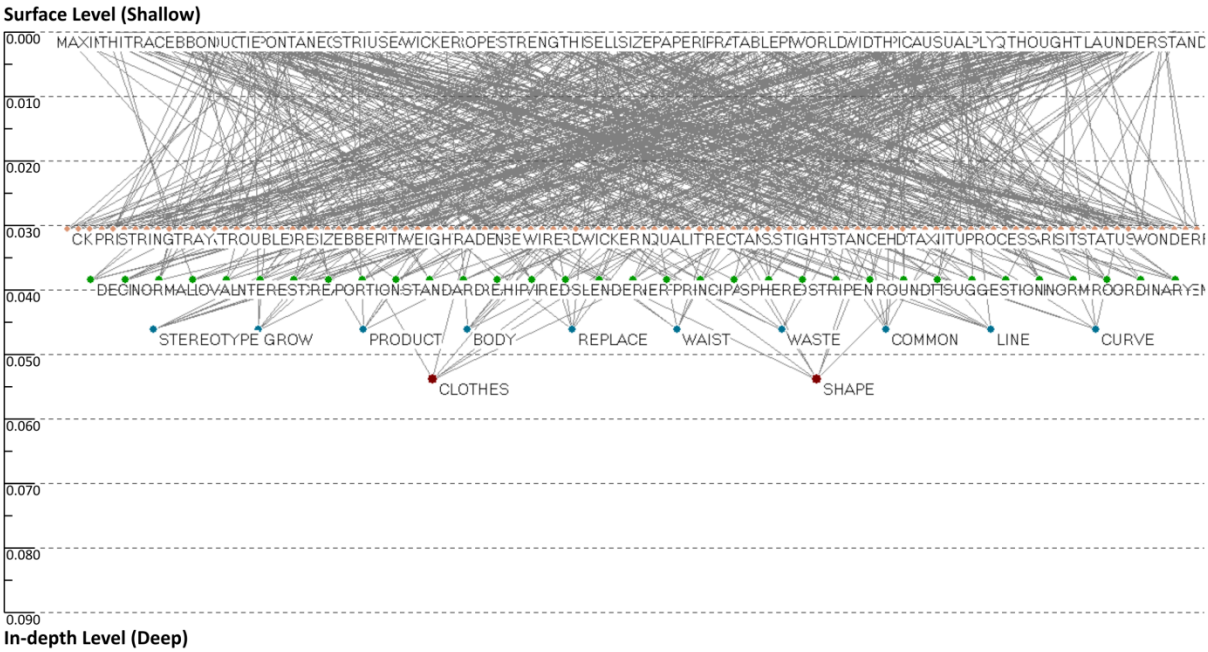


Figure 4.4: Craftsmen's associative concept networks.

4.4.2 Designers' associative concept network

Table 4.4 reveals that the designers' highest score for ODC was 0.0900 with a total of one word. If we consider the range between 0.0500 and 0.1000 as a representation of highly weighted associative words, then we can see that designers generated 40 associative words, or 28.6% of the total number of associative words. This means that designers generated deeper in-depth cognitive levels during their imaginative approaches in comparison to Craftsmen's in-depth cognitive levels (see, Figures 4.4 and 4.5).

Table 4.4: Distribution of Designers' ODC scores.

Designers				
No.	**Range**	**ODC Scores**	**(n)**	**Associative Words**
1	**≤ 0.1000**	**-**	**-**	**-**
2	**≤ 0.0900**	**0.0900**	**1**	**silverware**
3	**≤ 0.0800**	**-**	**-**	**-**
4	**≤ 0.0700**	**0.0700**	**2**	**fruit, tupperware**
5	**≤ 0.0600**	**0.0600**	**11**	**Chisel, common, custom, dish, dishes, focus, fresh, etc.**
6	**≤ 0.05000**	**0.0500**	**26**	**Basket, booth, carrot, cloth, clothes, creativity, etc.**
7	≤ 0.0400	-	-	-
8	≤ 0.0300	-	-	-
9	≤ 0.0200	-	-	-
10	≤ 0.0100	-	-	-
11	0.0000	0.0000	100	apple, attention, bamboo, banana, basket, big, bowl, etc
Total			140	

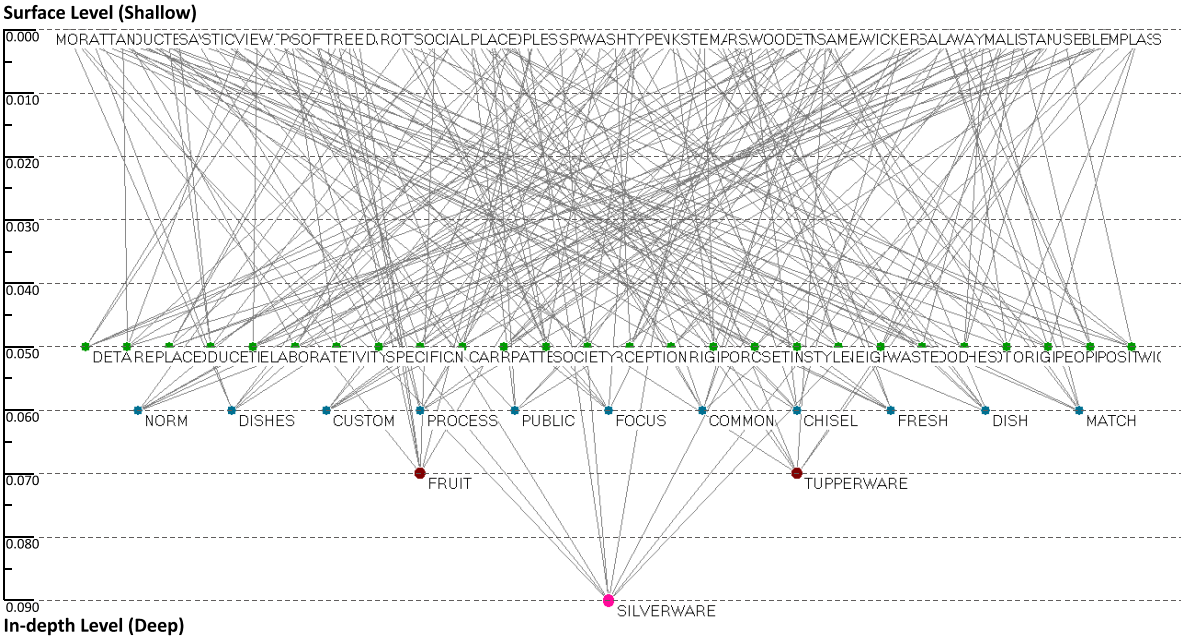


Figure 4.5: Designers' associative concept networks.

4.5 Comparison of the Associated Concepts

Figure 4.6 displays an image overlay that demonstrates the differences that existed between craftsmen's and designers' associative concept networks. The graph was organized in the Y-axis direction. The craftsmen's graph (red) has been placed over the designers' graph (grey). This overlay graph reveals that most of the associated words inhabited the surface level within the score category of 0.000. This surface cognitive level consisted of closely associated words or explicit words extracted from verbalized thoughts. The high score indicated that some nodes had more connections with other nodes that contained remotely associative words (polysemous). Thus, Figure 4.6 clearly depicts the significant differences that existed between the craftsmen's and designers in-depth cognitive levels. Craftsmen's highly weighted associative words were focused on technical or operationally related issues that resided on the designers' lower layer (i.e. the layer that was focused on presence of surroundings issues).

Table 4.5: Generated associative words following reduction (shown in part, ordered by the highest ODC scores, bolded words represent in-depth cognitive levels).

278 generated associative words	**140 generated associative words**
Craftsmen	**Designers**
clothes, shape, body, common, curve, grow, line, product, replace, stereotype, waist, waste, around, balloon, basic, bond, chest, cloth, corner, creation, creativity, decision, fresh, growth, hip, idea, interest, intestine, length, norm, normal, ordinary, oval, pattern, population, portion, principal, reduce, round, sample, slender, sphere, standard, stripe, suggestion, advertisement, alike, amount, attitude, bag, basket,..... etc.	**silverware, fruit, tupperware, chisel, common, custom, dish, dishes, focus, fresh, match, norm, process, public, basket, booth, carrot, cloth, clothes, creativity, destroy, detail, elaborate, neighbourhood, original, originate, pattern, people, perception, plan, porcelain, position, produce, replace, set, society, specific, style, waste, wicker,** apple, attention, bamboo, banana, basket, big, bowl, box, bread, break, buy,..... etc.

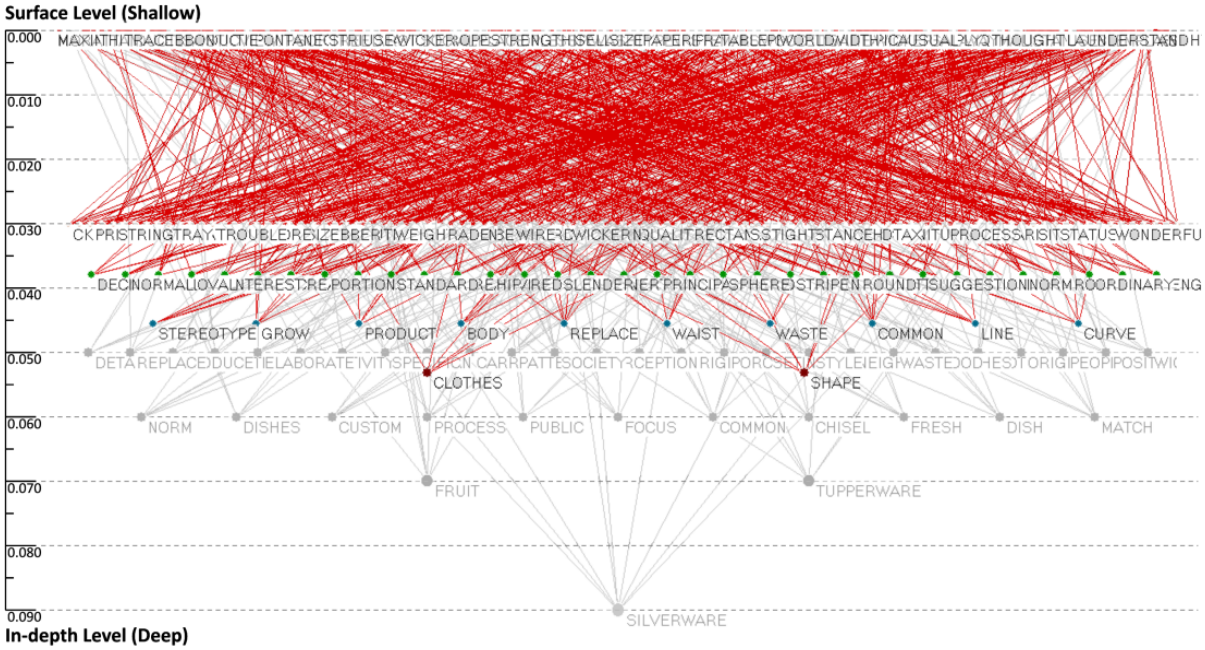


Figure 4.6: Overlay of Craftsmen's and designers' associative concept networks.

4.5.1 Identification of the characteristics of associative concepts

Until this stage, data extraction based on associative networks revealed that craftsmen generated 0.7% words at the in-depth cognitive levels. Designers generated 28.6% words. This is a significant difference. To detect the distribution and tendency of these associative words, we initially identified craftsmen's and designers' collected generated associative words based on their qualitative characteristics. We discovered that *Scene, Appeal, Operation,* and *Shape* were the most closely identified characteristics of a number of selected words at the in-depth cognitive levels (see, Table 4.6). These characteristics are listed below:

Scene: A word that corresponded to the presence of surroundings (i.e. object, nature, customs, etc.);
Appeal: A word that corresponded to the serving, preparation, or presentation (i.e. juice, style, etc.);
Operation: A word that corresponded to processing, or other physical activity (i.e. reduce, bond, etc.);
Shape: A word that corresponded to physical elements or units of measurement, (i.e. line, body, etc.).

Further, we intended that these identified characteristics would serve as variables that would be analysed in the factor analysis we would perform to obtain semantic relationships. The identified characteristics of craftsmen's and designers' associative concepts were selected on a proportional basis: 28 words were selected from the words collected for each group (10% of craftsmen's highly weighted associative concept/words; 20% of designers' highly weighted associative concept/words). A total of 56 words were selected out of 418 generated words. We decided to identify only highly weighted associated concepts/words to obtain characteristics (S*cene, Appeal, Operation, and Shape*). The range of highly weighted associated words had OCD scores of approximately 0.0500 or higher.

Table 4.6: Identified characteristics of associative concepts.

List of identified characteristics
(Scene) silverware, tupperware, basket, bowl, tray, dishes, norm, public, booth, etc. etc.
(Appeal) fresh, mint, cooked, rotten, food, raw, protein, dish, carrot, set, apple, etc.
(Operation) replace, bond, reduce, process, elaborate, produce, break, clean, etc.
(Shape) shape, body, curve, waist, length, big, long, part, small, etc**.**

4.5.2 Analysis of semantic relationships

We distributed 56 associative words that corresponded to the identified characteristics of associative conceptual structures. ODC scores ranged between the highest to the low (see, Table 4.6). The identified characteristics consisted of *scene*, *appeal*, *operation*, and *shape.* We used these four variables in our factor analysis. Furthermore, the correlation among variables was extracted into two factors. The KMO score of 0.502 was appropriate. The factor matrix and corresponding names are listed in Tables 4.7 and 4.8.

