

博士論文

**Identification of factors enhancing the novelty of ideas  
in innovation Workshops and their utilization for  
workshop design**

(イノベーションワークショップにおけるアイディアの新規性を  
促進する要因の特定と  
ワークショップデザインへの活用)

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## Abstract

In response to the social needs for innovation, many academic institutions all over the world have established educational programs to promote innovation focusing on the creation of new ideas. Innovation in this study is not only confined to the conventional conception of technology-driven innovation but also applies to the creation of any kind of value to human life, through introducing novel ideas, methods, directions, opportunities, and solutions that meet new requirements, through more effective products, processes, services, and technologies that are readily available to users. Reflecting this increasing need for human-centered innovation, the University of Tokyo provides innovation workshop programs to generate new ideas.

To design an education program for encouraging innovative idea creation, it is crucial to formulate an evaluation method for the appropriateness of ideas generated, as well as to identify factors that encourage an appropriate idea generation. However, despite numerous previous studies on idea generation, existing definitions of the indicators for evaluation are too general to establish an evaluation method in a general context. The existing methods of evaluation on new ideas are based on subjective judgements of a certain number of raters and their evaluations vary widely, depending on the personal perception of raters. In addition, there is lack of consensus on the factors which enable us to generate appropriate ideas in spite of numerous studies in creativity education. In this study, there are three main objectives: 1) To propose an evaluation method for appropriateness of ideas by excluding subjective judgements as far as possible; 2) To identify factors which enhance appropriateness of ideas in innovation workshops; 3) To utilize this data to propose a workshop design for enhancing appropriateness in idea generation.

The focus of the innovation workshops in this study is placed on the generation of ideas using analogical thinking. Analogical thinking has been identified as one of the key mechanisms for creative thinking by many researchers in the fields of cognitive psychology, cognitive science, artificial intelligence, learning science, creative research, and so on. Analogical thinking is a basic mechanism inspiring creative tasks, in which people transfer information from well-known domains and utilize it in a new domain in order to develop new ideas. In this regard, using analogical thinking for innovation workshops is required to facilitate idea generation.

To evaluate the ideas generated using analogical thinking, it is important to compare structural similarity and superficial similarity. Based on analogical thinking, creativity is best realized with the representation of core structural features in source ideas, and importing them into unusual domains. For example, to explain the electric circuit for people who are not well aware of it, the analogy of the water flow in a pipe is often used to enable us to understand a new concept in invisible domain more clearly with a well-known visible domain. In this study, the appropriateness of ideas is defined as those which have low superficial similarity and high structural similarity with the source ideas. According to this definition, an evaluation method is proposed based on the measurement of superficial similarity and structural similarity. Superficial similarities are calculated by evaluating semantic similarity between the domains of source cases and the created idea using latent semantic analysis. Structural similarities are judged using cluster analysis, followed by comparative analysis between the structure of new ideas and source ideas.

To implement the proposed method and identify factors contributing to creating an appropriate idea, innovation workshops have been conducted seven times with the participation of 45 university students. The workshops consist of three tasks: 1) Pre-task: All subjects were asked to read the 25 business cases study; 2) Categorization task: Subjects were asked to categorize the cases based on the underlying mechanism of the business through group discussion; 3) Generation task: Subjects were asked to create a new service idea individually using analogical thinking. The workshops for this study are divided into two groups according to the instruction given for the generation task: the 1st to 4th workshop, 22 participants were asked to generate idea freely based on analogical table; on the other hand, in the 5th to 6th workshops, 23 participants were asked to generate five new ideas first, then select the one idea to complete the analogy table.

As a result of the 1<sup>st</sup> - 4<sup>th</sup> workshops, a total of 20 ideas were created, 10 of which were evaluated as appropriate according to the proposed method. For identifying factors which promote appropriateness in idea generation, this study focused on the factors which are controllable by workshop facilitation. Thus, all the data which are available from the workshop was analyzed: each participant's performance in the categorization task; pattern in thinking process during the generation task. In addition, personal interview surveys were conducted after the workshop.