Table 4.7: Rotated factor matrix.

Adjectives (+)	Adjectives (-)	F1	F2
Appeal	Less Scene	,924	,260
Scene	Less Companion	,922	,004
Operation	Less Operation	,287	,905
Shape	Less Shape	-,637	,666
Eigenvalue (After rot):		2,19	1,33
KMO:			,502

Table 4.8: Corresponding factor name.

Factor	Adjectives	Eigenvalue	Factor Name
F1	Appeal, Scene	2,19	SURROUNDINGS
F2	Operation, Shape	1,33	OBJECT-ORIENTED

For Factor 1, *Appeal and Scene (*hereafter referred to as '*Surroundings')* were associated with the presence of the fruit basket/container. For Factor 2, *Operation and Shape (*hereafter referred to as '*Object-Oriented')* were associated with technical aspects of the fruit basket/container. Furthermore, factors were displayed on an orthogonal map to investigate the semantic relationships that existed between the identified characteristics of craftsmen's and designers' associative concepts (see, Figure 4.7).

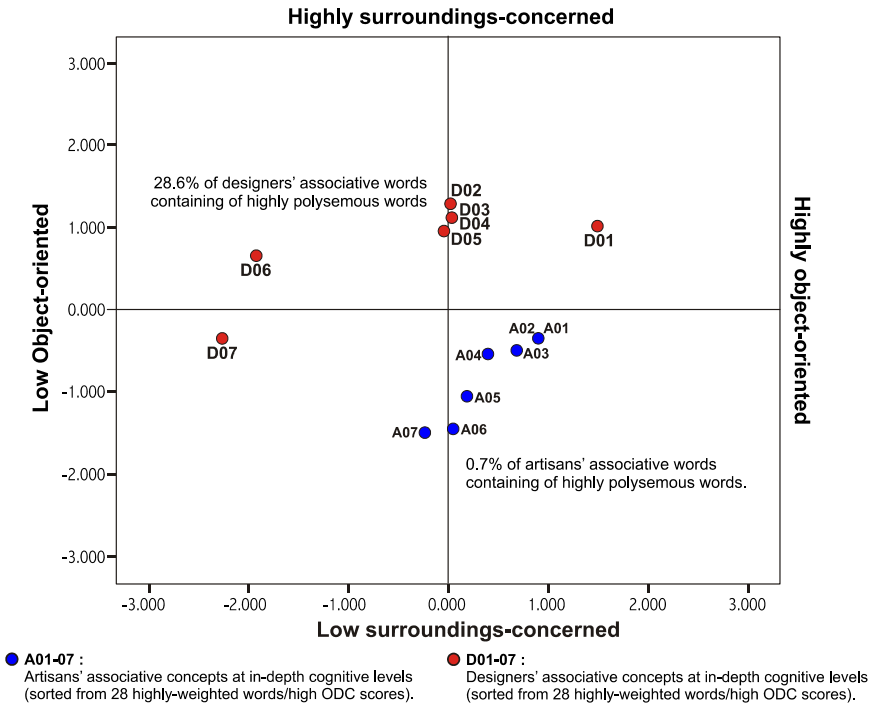


Figure 4.7: Semantic relationships map.

The semantic map displays craftsmen's in-depth cognitive levels related to *Operation* and *Shape* issues, as they were positioned on the positive *Object-Oriented* factor. Their position was significantly negative on the *Surroundings* factor. In contrast, designers' in-depth cognitive levels related to *Appeal* and the presence of scenery, displayed a positive *Surroundings* factor. In comparison with the associative network analysis, this indicated that craftsmen's in-depth cognitive levels during imaginative approaches tended to narrow. They were closely associated with physical appearance, as indicated by the stimulus words. In addition, designers' imaginative approaches revealed broader perspectives. Yet, the stimulus words were remotely associated with the current object (see, Fig. 4.8).

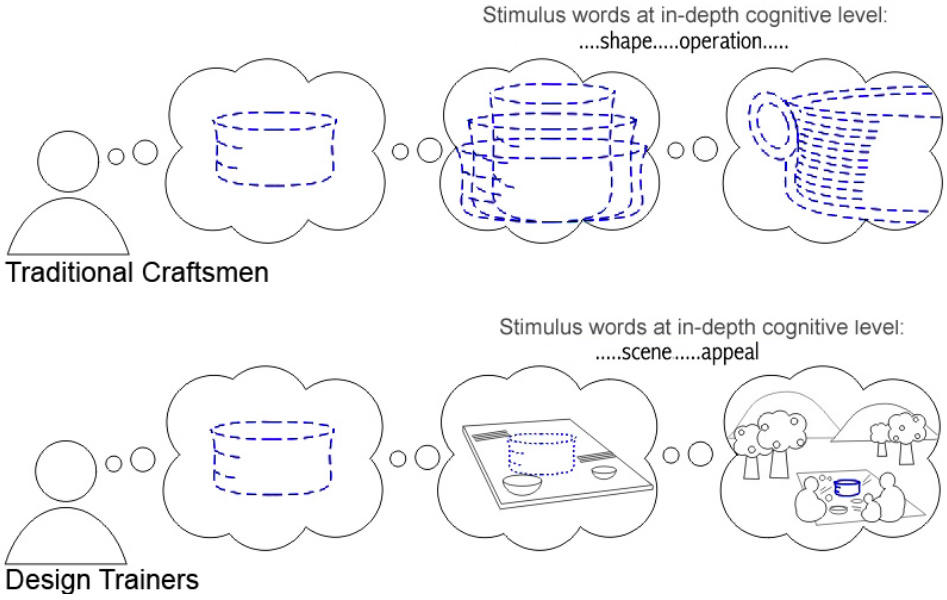


Figure 4.8: Craftsmen's and designers' imaginative approaches.

4.6 Cognitive Fixedness at In-depth Cognitive Levels of Traditional Craftsman

Based on the identified extracted words revealed by the concept network analysis, we observed that craftsmen tended to focus more intently on the appearance and technical aspects of the fruit basket/container. They observed features such as shape, body, curve, waist, length, reduce, replace, and so on. We categorized these features as characteristics of *Operation* and *Shape.* The results also revealed that designers tended to placed greater focus on the presence of the fruit basket/container. They offered the following associated words: silverware, Tupperware, dish, norm, public, booth, fresh, match, carrot, apple, and so on. We identified these features as characteristics of *Scene* and *Appeal*. These results were confirmed by Tables 4.3 and 4.4. We categorized approximately 10% of craftsmen's highly weighted associative concept/words as low *Object-Oriented.* We categorized 20% of designers' highly weighted associative concept/words as highly *Surroundings*-concerned. Our results revealed that craftsmen generated 0.7% words at in-depth cognitive levels. In contrast, we discovered that designers generated 28.6% deeper in-depth levels of cognition during their imaginative approaches (0.0500–0.1000 ODC range).

As demonstrated by the highest ODC score achieved at the in-depth cognitive levels that corresponded to remote association, we discovered that designers tended to use more highly weighted associative concepts (polysemous words). We relied on the Associative Gradient Theory to explore these results. This theory suggests that more closely associated or 'stereotypical' representations may lead to reduced creativity. Thus, if craftsmen and designers make greater numbers of associations, then they have a greater probability of achieving creative solutions, because remote associations (i.e. highly weighted associative concepts) are best suited for the creation of these solutions [35, 36, 37, 8]. Yamamoto et al. (2009) argued that the polysemy of a design idea could be significantly correlated with its originality. Therefore, we believe that designers' in-depth cognitive levels have greater probability of achieving creative solutions [59].

Based on our findings, we suggest that the roles of closely and remotely associated concepts at the in-depth cognitive levels during the early stage of idea generation differ for craftsmen and designers during their observations and definitions of design problems. craftsmen's in-depth cognitive levels have fewer polysemous features. Therefore, they tend to express concerns related to more tangible issues, such as *Shape* and *Operation*. In comparison, designers' in-depth cognitive levels possess more polysemous features. For this reason, they may express concerns related to intangible issues, such as users' affective preferences (i.e. *Scene* and *Appeal*). The semantic relationship map confirms that craftsmen tended to focus on the artefact's physical properties, rather than on the surroundings or on users' affective preferences. In contrast, designers paid significantly more attention to issues related to the artefact's presence and less attention to its physical properties.

Most traditional craftsmen who reside in villages in developing countries possess limited formal education. Poor economic condition within the rural area has likely shaped their attitude towards mastering technical skills rather than taking a formal education that usually takes a long time to complete. Generally, most craftsmen dropped out of primary education, and seriously turned to learn and acquire traditional craftsmanship to make quick money to their family. For years, the craftsmen have devoted their entire life to mastering the craft. This seems to be one of the factor that shaping their viewpoint mainly focused on technical issue and production chain such as, time, performance, quantity, object property, accuracy, delivery, and so forth.

The other factor that greatly shaping craftsmen's conservative viewpoint is the uniqueness of rural ecology as part of their culture [109]. In the rural communities, there are strong ties between livelihood and nature. Rural people feel blessed with their surrounding natural vegetation that provide

daily resources. The rich natural vegetation creates a romance about an ideal livelihood. The welfare of village communities is tied up by the tranquillity and prosperity of the surrounding nature. Therefore, during the experiment to imagine designing a fruit bowl, we discovered that the Craftsmen's stereotypical' representations of an ideal fruit bowl was a romanticism of a prosperous surrounding vegetation. An ideal design of a fruit bowl was then associated with a sincere gratitude to the Mother Nature. Some of Craftsmen's verbalized thoughts arised from day-to-day events they familiar of: things they hear, things they deal with, and so forth. The Craftsmen's conceptual process naturally involves a sense of gratitude towards nature as an integral part of their life and the objects they create. As demonstrated by their verbalized thoughts, such as material, nature, duck, leaves, fruit, and so forth. On the contrary, designers' viewpoint of an ideal fruit bowl design was highly associated to the future occurrences (e.g. users, appeal, appetizing).

4.7 Findings

To effectively develop effective methods to enhance craftsmen's creativity, we must evaluate the contents and methods used in design training programs, because the use of typical or widely accepted design methods may lead to less than satisfactory results. These efforts may fail to address the real problem, even if we modify the design object to make it easily understandable to craftsmen during training. Our study demonstrated that associative concept at in-depth cognitive level of craftsmen placed greater focus on product appearance and technical aspects, such as operation and shape. In contrast, designers paid greater attention to the presence of issues related to surroundings, such as scene and appeal. These results demonstrate that closely or remotely associated concepts correlate with shallow or in-depth cognitive levels based on creative solutions.

We believe these difficulties occurred because, during the design training program, requests were made that the craftsmen focus solely on the *Object* (i.e. the designed artefact). In fact, the systematic instructional materials required this type of focus. When the designers provided clear instructions about the potential design of an intended object during the training, they caused craftsmen to enter a *status quo* mental state. In this mental state, craftsmen's perceptual sets were tied to their tendency to make quick decisions and jump to familiar conclusions. The craftsmen were not asked to become flexible and discover alternatives. They were given clear guidelines to develop a craft object (a fruit basket/container). These guidelines were intended to enhance their creative processes. However, the guidelines failed to inspire the craftsmen to observe and explore in different, creative ways. Hence, designers must understand that craftsmen tend to execute these processes based on the heuristics required. Therefore, we suggest that designers offer looser and rather vague guidelines that may assist craftsmen to adopt broader perspectives. Instead of providing rigid or clear instructions for the design of a completely understandable object (e.g. 'a fruit basket/container'), we suggest that designers offer open-ended and rather vague instructions. For example, they could suggest that craftsmen design an object/artefact that would awaken appetites and inspire fresh feelings in family members.

It might be best that designers refrain from asking craftsmen to design concrete or obvious objects. Instead, they should free craftsmen from this rigid approach by suggesting vague or less-concrete design concepts. If designers permit craftsmen to enjoy experiences that inspire increased imagination, then designers will experience fewer difficulties when they direct craftsmen in the development of more concrete designs. We believe this approach will release craftsmen from perceptual barriers created by their former ways of thinking and responding. Thus, during training, craftsmen may begin to release themselves from their fixations with familiar concepts, including tangible or technical aspects (i.e. operation, shape, and proportion). Ultimately, training in creativity must focus on the enhancement of participants' cognitive resources. The development of teaching

methods based on different characteristics of craftsmen's and designers' imaginative approaches designers may lead to increased creativity.

It is challenging to describe the nature of the creative cognition that inspire craftsmen's and designers' conceptual design processes. This research examined the differences that existed between in-depth cognitive levels discovered in craftsmen and designers' imaginative approaches. Further, with additional development, these findings may serve as reference tools for the co-creation of educational programs (design training programs) aimed at the enhancement and development of craftsmen's creative cognition. Some scholars believe that creativity must be taught by instruction and training. However, we must not think that the imaginative approach that might release craftsmen from perceptual barriers in their ways of thinking can be developed instantaneously. Thus, we must strive to develop teaching methods that will enhance trainees' (craftsmen) creative cognitive abilities. We hope that this type of training will exert positive effects on their creative cognition. If this type of training is employed, rather than just thinking about beauty or attractive shapes, craftsmen will begin think more flexibly, broadly, and unconventionally. In the future, we hope to extend our research and apply this new approach to the development of an innovative design training program. We will observe the ways that trainees' creative cognition might be affected by the imaginative approach and measure the results of our observations.

In short, when imagine designing a fruit bowl, craftsmen's associative concept placed greater focus on product appearance and technical aspects, such as operation (i.e., replace, reduce, etc.) and shape (i.e., waist, body, etc.). In contrast, design trainers' associative concepts paid greater attention to the presence of issues related to surroundings, such as scene (silverware, norm, etc.) and appeal (fresh, dish, etc.). This study demonstrated that design trainers tended to use more remotely associated concepts (polysemous words) that have greater probability of achieving unconventional ways of thinking. While, traditional craftsmen tended to use more closely associated concepts that represent a narrow commitment to a particular issues they familiar with (cognitive fixedness in technical and object property).

Chapter 5
Overcoming Cognitive Fixedness

5.1 An Experiment to Challenge Conservatism to Extreme Levels

In today's technologically-driven and fast-changing environment, it appears that traditional knowledge or native know-how intrinsic to complex social systems have become increasingly unfamiliar to most of us [110]. In fact, some scholars have long alleged that creativity had its origin in native know-how. Four thousand years ago, early humans imagined what finished implements might look like as they knapped finely-wrought stone tools [111]. These primeval motivations are a part of the creative process that has long been integrated into humanity's existence since the early days when ancient craftsmanship began.

A traditional craftsman or master craftsperson is a current example of an individual who engages in art and employs native know-how during acts of creativity. Our case study observed traditional wooden sandal craftsmen who reside in a developing country. Traditional craftsmen nurture their knowledge in ways that makes them appear conservative in their approaches to production novelties, as well as product concepts [112]. Craftsmen are often recognized for their traditional viewpoints that may be structured by prior knowledge and typical features contained in familiar categories [112]. Numerous studies have affirmed that reliance on past experience is a type of cognitive fixedness in which an individual remains stuck with one perspective and struggles to find new alternatives [113]. Recent research focused on the differences that exist between the in-depth cognitive levels of craftsmen and designers has revealed that craftsmen tend to capture operational and object attributes, rather than the presence and surroundings of objects [114]. At the same time, this symbolic domain offers craftsmen the chance to become empowered. Many creative people believe that craftsmen's works have high development potential [115]. How can we actually challenge a culture's symbolic domain so we can *"make the familiar strange"* [3, 25]. Another term is, expressing the communal values (familiarity) concerning what is "good", "useful", "just", and "pleasurable" is the ultimate role of design field to craftsmen [116]. In a study on an extensive experience of craft promotion in developing countries, Suzuki (2005) concluded that design trainers miss the notion to interpret living environment and culture indigenous to be valued in design improvement [16]. Conventionality is a typical traditional viewpoint that always becomes main issue for creativity. The term denotes the quality of being governed by custom or a subject to the control of social agreements [100]. In a certain extent, one must be conventional or conservative to be creative, because creativity is the process by

which a symbolic domain in the culture is changed. Being only conventional leaves the domain unchanged, at the same time, taking too many chances of creativity is not necessarily meaningful. Therefore, mastering a symbolic domain means to learn its rules of unconventionality [39].

5.2 Research Aim

In this design experiment of creating a new design of traditional wooden sandal we aim to overcome the cognitive fixedness. The experiment investigates the potential unfamiliar stimuli of cognitive fixedness that tend to inhibit traditional craftsmen's mindset. Craftsmen are challenged to generate their conservative ideas at extreme level, and furthermore redevelop and utilize the unfamiliar stimuli obtained from extreme levels of cognitive fixedness.

5.3 Research Method

We conducted an experiment in which we offered design training (in-studio design and creativity training). We observed later stages of idea generation as craftsmen developed new ideas for traditional wooden sandals. During the first stage, design trainers challenged craftsmen to generate ideas at extreme levels based on their prior conceptions and knowledge. Craftsmen's conceptual sketches and frequently verbalized thoughts related to unfamiliarity or skepticism were later examined to obtain stimulating keywords. During the second stage, the craftsmen redeveloped previous ideas by employing these stimulating keywords. Finally, the design trainers evaluated transformations that occurred during idea generation (see, Figure 5.1).

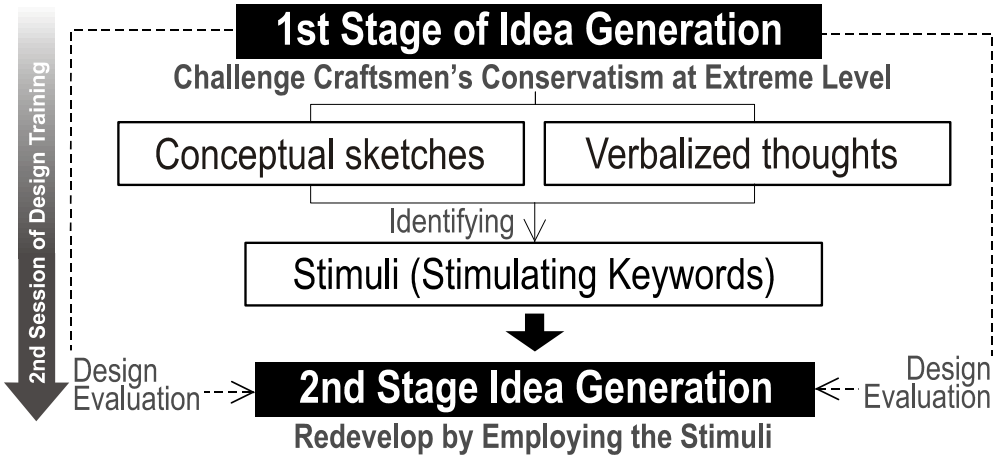


Figure 5.1: Research framework: design training experiment.

5.3.1 Participants

Traditional wooden sandal making industry is one of several potential handcraft industries of Tasikmalaya city, Indonesia. Authorities at all levels were concerned and provided technical assistance and design training to improve skill level and creativity of the local craftsmen.

The subjects consisted of 15 male traditional wooden sandal craftsmen whose ages ranged between 27 to 51 years. They are respected as master craftspeople who possess special skills and artistry. Two designers served as design trainers. They guided this experiment.

5.3.2 Procedure

The experiment was conducted during a 20-day period (eight hours per day). An outline of the procedure and discussion of the second session (Design Exercise*) are provided below:

a. First session: Design Basics lecture:
   - Design Principles (balance, proportion, and so on).
   - Creativity Icebreaker games for habituation. Second session: Design Exercise*

b. Second session: Design Exercise*
   - From preliminary ideas to idea development.

c. Third session: 1:1 workshop prototyping.
   - Foam modeling, upper strap variations, and finishing.

During the second session (Design Exercise*), we employed the followings steps:

1. The first stage of idea generation:
   a. Escalating craftsmen's extreme conservatism.
   b. Identifying unfamiliar stimuli in craftsmen's conceptual sketches and verbalized thoughts.
2. The second stage of idea generation:
   a. Redevelop previous concepts by employing obtained unfamiliar stimuli (Stimulating Keywords).
3. Finally, we evaluated transformations that occurred during idea generation and reviewed potential aspects.

5.4 Analysis on Overcoming Cognitive Fixedness

5.4.1 The first stage of idea generation

We observed several stages of idea generation during an experiment which craftsmen generated ideas for new design of traditional wooden sandal (see, Figure. 5.1). The craftsmen were encouraged to achieve extreme levels to generate their best ideas. They were instructed to generate ideas in their usual manner, but they were asked to generate these ideas as extreme levels. Rather than requesting that they act unconventionally, they were challenged to employ their old ways/conservatism to extreme levels. We observed that they elaborated their prior conceptions and knowledge in designs that contained meticulous curvature forms, complex decorative shapes, and linear, repetitive-patterns (see, Figure 5.2). We realized that the craftsmen believed that these conservative ideas fulfilled fundamental conceptions of appropriate sandal shapes: "continuity" and "appropriateness." A good sandal design must correspond to the requirements of "continuity" and "appropriateness." The sandal's shape must be continuously streamlined and the design must perform well as a finished sandal. However, in contrast, craftsmen's verbalized thoughts revealed their unfamiliar or skeptical feelings generated by their extreme cognitive fixedness. Some examples of craftsmen's expressions of unfamiliar or skeptical feelings include *"seems like it might be so painful to wear," "seems like it might break easily,"* "*it's an odd upside-down sandal."* We omitted less relevant verbalizations, sorted craftsmen's relevant, frequently verbalized thoughts, and transcribed them into English. We designated *"painful," "broken,"* and *"upside-down"* as Stimulating Keywords (unfamiliar stimuli). These terms were associative words that craftsmen produced after reflection. These terms corresponded to their in-depth cognitive levels [1]. Verbalized thoughts with discrepancy to their fundamental comprehension were not taken into consideration. The selection was also based on repeated verbalization performed by 87% of craftsmen.

Our intention was to capture stimuli that activated their prior knowledge and conceptions of

beautiful sandals (rigid belief). A current design of extreme beauty might include a plain hyper-flat shape that is immensely minimalistic. In contrast, the craftsmen believed that a design of extreme beauty would include a super-meticulous, exaggerated shape (see, Figure 5.2).

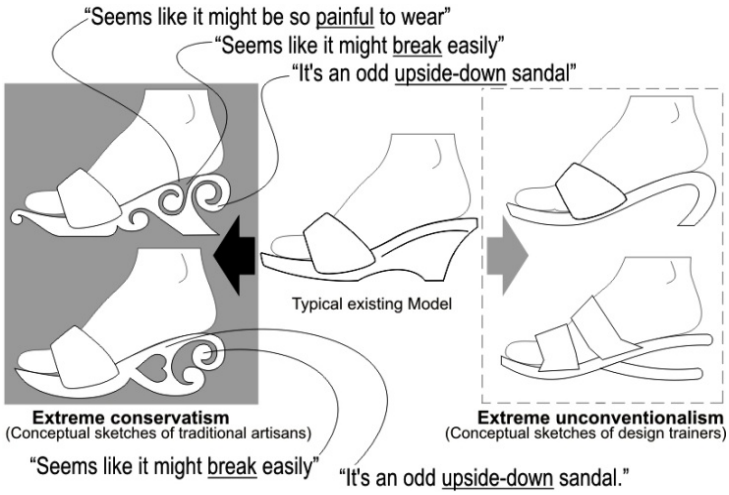


Figure 5.2: Extreme conservatism in idea generation

5.4.2 The second stage of idea generation

Csikszentmihalyi has stated that creativity is the process by which a symbolic domain in the culture is changed [39]. We challenged craftsmen to redevelop their previous ideas (extreme conservatism) by the use of Stimulating Keywords: *"painful," "broken,"* and *"upside-down."* During the second stage of idea generation, craftsmen tended to maintain a moderately fundamental comprehension of sandal ("continuity" and "appropriateness"). Although they still felt awkward, at the same time, they did not express reluctance or rejection. In all likelihood, the stimuli (*"painful," "broken,"* and *"upside-down"*) were derived from their unconscious minds. Thus, they were willing to experiment. Their search for the beauty in *"painful," "broken,"* and *"upside-down"* released them from their strict fundamental comprehension of "continuity" and "appropriateness."

Interestingly, the stimuli, *painful*, *broken,* and *upside-down,* did not match their fundamental knowledge and conceptions of sandals related to criteria, "continuity" and "appropriateness." During the second stage, the craftsmen redeveloped previous ideas by employing stimulating keywords. Finally, design trainers evaluated transformations that occurred during idea generation. The experiment demonstrated that the ability to capture and utilize stimuli during extreme levels of cognitive fixedness might lead to unconventional ways of thinking (see, Figure 5.3).

5.4.3 Evaluation of the experiment

Craftsmen's conceptual sketches during the first stage revealed that they had taken a completely different direction. The features of extreme conservatism were complex-decorative. In contrast, the features of extreme unconventionalism were minimum-attribute. However, during the second stage of idea generation, evaluations by design trainers revealed that craftsmen's conceptual sketches had become increasingly unconventional. They yielded some potential accents that looked promising for realization. The craftsmen became a bit more flexible in heel size composition, direction, and orientation. In fact, they did not become awkward as they deformed the basic structure of the sandal (see, Figure 5.3 and 5.4).