Consequently, three factors were considered to have a significant relationship with the appropriateness of ideas generated using analogical thinking: 1) categorization skill; 2) deliberation before reaching the creative leap moment; and 3) having trial and error in setting a domain for a new idea. Specifically, the participants who showed higher skill in categorization tasks had a greater possibility of generating appropriate ideas. In addition, the participants who deliberated more before reaching the ‘creative leap’ stage, as well as engaging in more trial and error before deciding on the final domain of a new idea, generated an appropriate idea.

Consequently, this study proposed a workshop design to strengthen the factors for facilitating an appropriate idea generation. As for the factor of categorization skill, it presumably results from personal level of knowledge, and group dynamics during the categorization task, which is carried out through discussion among team members. Thus, it is difficult to be trained through the workshop facilitation. More importantly, any proposal for an improved workshop design method should focus on the ideation process, such as improving the instruction for forming analogy tables which allow participants to apply high structural similarity from the source ideas, presenting a numbers of examples for finding domains, which are different from the source ideas, or setting an additional task for encouraging deliberation, as well as trial and error before reaching the ‘creative leap’ moment.

As a consequence, for the 5th – 6th workshops (N=23), to foster deliberation before reaching the ‘creative leap’ moment, an additional task was given to the participants. The various examples of domains were presented to each participant as a cue, before the task of generating a idea using analogy table. In this session, participants were asked to generate five new ideas within 15 minutes; also, they were instructed to create new ideas as diverse as possible in terms of a business domain. As a result, 23 ideas were generated in total, and 15 of them were evaluated as appropriate ideas according to the same evaluation method. Comparing with the results from the previous workshops, the proposed workshop design promoted two factors for generating an appropriate idea, which are deliberation before reaching the ‘creative leap’ moment, as well as having trial and error in setting a domain for a new idea.

Throughout this study, we have found that, firstly, the proposed evaluation method can effectively evaluate the appropriateness of ideas generated using analogical thinking. This is important not only because it allows us to overcome weaknesses in current assessment methods

which depend on subjective judgements but it also enables further studies into how people generate appropriate ideas, by observing the entire ideation process. Secondly, important factors for generating appropriate ideas were identified as categorization skills and the ideation process, in other words, deliberation before reaching the creative leap stage and extensive trial and error before deciding the domain for a new idea. While almost all past research has focused on the outcomes of ideation workshops, which are the new ideas themselves, this study allows us to trace the source of idea as well as individual thought processes. Last, but not least, the workshop design method was proposed to enhance appropriateness in generating an idea using analogical thinking for innovation workshops.

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# 1. Introduction

## 1.1. Background

### 1.1.1. The increasing needs for innovation

The three most drastic transitions to have taken place in human history are the agricultural revolution, the industrial revolution and the information age (Dertouzos & Moses, 1979; Gates et al., 1995; Negroponte, 1996; Toffler, Longul, & Forbes, 1981). Each transition brought an immense improvement in productivity and the speed of development has accelerated. This radical change allows us to live in a world of abundance. In contrast to those who lived in the industrial age of high volume but low variety, people who live in current information-led society of high variety and low volume are seeking for the new ideas.

In this contemporary world of exuberance, innovation is a prerequisite for finding new opportunities for the both private and public sectors. In the private sector, the paradigm has shifted from manufacturing to value creation through innovation. Innovation in a business is not an option, but an imperative for survival. Innovation allows us to create a new business, which is differentiated from all of the others by a unique business idea. Consequently, business organizations, more than ever before, recognize that they need employees who think creatively in order to maintain their competitive edge. In response to this, large numbers of companies are providing creativity training programs as a means of enhancing innovative thinking in their employees.