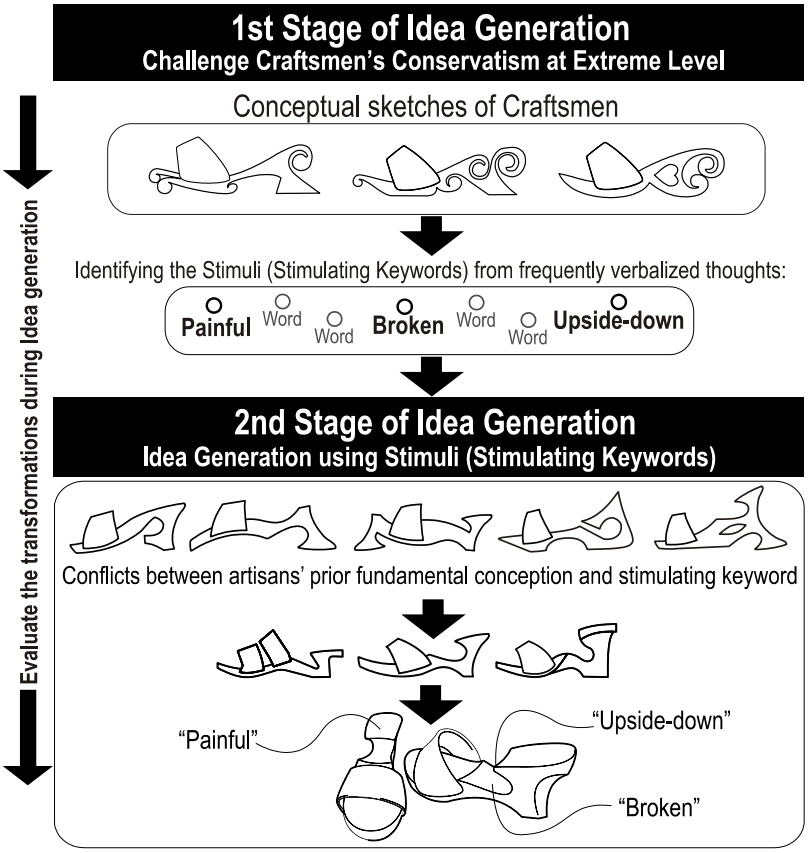


Figure 5.3: Design Experiments.

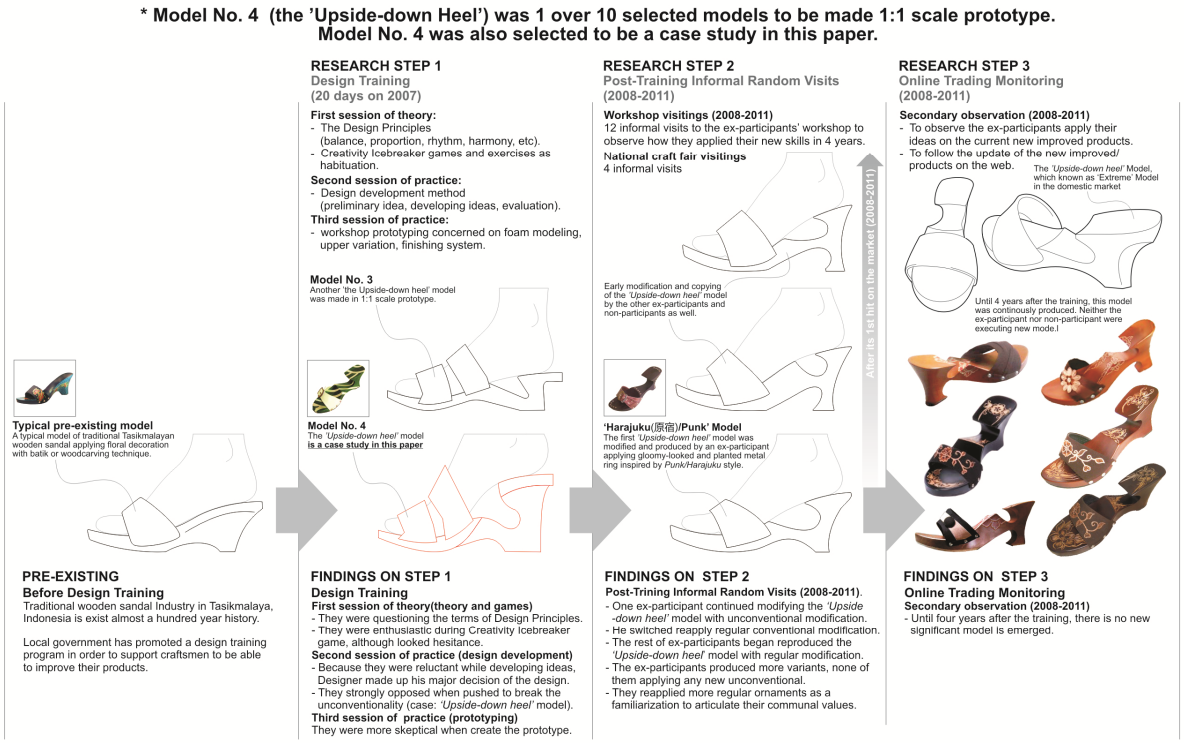


Figure 5.4: Transformation that occurred during 2nd later stage of idea generation.

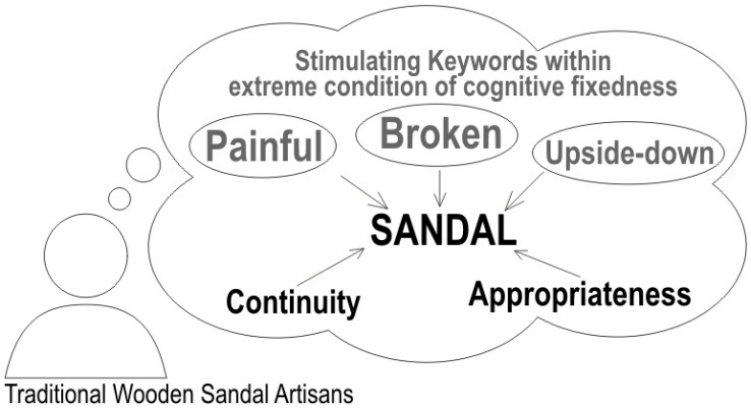


Figure 5.5: The conflict that exists between fundamental comprehension (cognitive fixedness and unfamiliar stimuli contained in extreme levels of cognitive fixedness

Finally, we realized that craftsmen apparently were motivated to transform their fundamental comprehension when they engaged in extreme levels of conservatism. They were motivated to become flexible in the face of fundamental comprehension (see, Figure 5.5 & 5.6). This conflict was confirmed in their frequently verbalized thoughts that employed the opposite terms of fundamental comprehension. During the second stage of idea generation, they were introduced to their own unfamiliar stimuli that were obtained during their exposure to extreme levels of conservatism. They became more spontaneous and allowed ideas to flow that modified their fundamental comprehensions (cognitive fixedness) of "continuity" and "appropriateness." Ultimately, this experiment demonstrated that, in all likelihood, when craftsmen's conservatism is pushed to extreme levels, they will become more unconventional during their creative activities (see, Figures 5.7).

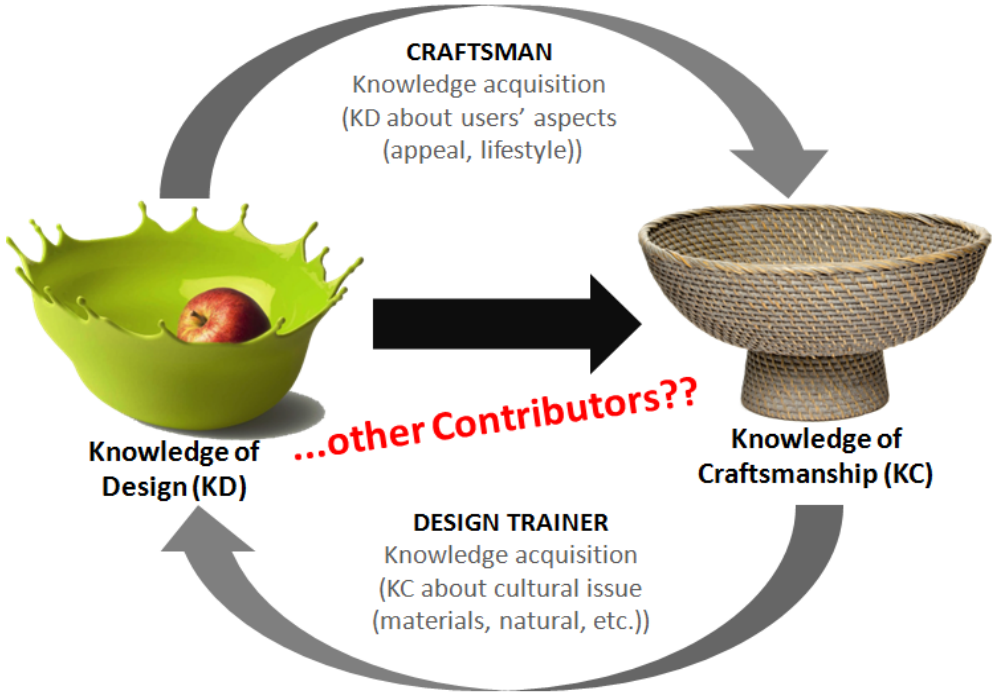


Figure 5.6: Design trainer-craftsman's inter-domain knowledge transfer require more contributors to successfully creating shared value (Image on the left-hand side is copyrighted of Niels Römer, image on the right-hand side is the copyrighted property of their respective owners)

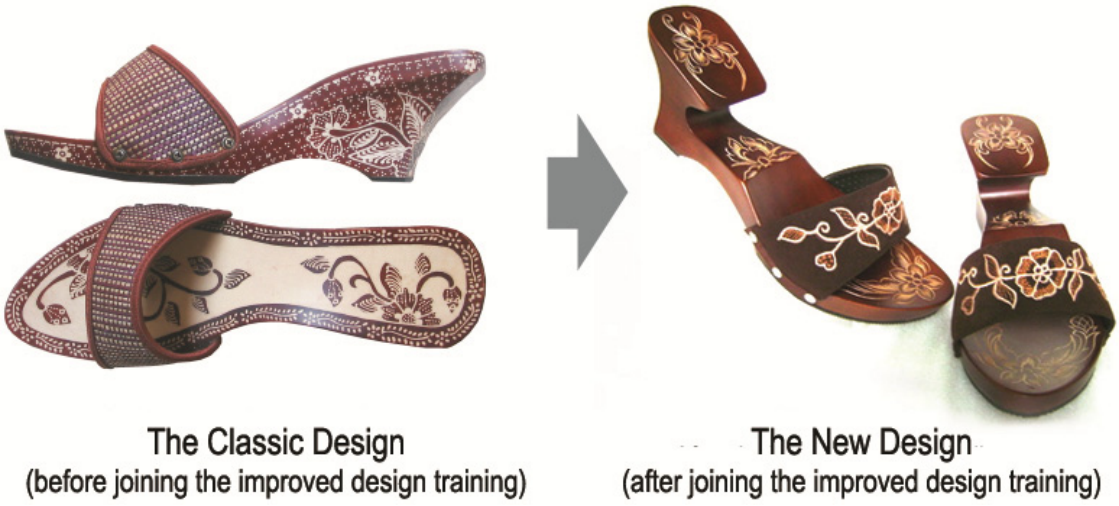


Figure 5.7: Before and after

5.5 Findings

This study makes substantial contributions to our understanding of the ways that unfamiliar stimuli can inhibit or encourage craftsmen's cognitive fixedness. Conservative craftsmen who gain the ability to capture and utilize these unfamiliar stimuli may develop increasingly unconventional ways of thinking. Craftsmen have traditionally learned craftsmanship through apprenticeships in which they acquire ancient creative know-how. We suspected that this ancient know-how contains certain unfamiliar stimuli that become activated during creative cognition is stimulated. They continue to cause inhibition deep within traditional craftsmen's minds.

The experiment demonstrated that the ability to capture and utilize unfamiliar stimuli (i.e., broken shape, painful shape, upside-down shape) during extreme levels of cognitive fixedness may lead to unconventional ways of thinking. Ultimately, this experiment demonstrated that, in all likelihood, when craftsmen' conservatism is pushed to extreme levels, they will become more unconventional during their creative activities and able to overcoming the cognitive fixedness. Ethnographers have stated that native know-how is often collectively referred to as the accumulated cognitive and perceptive experiences of interactions that occur among a group of people [110]. However, contributions is required to create circumstances that challenge cognitive fixedness. Contributors, such as, designers, users, consumers and others would help to push them to enter extreme levels of their prior knowledge. Therefore, a model is necessary to create circumstances that allow empowering cognitive fixedness happen. The empowered cognitive fixedness is facilitated with improved model of design training and this disallow to occur in the previous model of design training (see, Figure 5.8).
The differences with the previous design training are as follow:

The previous model of design training:

- One-sided knowledge-transfer (pressure to be unconventional).
- Giving more attention to problem-driven.
- Depending on the program and the presence of the designer.

The new proposed model of design training:

- Both-sided knowledge transfer (carried out with their custom, habit or belief)
- Bringing dialectical belief
- Involving broad knowledge contributors.

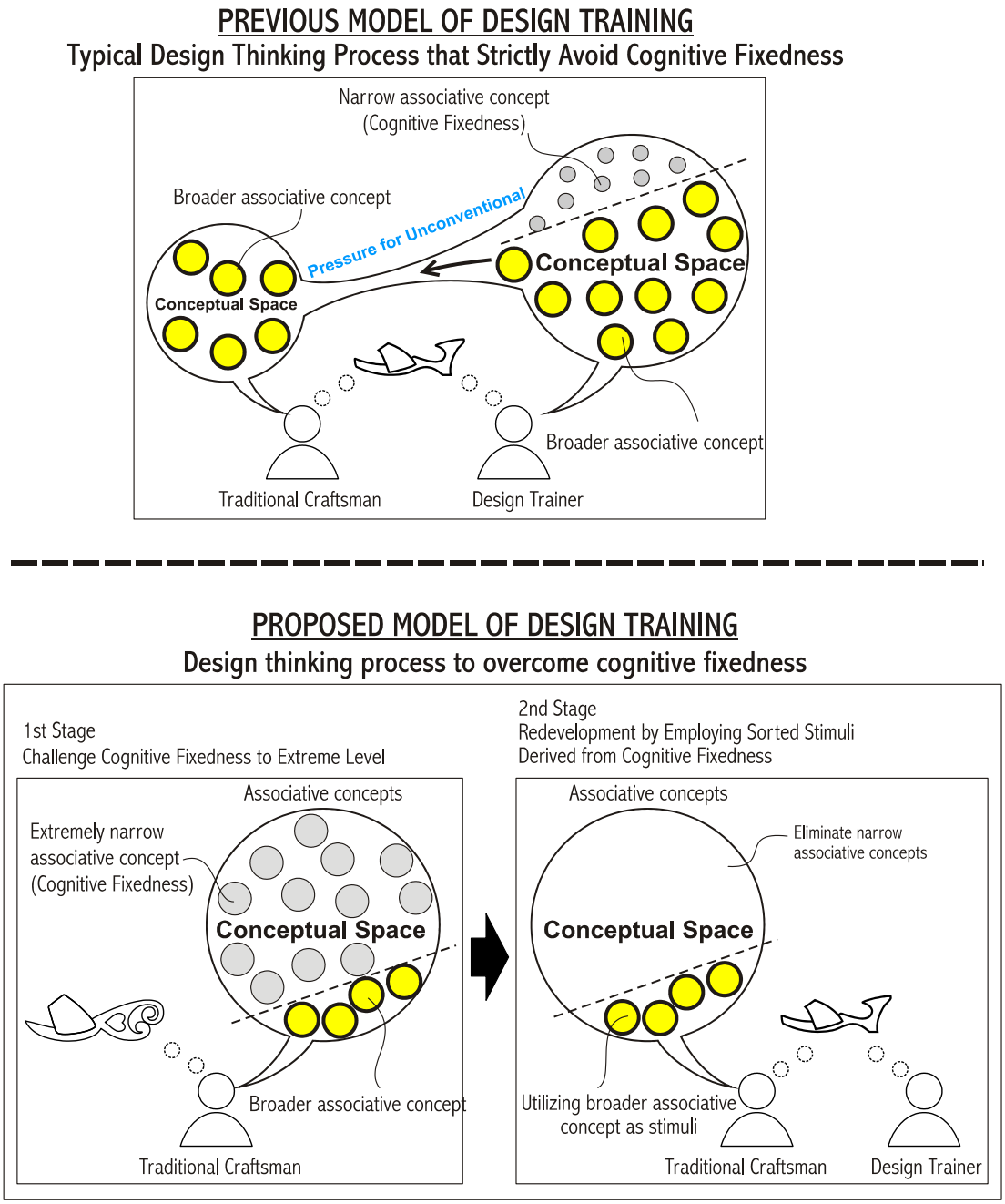


Figure 5.8: The comparison between previous model and the proposed improved design training.

The 'upside-down wooden sandal' gains its popularity in the domestic market and massively copied among local wooden sandal craftsmen. Pictures aboved are found on many websites for local market under local name *'kelom ekstrim'* as the evidence of the succes of the proposed improved model of design training (see, Figure 5.9)

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Figure 5.9: The evidence of the success of the program (The ‘upside-down wooden sandal’ under local name ‘kelom ekstrim’ gains popularity in the domestic market and massively copied among local wooden sandal craftsmen) (All images are the copyrighted property of their respective owners)

Figure 5.10: Recent coming products of the post-training that showing more radical of product development done by the craftsmen (All images are the copyrighted property of their respective owners)

Chapter 6

Discussion for the Improvement Model of Design Training

6.1 Evaluation of Overcoming Cognitive Fixedness

6.1.1 The cognitive fixedness shaped in childhood

Our previous study aim to identify the parent-child intimate expressions and acts of devotion which demonstrated that Indonesian children participants experienced a true apprentice-like situation over the experiments. Where parents guided their children as if they were co-workers completing a task in tandem. The parents gave strict orders to the children to pay attention to their instructions, which shows inter-dependence among parent-child interaction. This likely has been fostered since early childhood development that allows children to acquire a formative skill (i.e., craftsmanship) and at the same time shapes Indonesian children in craft villages become inter-dependence and maintain consistently the rigid practice of craftsmanship as a consistent belief. The role taking-behavior performed by parent as master-apprentice relation is reasonably and excessively suspected bringing conservative belief (belief in form, belief in perfection; belief in manner). The belief in conservativism is allegedly as result from accumulative rigid direction concerning object property and mastery.

6.1.2 Cognitive fixedness of traditional craftsman

When craftsmen were instructed imagine designing a fruit bowl, craftsmen's associative concept placed greater focus on product appearance and technical aspects, such as operation (i.e., replace, reduce, etc.) and shape (i.e., waist, body, etc.). In contrast, design trainers' associative concepts paid greater attention to the presence of issues related to surroundings, such as scene (silverware, norm, etc.) and appeal (fresh, dish, etc.). This experiment demonstrated that design trainers tended to use more remotely associated concepts (polysemous words) that have greater probability of achieving unconventional ways of thinking. While, traditional craftsmen tended to use more closely associated concepts that represent a narrow commitment to a particular issues they familiar with (cognitive fixedness in technical and object property). Closely associated concepts which represent cognitive fixedness correspond with their origin cognitive fixednsess that internalised and deeply rooted in action and attitudes as shown in previous observation. Further, we applied a method to overcome the closely associated concept to become broader.

6.1.3 The empowered cognitive fixedness

We observed several stages of idea generation during an experiment which craftsmen generated ideas of new design of traditional wooden sandal. During the first stage, craftsmen were challenged to generate ideas at extreme levels based on their prior knowledge. We examined their conceptual sketches and verbalized thoughts to obtain unfamiliar stimuli (stimulating keywords). Interestingly, some collected verbalizations did not match their fundamental knowledge or consistent belief on conceptions of sandals related to proper criteria "continuity" and "appropriateness." Design trainers select three unfamiliar verbalizations (unfamiliar stimuli) and took further confirm. The selected unfamiliar stimuli that frequently expressed are *painful*, *broken,* and *upside-down.* These selected three unfamiliar stimuli were then evaluated by design trainers, these show the example of existance of potential in barrier. These three unfamiliar stimuli is the result of escalation of cognitive fixedness that correspond to remotely associated concepts. This shows that in the state of extreme of cognitive fixedness, craftsmen unconsciously encountered dialectical belief, a state where their conservatism became less rigid. Craftsmen's conceptual sketches during the first stage revealed that they had taken a completely different direction. The features of extreme conservatism were complex-decorative. In contrast, the features of extreme unconventionalism were minimum-attribute. This means they are not just thinking of object properties and technical terms but also thinking more abstract and surroundings issues (appeal or scene).

During the second stage, the craftsmen redeveloped previous ideas by employing unfamiliar stimuli (keywords). Evaluation by design trainers revealed that craftsmen' conceptual sketches had become increasingly unconventional. They yielded some potential accents that looked promising for realization. The craftsmen became a bit more flexible in heel size composition, direction, and orientation. In fact, they did not become awkward as they deformed the basic structure of the sandal.

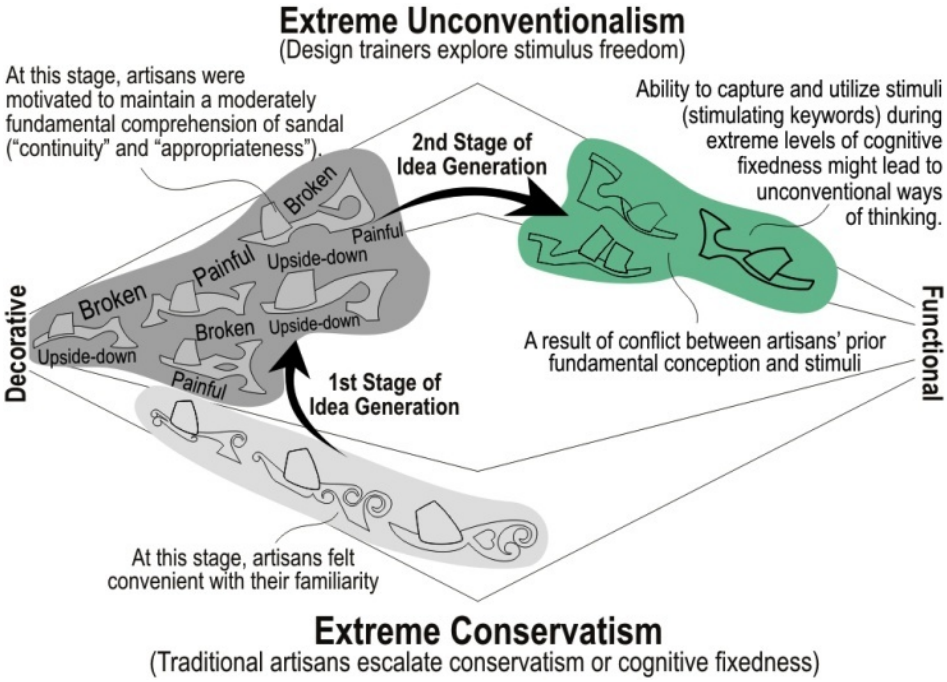

Figure 6.1: Traditional craftsmen's transformations during idea generation

We realized that craftsmen apparently were motivated to transform their fundamental comprehension when they engaged in extreme levels of conservatism. Ultimately, this experiment demonstrated that, in all likelihood, when craftsmen' conservatism is pushed to extreme levels, they

will become more unconventional during their creative activities. This design experiment demonstrated that true co-creativity support existed between design trainers and traditional craftsmen as participants. This study also demonstrated, abilities to capture and utilize unfamiliar stimuli during extreme levels of cognitive fixedness after all requires participatory works. Contributors, such as, designers, users, consumers and others would help to push them to enter extreme levels of their prior knowledge. Therefore, a model is necessary to create circumstances that allow empowering cognitive fixedness happen.

6.2 Contributors in Co-Creation Educational Activity

Co-creation emphasizes the generation of mutual value with other contributor coming "on stage" to be seen as an active and knowledgeable participant for the purpose of attaining value [117]. Co-creation are examples of naturally-maintained activities performed in traditional societies. Traditional creative workers in developing countries, who continue to preserve and use their native creative know-how are likely less considered to be engaged in this particular issue. Ethnographers have stated that native know-how is often collectively referred to as the accumulated cognitive and perceptive experiences of interactions that occur among a group of people [110]. Whereas, these societies support cultures that rely on collectivity and solidarity in their daily lives. One example of ancient creative co-creation is an old Asian rod puppet show entitled “Wayang Golek.” In this show, the story’s spontaneous flow relies on viewers’ responses and moods. This is a true example of native know-how that involves creative co-creation based on human-to-human interactions. Many other examples are available.

Craft products (i.e., souvenirs) normally were bought in a very unique circumstance, where consumers are the ones who go shopping as a goal rather than shopping with a goal. This circumstance contain of a unique consumer’s affective preferences which is completely inconceivable to a traditional craftsman. Therefore, in order to understand users' affective preferences, a realistic and more engaging circumstance is necessary to be presented directly to the craftsman. The co-creation educational activity for traditional craftsman is an idea to provide experiences with which all the stakeholders may construct their own unique narratives of co-creation (traditional craftsmen, consumers, designers, and the local government).

Furthermore, our recent study also demonstrated that craftsmen’s ability to capture and utilize unfamiliar stimuli during extreme levels of cognitive fixedness might lead to unconventional ways of thinking [118, 12]. However, empowering this cognitive fixedness is definitely not a standalone activity. In the case of our previous research, traditional craftsmen may reach unconventional ideas with role of design trainers in giving clue and direction. This system requires contributors to succeed. Therefore, this study will consider the use of cognitive modelling of creative knowledge work that suggest the important role of contributors [50]. Gero and Kannengiesser stress the role of players, creativity is thought to be a social construction that involves the value systems of many players, not just those of the designer [10, 119].

6.2.1 Knowledge contributors

Candy’s model (1999) of cognitive modelling of creative knowledge work describes the model of the main process involved to support co-creation. It is based on three primary activities that occur during the creative process: problem reframing (constraints and requirements), idea generation (generation and exploration), and evaluation (test). These creative activities combine with a set of Contributors to become essential parts to support co-creation. The Contributors are referred to as Knowledge Contributors. They involved and contributed, directly or indirectly, during the creative process.