Moreover, several prestigious periodicals, such as CNN<sup>1</sup>, Forbes<sup>2</sup>, Business week<sup>3</sup> as well as consulting companies such as the Boston Consulting Group publish lists of the world's most innovative companies<sup>4</sup>. Crucially, companies ranked in these lists, such as Apple, Google,

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<sup>1</sup> The World's Most Admired Companies: Innovation. CNN. from [http://money.cnn.com/magazines/fortune/mostadmired/2011/best\\_worst/best1.html](http://money.cnn.com/magazines/fortune/mostadmired/2011/best_worst/best1.html)

<sup>2</sup> The World's Most Innovative Companies List. (2014/01/09/01:45:43). Forbes. from <http://www.forbes.com/innovative-companies/list/>

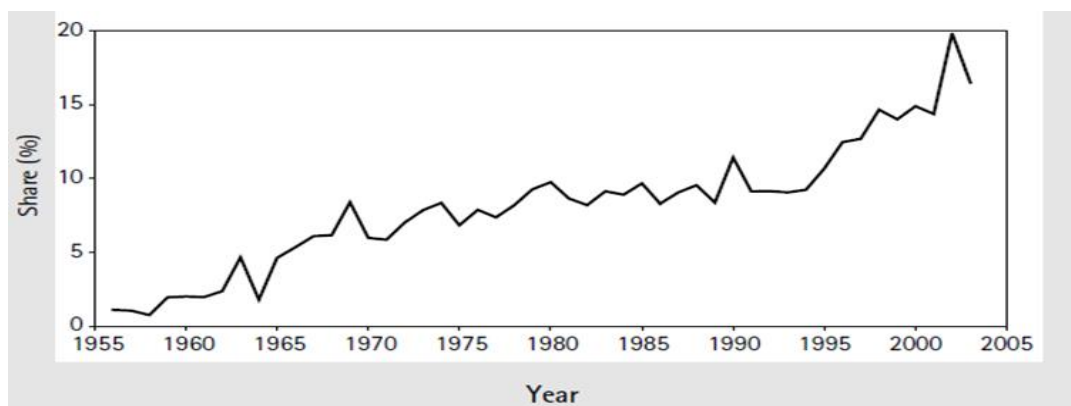
<sup>3</sup> Most Innovative Companies - BusinessWeek. (2014/01/09/02:02:48). Businessweek.com. from [http://www.businessweek.com/magazine/toc/10\\_17/B4175innovative\\_companies.htm](http://www.businessweek.com/magazine/toc/10_17/B4175innovative_companies.htm)  
[files/632/B4175innovative\\_companies.html](http://www.businessweek.com/magazine/toc/10_17/B4175innovative_companies.htm)

<sup>4</sup> BCG. (2014). The 50 Most Innovative Companies. from [https://www.bcgperspectives.com/content/articles/innovation\\_growth\\_digital\\_economy\\_innovation\\_in\\_2014/](https://www.bcgperspectives.com/content/articles/innovation_growth_digital_economy_innovation_in_2014/)

Amazon.com, Facebook, etc., are highly correlated with those listed as top ranking companies in terms of market capitalization.

The academic field, without exception, has paid profound attention to innovation. Reflecting this new emphasis, the number of scholarly articles with innovation in their titles per 10,000 social science articles has increased from 10% shares in 1990s to 20% shares in early 2000s according to the social science citation index of the Thomson Reuters Web of Science. (see the figure 1.) Significantly, C. R. Carlson and Wilmot (2006) noted that improvements in knowledge-based products and services have no upper limits. While, according to Vicenzi (2000), the most successful organizations promote environments where creativity and innovation are occurring consistently at all levels and in all functions of the organization.

Figure 1. Scholarly articles with innovation in the title per 10,000 social science articles



Source: Fagerberg, Mowery, and Nelson (2006)

Original data sourced from the ISI Web of knowledge. Social science citation index (<http://apps.webofknowledge.com/>)

The significance of innovation is not restricted to business organizations. The US government has established several bureaus within the departments: the Office of Innovation and Entrepreneurship (OIE)<sup>5</sup>, housed within the U.S. Economic Development Administration; the

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<sup>5</sup> <http://www.eda.gov/oie/>