Knowledge contributors can be divided into three knowledge categories (actors), *Domain Knowledge, Context Knowledge,* and *Strategic Knowledge.* We realized that actors contributed in these three knowledge may provide circumstances that allowing the unconventional ways of thinking happens. For example, a role to challenge cognitive fixedness of craftsmen would be ideal through the contribution of the users or consumers. The contributors have capacity and are based on the same desire with craftsmen to obtain good and desirable artifacts. Thus, the contributors will share their insights to challenge craftsmen' cognitive fixedness (see, Figure 6.2).

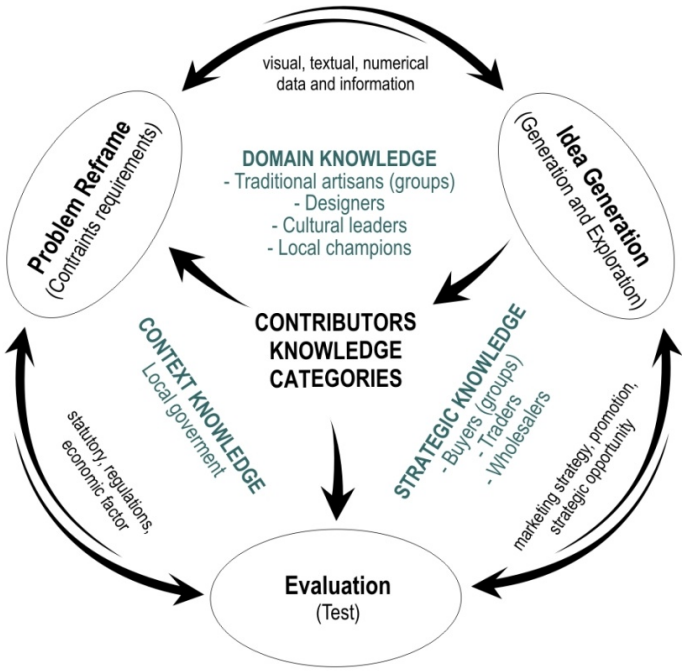

Figure 6.2: Co-creation model for group of craftsmen with stagnancy in product development (Adapted from Cognitive Modelling of Creative Knowledge Work; Candy, 1999))

Candy's model (1999) indirectly brought a nature of mutual work of creative knowledge work. Knowledge contributors are the actors that co-create in obtaining a result that meets users' preferences. This is a knowledge distribution with common goal of getting a satisfactory result to everyone who participated. Contributor from *Domain Knowledge* is one who competent about local or design knowledge that applies to a particular product area. Contributor from *Context Knowledge* is one who competent about statutory regulations, organizational, macro/micro economics. Furthermore, Contributor from *Strategic Knowledge* is one who represent the consumers, it includes understanding in users' preferences, marketing strategy, cost issues, etc.

6.3 A New Model of Design Training

We discovered on the experiment to challenge cognitive fixedness that the obtained unfamiliar stimuli of craftsmen during extreme levels of cognitive fixedness were much assisted with the direction from design trainers. The unfamiliar stimuli that might lead to unconventional ways of thinking were likely still hidden and unexplored, and were not easily recognized by craftsmen. According to Candy's model (1999), it describes the creative activities which combined with a set of Contributors to become essential in this interaction model to support co-creation. The Contributors are referred to as Knowledge Contributors. They are involved and contributed, directly or indirectly. Knowledge Contributors are Actors. All actors contribute knowledge facilitated by the participatory support

system that allows actors to contribute to and co-create during the creative process. Knowledge Contributors can be divided into three knowledge categories (actors) as follows:

Domain knowledge is specialist design knowledge that applies to a particular product area or design field. It may takes the form of visual, textual, numerical data, etc. It comprised of traditional craftsmen as a group (not as individuals), designers, local champions. In an example of a design training delivery, the role of domain knowledge of designers may be enhanced by role of strategic knowledge, such as users or consumers. These actors play important role to lead indirectly to challenge craftsmen to access extreme levels of cognitive fixedness.

Context knowledge is knowledge that affects the way the domain knowledge is applied, derived from statutory regulations, organisational. The actors are local government, they contribute to set up the programme. It may also provides access to trends and promotion related to strategic opportunities for the local community.

Strategic knowledge, it includes users' affective preferences, marketing strategy, cost issues. Strategic knowledge contributes as a main resource to open the belief system (users' preferences). Users or consumers, traders, wholesalers plays important role to be the catalyst. In related to our aim to develop a co-creation model that might empowering traditional craftsmen' cognitive fixedness. Actors from Strategic knowledge play important role to lead directly or indirectly to challenge cognitive fixedness.

These interactions inform every aspect of the culture of participation that is permeated by co-creation and co-creativity. Therefore, the utilization of cognitive fixedness as the basis for the development of a creative support system will not succeed unless significant attention paid to the nature of co-creation. If we take a closer look, development of a new concept is not the work of a few individuals who spend most of their time in intense experimentation. This type of system must avoid individualism and competition. It must allow all individuals in a group to participate and join in collective generation of ideas. Therefore, to successfully develop a system or application that empower traditional craftsmen' cognitive fixedness, we suggest that serious consideration be given to the involvement of knowledge contributors. This study showed that cognitive fixedness based on traditional viewpoints may be redirected by natural involvement of knowledge contributors that always in the position to challenge.

Ultimately, to create a system that allow co-creation for traditional craftsmen to overcome their cognitive fixedness, we propose a co-creation model of creative knowledge work that applicable in a design training. The main characteristic of the co-creation design training is bringing together the three knowledge contributors (craftsmen, designers, consumers/users and supported by official local government) to contribute their competency in design training.

During a challenge to generate ideas at extreme levels based on their prior knowledge, both design trainers and traditional craftsman successfully established an inter-domain knowledge transfer. However, it was merely a collaboration, there was no value creation during that event. Therefore, design training as a nationwide governmental HRD programme with aims to improve product quality requires involvement from real actors (users or consumers). A conventional design training will affect only to the group of craftsmen during the training operation. To be able to generate a greater effect and a value creation, it is necessary to develop the concept of the programme.

A design training and craft workshop experience as a service might attract consumers to self-experience and engage in the creative process and at the same time learning technical craftmanship. The proposed programme is an embedded design training programme within the tourism-based craft workshop-like setting. In this event, consumers create shared value at the same time. They create this personal and nostalgic value along with the programme, they also share a whole episodic experience

unwittingly. Those whole episodic comprises of recreational behavior, stylistic experience, mood and curiousity experience. Those experiences represent their self-expression which is highly valuable and inconceivable by traditional craftsman. In this event, a designer and traditional craftsman play their role as a coach to train creativity and to create craftwork. Actually, a craftsman is learning from the true event of artifact-users attachment episode. A craftsman observes what consider consumers to purchase and piece by piece of valuable information from the tourism episode, etc. This craft workshop-like circumstance may brings a traditional craftsman to learn different beliefs (style, habit) of the consumers. Here, a craftsman directly capture the mood and the feeling of the consumers from first-hand experience. Moreover, they would realize that a success of a product is not merely of a perfect shape or reasonable price, but thinking of a surrounding atmosphere, moment, and mood would contribute to a success of artifact design. Here, a design trainers is the contributor who could manage and lead a creative episode to occured. A co-creation educational activity is an improved and embedded design training within a craft workshop-like setting, it appears to creating shared value and satisfying all actors involved (see, Figure 6.3).

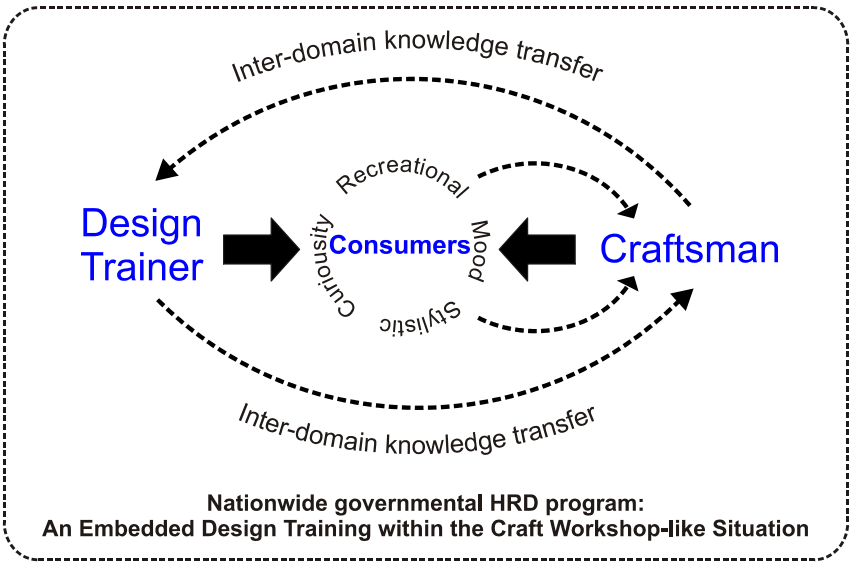

Figure 6.3: A model of co-creation educational activity for traditional craftsmen

6.4 A Design Training to Overcome Cognitive Fixedness with Knowledge Contributors

We recognized that conventional design education is incompatible with the mindset of traditional craftsmen who tend to hold strong and genuine beliefs, we have aimed to create a model of design education content that fits with their beliefs and creative characteristics. In the future, therefore, craftsmen should demonstrate enhanced creative abilities and production of more desirable products. To facilitate development of this model, we studied gaps in the creative process of design training for traditional craftsmen. We identified the gaps by focusing on in-depth cognitive levels during the early stage of idea generation. Instead of introducing traditional craftsmen to a conventional design process, we offered an improved knowledge acquisition feature in the design education model. This feature respects and utilizes craftsmen's prior knowledge, and it intrinsically may diminish their reluctance to open up to other cultures or values. The construction of a design education model that fits craftsmen's beliefs and delivers a curiosity for the unfamiliar—a prerequisite for unconventional thinking.

The incorporation of the dialectical is a novel approach to design education curriculum that

permits two-way criticism. Belief is a source of commitment that an individual holds strongly, be it tradition, habit, or value; dialectical belief is a psychological state characterized by curiosity arousal or apprehension regarding the existence of another belief. Dialectical beliefs unwittingly facilitate two-way criticism for resolving dissonance. It delivers curiosity for the unfamiliarity of another belief system. Traditional craftsmen are the targets of design education curriculums, which are designed to affect in-depth cognition and facilitate experiencing the dialectical state during idea generation. During idea generation, craftsmen are challenged to employ their prior knowledge to run into extreme exposure of conservatism, which unconsciously makes them wonder about their objectivity and the suitability of their values. Whenever the challenge of extreme exposure is presented, feelings of uncertainty may be manifested as intentions to seek another value or custom that presumably would be suitable.

Ultimately, there were two major problems education raised in every design training session held—market demand and preservation of traditional values. Some experts claim that conceptualizing new ideas for products cannot be obtained simply by understanding the market; this process is an inner-sense driven phase stemming from an inspiration (see, Figure 6.4). The ability to capture the gap between users' affective preferences and their tendency to accommodate traditional values is related to implicit or in-depth cognitive levels rather than explicit issues. Unconventional ways of thinking that could result in greater creativity were experienced by designers and craftsmen during the Design experiment. The trigger for unconventional thought was construction of the design education model, which challenged craftsmen to experience the escalation of extreme conservatism. At this stage, vaguery regarding instructions and targets deepened their intrinsic motivations and lessened their intensities regarding attainment of goals. In addition, reflection through verbalization captured very important keywords (unfamiliar stimuli). These stimuli were crucial for further stages in addressing the enhancement of cognitive resources. Therefore, the design education model was constructed to modify intrinsic motivations at the in-depth cognitive level (concept generation). Incorporation of the dialectical approach facilitates two-way criticism. A prior belief as a source of a strongly held premature commitment is a main issue to be controlled. Such a belief must be challenged by an extreme level of conservatism to generate questions, arouse curiosity, or apprehend the existence of another belief. Dialectical belief represents a cognitive experience of self-criticism; it enables one to criticize, evaluate, and compare unfamiliar belief systems. The usual design method normally avoids the presence or intensity of intrinsic drive and giving more attention to problem-driven; here, we have created a model that allows complete joy of the inner-sense driven experience at the idea generation stage. To complete a fulfilling sense of resonance, the goal-driven stage (before the reflection stage) has been eliminated. At the reflection stage, in-depth cognition is affected by the dialectical state, as indicated by a personal examination of one's own beliefs. Whenever the total enjoyment of one's beliefs is experienced, feelings of curiosity may be aroused regarding other values or customs (other beliefs).

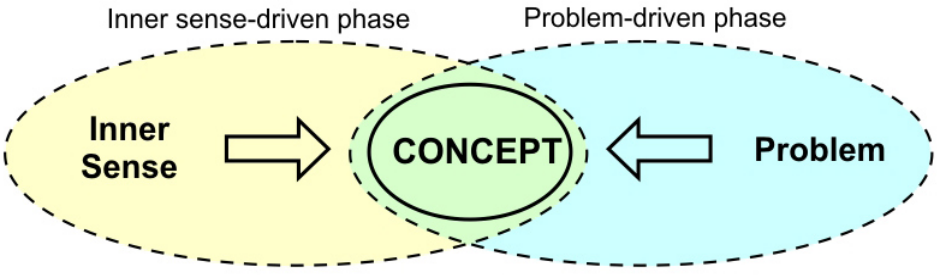

Figure 6.4: The two phases in concept generation (Taura & Nagai, 2012).

The later stage of idea generation is more difficult for craftsmen to follow because it requires the ability to synthesize, analyze, and compose simultaneously in order to define and ideate. A gap in abilities to analyze indicates that the solution lies hidden therein. Definition and ideation is related to the process of discovering the hidden solution in the gap. Idea generation proceeds to a new concept by referring to certain existing concepts from the real world or the designer's mind. We believe that craftsmen experience difficulties at this stage because they feel comfortable with fixation or commitment based on prior knowledge, as demonstrated by their responses to extreme levels of conservatism. Dialectical belief was possible be accessed through conforming their belief (tradition, habit, value) to their reflection from verbalized thought. The responses to extreme levels of conservatism indicated that beliefs might not match fundamental comprehension of ideal artifacts. Further, the keywords from verbalized thoughts were employed as stimuli to further re-define or re-ideate. Up to this stage, re-define and re-ideate is a dialectical of ideality of their familiar and habit with other unknown-ness or unfamiliarity area. Curiosity might be aroused only if they experience some uncertainty over their prior ideality (see, Figure 6.5).

6.4.1 Dialectical-belief feature in the improved model of design training

To successfully access a conceptualization, master craftspersons who are not literate in design must accentuate the inner sense-driven phase rather the problem-driven phase. Our experiments demonstrated that craftsmen tended to place greater focus on operational aspects of an artifact (e.g., replace, reduce, etc.) or shape (e.g., waist, body, etc.). This focus represents a mental state trapped in the tangible issues of an artifact that create perceptual barriers and obstruct an imaginative approach. In contrast, craftsmen were challenged to generate conservative ideas at extreme levels during Design Experiment 2; subsequently, we captured dissonance through verbalization. The keywords or unfamiliar stimuli derived from their conservatism did not match with ideality in fundamental comprehension. The stimuli from this experiment created intangible issues or relevant metaphors, such as Scene and Appeal.

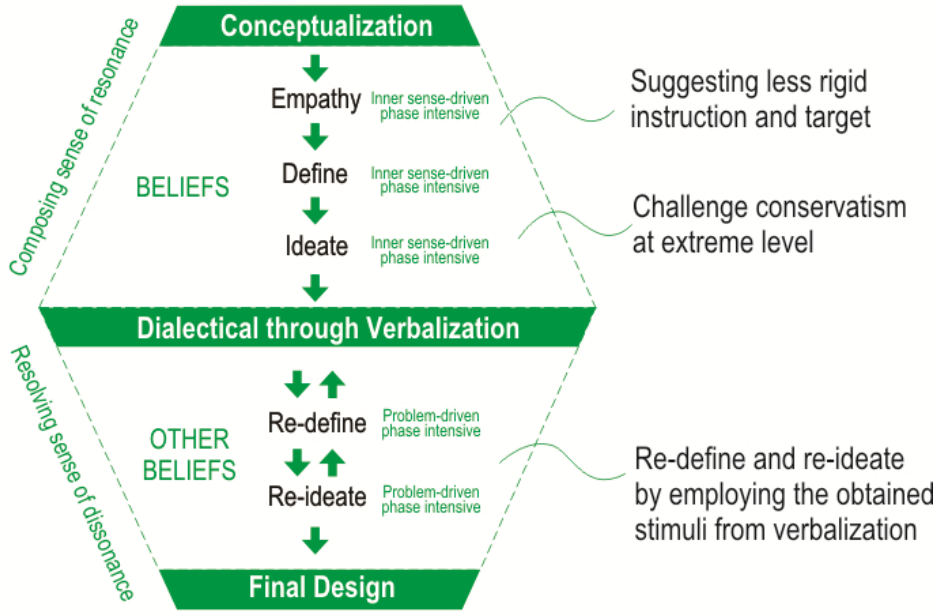

Figure 6.5: A design education model for Craftsmen

To produce more intrinsic experiences that access thoughts at the in-depth cognitive level and broaden perspective or creativity, craftsmen must be positioned to experience the dialectical phase in a familiar way. Dialectical belief is a criticism phase where one begins to doubt his/her premature commitment; consequently, the individual may become curious about different belief systems. To overcome traditional craftsman's stagnancy in product development, a co-creation educational activity must involve the knowledge contributors. To put all the contributors on the same stage, it requires an embedded design training within a craft workshop-like setting that serve at a tourist spot. The proposed design training programme will attract consumers to self-experience in a unique creative process, and craftsmen are at first-hand experience to observe users/consumers' affective preferences. In the future, it is necessary to extend and develop this research to create a complete framework of a groupware that can be utilized in design training.

Chapter 7
Conclusion

One's cognitive capacity is greatly influenced by his/her attributes, such as culture, beliefs, and insights. At some point, these attributes are regarded as an advantage or even a barrier. A perceptual barrier is created by old ways of thinking and responding [8]. In the craft tradition, a repeated-type experience has shaped a craftsman's ability to exploit in very subtle ways, but he/she has no theoritical understanding of how these effects are achieved [120]. The conceptual ideation process is generated from mindsets and stimulus that are intertwined. Therefore, every mindset and stimulus has a role either as potential or barrier.

In the case of Indonesian master craftsmen, their conceptual stimulus has constructed a typical mindset which stimulates a pragmatic viewpoint. This typical mindset may be seen as cognitive resources used in conceptualising that maintain explicit considerations (cognitive fixedness). These explicit considerations lead their conscious mind to be stereotypical and follow the rule of familiarity to respond to issues of consumers, material, dimension, quantity, production cost and technique. This makes their conceptual thoughts conventional which avoids any radical changes. However, their conceptual stimulus when challenged to generate ideas at extreme levels demonstrates an urge of accessing more implicit realms. We believe, at this point that a master craftsman encounters conflicting cognitions to maintain strong typical mindsets (beliefs) from various unrelated conceptual stimulus.

In short, this study reveals that there are some domains of strong mindset that are inherent in ultimate mastery, whereas at the same time it limits other domains of typical mindset. The strong typical mindset are things that a craftsman is familiar with which maintain their beliefs and conventional thought, which may be known as a barrier. These mindsets generate the conceptual stimulus. These unfamiliar stimuli are how they respond to and interpret the object, function, user, and beliefs. The more conventional the ideas the more they are being secure within the strong typical mindsets. However, there is consistently minor attention given to other domains of typical mindset which is likely to be contradictory. This minor attention may be regarded as a weak stimulus (unfamiliar stimuli) that has potential to balance a fixed and strong typical mindset (cognitive fixedness). A true creative process allow conflicts to occur, and this conflict is positively exploited, i.e., '*making familiar strange*' or '*bisociation*' theory [25, 27]. A presence of weak conceptual stimulus, which allegedly is contradictory towards strong typical mindsets, provides potential to lead an unconventional way of thinking. Curiosity towards unfamiliarity is one way of a creative individual conceptualising.

We realized that craftsmen's unfamiliar stimuli that generated at extreme level of cognitive fixedness (i.e., broken shape, painful shape, upside-down shape) are the remotely associated concepts

that potential for unconventional ideas. This shows that in the state of extreme of cognitive fixedness, craftsmen unconsciously encountered dialectical belief, a state where their conservatism became less rigid. This means they are not just thinking of object properties and technical terms but also thinking more abstract and surroundings issues (appeal or scene). To avoid narrow or closely associated concepts and produce more intrinsic experiences that access remotely associated concepts at the in-depth cognitive level, craftsmen must experience the dialectical belief in familiar way. Dialectical belief is a criticism phase where one begins to doubt his/her premature commitment (cognitive fixedness); consequently, the individual may become curious about different belief systems. The improved method to challenge traditional craftsman to generate their conservative ideas at extreme level is able to overcome cognitive fixedness. To facilitate an effective design training we proposed an embedded design training program within a tourism-based craft workshop-like setting. The visitors, consumers are the knowledge contributors that co-create in design activity with the craftsmen. Challenges are result from the presence of knowledge contributors that brings episodic recreational behavior, i.e., stylistic, mood and curiousity. Ultimately, the knowledge contributors will constantly challenge cognitive fixedness to access remotely associated concepts. Our claim is, cognitive fixedness of individual who possess conservative viewpoint (i.e., craftsman) can be overcame through challenge to cognitive fixedness at extreme levels and utilize the obtained unfamiliar stimuli. This improved model of design training will be more effective with co-creation design education involving knowledge contributors (i.e., consumers).

7.1 Contribution

In the case of people with a conventional viewpoint, for example a craftsman, our study proves that weak conceptual stimui (unfamiliar stimuli) exists as a challenge of unfamiliarity. This challenge is an unconventional resource which provides an opportunity to be exploited through targeted design education. Local government and design trainers who create and deliver a design training need to be aware of these regional differences (cultural uniqueness) that exist as cognitive resources. Design trainer must enable the craftsperson to identify and utilize their potential cognitive resources. Therefore, through understanding the cultural uniqueness of these mindsets and stimuli we can provide resources for the development of design training (Nationwide Governmental HRD Program in developing countries) that focus on the enhancement of traditional craftsmen's cognitive resources to produce more desirable products. The contribution of this study are as follows:

- The contribution of this study is an improved model of design training for traditional craftsman to overcome their cognitive fixedness. This will be useful to improve creativity and design education delivery for people who possess conservatism in order to produce more desirable products. One of the government strategic program is the design and creativity training delivery to the craftspeople—a nationwide governmental HRD program. For the long-term impact, this improvement will foster rural economic growth in line with the effort of government in developing countries to develop rural craft industries.
- Contribution of this study to Knowledge Science is a knowledge creation of a new co-creation design education for people with conservative/traditional viewpoint (i.e., traditional craftsman) with involvement of knowledge contributors. Based on our study, we propose an improved model of embedded design training within a craft workshop-like setting that serve at a tourist spot. The proposed design training program that allow all knowledge contributors appear on the same stage. This model would attract consumers to self-experience in a unique creative process, and at the same time a craftsman are at first-hand experience to observe users/consumers'

affective preferences. The proposed model of design training is based on the findings from several studies conducted, and the finding are as follows:

- **Chapter 3 - Substantial understanding on the origin of cognitive fixedness**
  This study shows, the strong role-taking behavior of Indonesian parents appeared to reinforce intimacy in an apprentice-like, co-creative play experience to help the children gain formative skills. We concluded that the stronger the spoiling behavior (i.e., strong role-taking behavior) is, the greater the parent's contentment is in acting as a loving parent and satisfying the child's expectation for dependency. Over time, role-taking behavior facilitates children's development of formative skills (e.g., craftsmanship) which seems to give apprentice-like experience, while independence leads to more exploratory thinking (i.e., creativity). This likely has been fostered since childhood stage that shapes Indonesian children in craft villages become inter-dependence and maintain consistently the rigid practice of craftsmanship as a consistent belief (cognitive fixedness).
- **Chapter 4 – Discover the characteristic of cognitive fixednes of craftsmen**
  This experiment demonstrated that design trainers tended to use more remotely associated concepts (polysemous words) that have greater probability of achieving unconventional ways of thinking. While, traditional craftsmen tended to use more closely associated concepts that represent a narrow commitment to a particular issues they familiar with (cognitive fixedness in technical and object property).
- **Chapter 5 - Overcoming craftsmen's cognitive fixedness**
  We conduct a design experiment of new design training to empower craftsmen's cognitive fixedness. The experiment demonstrated that the ability to capture and utilize unfamiliar stimuli during a challenge of extreme levels of cognitive fixedness might lead to unconventional idea, for example, an up-side down wooden sandal. We realized that craftsmen's unfamiliar stimuli that generated at extreme level of cognitive fixedness (i.e., broken shape, painful shape, upside-down shape) are the remotely associated concepts that potential for unconventional ideas.
- **Chapter – 6 Discussion on the improved model of design training**
  The improved method to challenge traditional craftsman to generate their conservative ideas at extreme level is able to overcome cognitive fixedness. However, traditional craftsman's cognitive resource that has been fostered since childhood is apparently dependent. Therefore, we proposed an embedded design training program within a tourism-based craft workshop-like setting. The visitors, consumers are the knowledge contributors that co-create in design activity with the craftsmen. Challenges are result from the presence of knowledge contributors that brings episodic recreational behavior, i.e., stylistic, mood and curiousity. Ultimately, the knowledge contributors will constantly challenge cognitive fixedness to access remotely associated concepts.

7.2 Future Research

This study made a substantial contribution to Knowledge Science through the creation of a suitable design education model for people with conservative/traditional viewpoint, i.e., craftsman that respects and utilizes their prior traditional viewpoints. This means our study resolves issues from the viewpoint of knowledge creation in the activities particularly in human cognition and embodied knowledge. Traditional craftsmen's in-depth cognition levels may not be transformed instantly so that the individuals experience two-way criticism, however the model appears to provoke curiosity

regarding unfamiliar values or customs. This unconventional interest presumably would lead to new experiences reflexively. This model is ready to be implemented in rural crafts industry HRD development programs. To be ready implemented in many rural craft area, some extended ressearh is crucial to be done, the future research needs to be focused on following issues:

- Development of design training curriculum for people with conservative/traditional viewpoint (i.e., traditional craftsman).
- Development of design training modul that utilizing prior knowledge to enhance the thinking process of individuals with embodied-skills.

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Appendix

1. **Observation at three local craft villages in Indonesia and one village in Japan. The three experiments are as follows:**
   - Experiment A: Making a Japanese ceramic whistle (陶笛) to observe children's formative play skills (craftsmanship).
   - Experiment B: Making a musical instrument that produces three tones to observe group work and parent-child communication.
   - Experiment C: Making a musical instrument that produces sound as a result of the player's body action observing children's exploratory thinking and parent-child communication.

2. **Experiment on the cognitive fixedness from the associative concepts of craftsmen and designers when they conceptualize their ideas at the early stage of idea generation.**

3. **Experiment to create a new design of traditional wooden sandal by challenge of cognitive fixedness at extreme level and to utilize the obtained unfamiliar stimuli.**

Experiment Instructions in Chapter 3

Observation at three local craft villages in Indonesia and one village in Japan.

Aim :

We aim to identify the intimate interaction and acts of devotion on Indonesian and Japanese parent-child living in local craft village. We want to observe the origin of cognitive fixedness in conservative viewpoint shaped in childhood that contribute in the rigid practice of craftsmanship.

We gather data on the followings:

(1) Children's formative play skills (craftsmanship)
(2) Parent-child communication structures

Procedure:

We conducted three experiments in each of three local craft villages in Indonesia and one village in Japan. The three experiments are as follows:

- Experiment A: Making a Japanese ceramic whistle (陶笛) to observe children's formative play skills (craftsmanship).
- Experiment B: Making a musical instrument that produces three tones to observe group work and parent-child communication.
- Experiment C: Making a musical instrument that produces sound as a result of the player's body action observing children's exploratory thinking and parent-child communication.

Research Method

Each experiment (A, B, and C) was conducted separately in each town and was completed within a period of one hour. The parents sat next to their children at a U-shaped table. The children were asked to complete three tasks on their own, but the parents were allowed to assist if the child needed help. The participants were free to communicate with each other. Two video cameras were set up to record their interactions.

- Experiment A: The children were asked to make a Japanese whistle by replicating a sample, with video guidance available.
- Experiment B: The children were divided into two groups to create a single musical instrument through collaborative work.
- Experiment C: The children each made their own instrument.

The objects made by the children (Experiments A and C) and recorded activities were evaluated as the assessment of the children's formative play skills. The evaluation employed a three-point Likert-scale and was rated by six experts in craft and design. Next, the parent-child communication structures were analyzed using Network Analysis derived from video transcription that covered the communication between five children and their parents (pair, inter-, and cross-communication) in each town. The number of utterances in communication was counted using Pajek 2.05 and based on 2D layers in the Y direction.

Subjects:

The Indonesian participants comprised 15 children from three different regions. The Japanese participants comprised 4 children from one region. The gender of the subjects was random, and the age range was 7 to 12 years. Each child was paired with one of his/her parents (i.e., mother or father). Thus, the total number of participants included 19 children and 19 parents. All the participants lived near the local craft village in their region, and most did not know each other.

Experiment Instructions in Chapter 4

Experiment on the cognitive fixedness from the associative concepts of craftsmen and designers when they conceptualize their ideas at the early stage of idea generation.

Aim:
We aim to understand the differences characteristic of the cognitive fixedness of craftsmen and designers. We investigate the cognitive fixedness from the associative concepts of craftsmen and designers that occured when they conceptualize their ideas at the early stage of idea generation.

Research Method and Procedure:
We employ a Think-Aloud Protocol to obtain verbalized thoughts of master craftsmen. The collected verbalizations are identified through through a list of characteristics of the conservatism concept. The identified characteristics are then analysed by means of a conceptual network to reproduce a model of the individual's mental state. This captures the structure of thought that forming conservatism of the conceptual ideation process occurs in master craftsmen.

Subjects:
Four Indonesian master craftsmen four design trainers.

Procedure
Subjects conduct a Think-Aloud Protocol to search for new design ideas by imagine designing a new craft/artifact and freely express their ideas verbally. We placed no constraints on time or the subjects when they verbally expressed their ideas and engaged in spontaneous thinking.

The direct instruction is as follow:
'Please imagine designing a new artifact and freely express the ideas verbally'.
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Experiment Instructions in Chapter 5

Experiment to create a new design of traditional wooden sandal by challenge of cognitive fixedness at extreme level and to utilize the obtained unfamiliar stimuli.

Aim :

In this design experiment of creating a new design of traditional wooden sandal we aim to overcome the cognitive fixedness. The experiment investigates the potential unfamiliar stimuli of cognitive fixedness that tend to inhibit traditional craftsmen's mindset. Craftsmen are challenged to generate their conservative ideas at extreme level, and furthermore redevelop and utilize the unfamiliar stimuli obtained from extreme levels of cognitive fixedness.

Research Method and Procedure :

The experiment was conducted during a 20-day period (eight hours per day). An outline of the procedure and discussion of the second session (Design Exercise*) are provided below:

a. First session: Design Basics lecture:
   - Design Principles (balance, proportion, and so on).
   - Creativity Icebreaker games for habituation. Second session: Design Exercise*

b. Second session: Design Exercise*
   - From preliminary ideas to idea development.

c. Third session: 1:1 workshop prototyping.
   - Foam modeling, upper strap variations, and finishing.

During the second session (Design Exercise*), we employed the followings steps:

1. The first stage of idea generation:
   a. Escalating craftsmen's extreme conservatism.
   b. Identifying unfamiliar stimuli in craftsmen's conceptual sketches and verbalized thoughts.
2. The second stage of idea generation:
   a. Redevelop previous concepts by employing obtained stimuli (Stimulating Keywords).
3. Finally, we evaluated transformations that occurred during idea generation and reviewed potential aspects.

*** Wooden Sandal Craftsmen**

This project was held in a traditional wooden sandals craft center in Tasikmalaya City, West Java, Indonesia. The training is conducted for two weeks, which is 1 week for design training and another one week for making the prototype. 15 craftsmen were trained in this design training with 3 design trainers. In the first session (design traiing) each of the craftsmen must design one to two design option, then there at the end of the 1st session all craftsmen and design trainers were discussed to select some products that would be developed in 2nd session (make prototyping). On the 2nd session 5 were selected to be made as prototype. At this stage, all selected designs were made as 5 prototypes.

Silabus Pelatihan 4 Komoditi

Bambu, Bordir, Batik, Alas Kaki (Kelom)

	Jam	Daftar Aktivitas	Hari																				Keterangan
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
1. TEORI (KOLEKTIF)	13.00 - 14.30	Pengantar : "Memahami unsur-unsur keindahan (Proporsi, Skala, Keseimbangan, dls)"																					Dalam satu ruangan secara kolektif
	14.30 – 15.00	Diskusi/Tanya Jawab																					
	15.00 – 15.30	Rehat																					
	15.30 – 16.00	Perkembangan terkini Batik																					
	16.00 – 16.30	Perkembangan terkini Bordir																					
	16.30 – 17.00	Perkembangan terkini Alas Kaki/Kelom																					
	17.00 – 17.30	Perkembangan terkini Bambu																					
2. TEORI (BY GROUP)																							Dibagi dan dipisah berdasarkan kelompok
	13.00 - 14.00	Eksplorasi I (masing-masing Komoditi)																					
	14.30 – 15.00	Diskusi																					
	15.00 – 15.30	Rehat																					
	15.30 – 16.30	Eksplorasi II (masing-masing)																					
	16.30 – 17.30	Diskusi																					
3. TEORI (BY GROUP)																							Dibagi dan dipisah berdasarkan kelompok
	09.00 - 14.30	**Tugas I /Latihan Gambar (Design 1)** Pola, sambungan, Bentuk, Ornamen																					
	15.00 – 15.30	Rehat																					
	15.30 – 17.30	**Tugas II /Latihan Gambar (Bambu Rangkai)** Pola, sambungan, Bentuk, Ornamen																					
4. TEORI (KOLEKTIF)																							Dalam satu ruangan secara kolektif
	13.00 - 14.00	Pengantar : "Eksperimen dan Eksplorasi dalam Desain"																					
	14.30 – 15.00	Diskusi/Tanya Jawab																					
	15.00 – 15.30	Rehat																					
	15.30 – 16.00	Pembahasan Batik																					
	16.00 – 16.30	Pembahasan Bordir																					
	16.30 – 17.00	Pembahasan Alas Kaki/Kelom																					
	17.00 – 17.30	Pembahasan Bambu																					
5. PRAKTEK (KOLEKTIF)																							Dalam satu ruangan secara kolektif
	09.00 – 15.00	Praktek di SENTRA masing-masing																					Selama praktek dikontrol secara berkala 3x

Silabus Pelatihan 4 Komoditi
PRODUK KERAJINAN KELOM
PPK IPM 2007

Waktu : 6 JPl x 20 Hari
Alat : Hand Out, Kertas, Styrofoam, Cutter, Lem Styrofoam, Amplas, Kayu Albasiah, Cat Duco dan thinner, Air brush
Materi :

Ming /Hari	Kegiatan	Materi	Keterangan	Alat dan Bahan
I/1	**Pengantar**	Mengenal unsur-unsur pembentuk keindahan	Mempelajari • Keseimbangan • Proporsi • Aksentuasi • Kreativitas	Infokus + Handout
I/2	**Wawasan bentuk Hubungannya dengan kelom**	Bentuk dan segmentasi pasar	Setiap segmentasi memiliki bentuknya sendiri-sendiri yang harus disadari oleh para pemngrajin	Infokus + Handout
I/3	**On –Paper Practice**	Simulasi Desain putihan	Mengelaborasi bentuk-bentuk kelom	Kertas A4, pinsil
I/4	**On –Paper Practice**	Simulasi Desain putihan	Mengelaborasi bentuk-bentuk kelom	Kertas A4, pinsil
I/5	**Studi model**	Pembuatan model putihan dengan menggunakan styrofoam	Aplikasi gambar ke bentuk 3 dimensi	Styrofoam, cutter, amplas, lem styrofoam
I/6	**Studi model**	Pembuatan model putihan dengan menggunakan styrofoam	Aplikasi gambar ke bentuk 3 dimensi	Styrofoam, cutter, amplas, lem styrofoam
I/7	**Studi model**	Pembuatan model putihan dengan menggunakan styrofoam	Aplikasi gambar ke bentuk 3 dimensi	Styrofoam, cutter, amplas, lem styrofoam
II/8	**Pembuatan putihan**	Pembuatan putihan dengan kayu albasiah	Mengaplikasikan bentuk 3 dimensi styrofoam ke kayu albasiah	Kayu albasiah, mesin perkayuan, amplas.
II/9	**Pembuatan putihan**	Pembuatan putihan dengan kayu albasiah	Mengaplikasikan bentuk 3 dimensi styrofoam ke kayu albasiah	Kayu albasiah, mesin perkayuan, amplas.
II/10	**Pembuatan putihan**	Pembuatan putihan dengan kayu albasiah	Mengaplikasikan bentuk 3 dimensi styrofoam ke kayu albasiah	Kayu albasiah, mesin perkayuan, amplas.
II/11	**Pengantar upper**	Penjelasan keanekaragaman upper	Menyesuaikan upper dengan bentuk putihan	Laptop, dengan berbagai image
II/12	**On –Paper Practice**	Simulasi upper	Membuat aneka ragam upper dalam bentuk gambar	Kertas A4, pinsil
II/13	**On –Paper Practice**	Simulasi upper	Membuat aneka ragam upper dalam bentuk gambar	Kertas A4, pinsil
II/14	**Aplikasi model upper pada putihan**	Pembuatan upper dari kertas	Mencoba mencocokan upper denga putihan yang sudah dibuat	Kertas konstruk, lem paku paying, gunting, cutter
III/15	**Aplikasi model upper pada putihan**	Pembuatan upper dari kertas	Mencoba mencocokan upper denga putihan yang sudah dibuat	Kertas konstruk, lem paku paying, gunting, cutter
III/16	**Pengecatan**	Cat dasar Atau sending	Memberikan sending sealer	Sending sealer, amplas,

	putihan	sealer	pada putihan sehingga siap untuk finishing lebih lanjut	kompresor
III/17	**Pengecatan putihan**	Pemberian warna dan motif	Memberikan warna pada putihan yang sudah di sending sesuai dengan desain yang sudah dibuat	Cat duco, amplas, kompresor, air brush
III/18	**Pengecatan putihan**	Pemberian warna dan motif	Memberikan warna pada putihan yang sudah di sending sesuai dengan desain yang sudah dibuat	Cat duco, amplas, kompresor, air brush
III/19	**Pemasangan upper dan packaging**	Pemasangan upper	Mencocokkan upper dengan putihan yang sidah di finishing	Berbagai material upper
III/20	**Pemasangan upper dan packaging**	Packaging	Membuat packaging yang cocok dengan karakter kelom	Kain, kertas