Office of Innovation and Improvement (OII)<sup>6</sup> and the Office of Investing in Innovation (Oi3)<sup>7</sup>, Innovation (M/PRI)<sup>8</sup>, the Under Secretary for Management's central management analysis organization which housed within the U.S. Department of state. The UK government created The Department for Business, Innovation & Skills (BIS) as a ministerial department of the United Kingdom Government on June 2009<sup>9</sup>. The UK's Department for Innovation, Universities, and Skills (2008) commented on the wider implications of innovation in the face of globalisation and environmental challenges by highlighting the importance of all types of innovation in creating and maintaining competencies and responding to environmental and demographic restrictions. Australian government formed The Department of Innovation, Industry, Science and Research (DIISR) in 2007, changed its name as The Department of Industry, Innovation, Science, Research and Tertiary Education in 2011, and currently succeeded as The Department of Industry and Science<sup>10</sup>. New Zealand government established The Ministry of Business, Innovation and Employment (MBIE) on 1 July 2012<sup>11</sup>. Besides, Ireland government<sup>12</sup>, and several provinces of Canadian governments have founded the Ministry or working groups relating the innovation: Ministry of Research and Innovation in the government of Ontario<sup>13</sup>; Ministry of Social Development and Social Innovation the government of British Columbia<sup>14</sup>.

International organizations are not exception. Many international organizations launched the institutes, laboratories or working groups regarding to the innovation. For instance, the World Bank and the OECD developed the Innovation Policy Platform (IPP)<sup>15</sup> as a joint initiative to provide policy practitioners around the world with a simple and easy-to-use tool, supporting them in the innovation policy-making process. The World Bank Innovation labs<sup>16</sup> support research and cross-sector collaboration to create ecosystem to foster social innovation and local

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<sup>6</sup> <http://www.ed.gov/edblogs/oii/>

<sup>7</sup> <http://www2.ed.gov/about/offices/list/oii/oi3/index.html>

<sup>8</sup> <http://www.state.gov/m/pri/>

<sup>9</sup> <https://www.gov.uk/government/organisations/department-for-business-innovation-skills>

<sup>10</sup> <http://www.industry.gov.au/Pages/default.aspx>

<sup>11</sup> <http://www.mbie.govt.nz/>

<sup>12</sup> <http://www.enterprise.gov.ie/en/>

<sup>13</sup> <http://www.ontario.ca/ministry-research-and-innovation>

<sup>14</sup> <http://www.sdsi.gov.bc.ca/ministry/index.htm>

<sup>15</sup> <https://www.innovationpolicyplatform.org/>

<sup>16</sup> <https://wbi.worldbank.org/wbi/stories/striking-poverty-ecosystems-innovation-and-role-innovation-labs>

co-production of solutions. UNICEF established Innovation Labs<sup>17</sup> which is open, collaborative incubation accelerators that bring business, universities, governments and civil society together to create sustainable solutions to the most pressing challenges facing children and youth.

There is agreement that to sustain their competitive position and strengthen it, organizations and economies must innovate and promote innovation. Innovation is a key policy and strategic issue. Definitely, innovation allows us to solve complex problems that cannot be solved by traditional, routine or common methods. Creating novel solutions to problems has fascinated many researchers in diverse disciplines. There is wide range of approaches in perspective of cognitive, biological, clinical, social, organizational, educational, historical, cultural, managerial and personal area. In spite of tremendous amount of information on the innovation, we still lack of how to evaluate innovative ideas and which thinking process encourages innovativeness.

### **1.1.2. Educational programs for promoting innovative idea creation**

Despite of its tremendous contribution to technological or theoretical innovation, academy has been dishonored for a long time by a lot of people who claim that it neglects the reality and insensitiveness of the rapid changes in real world. Furthermore, especially in the engineering school, Felder et al. (2000) noted that traditional instructional methods are not adequate to equip engineering graduates with the knowledge, skills, and attitudes required of them in the coming decades. In response to those criticisms and social needs, during the last decades, a number of research centers and departments have been founded focusing on the innovation for economic and social change. Many of these have multidisciplinary perspectives, much attention focusing on the need for innovation to be studied from different viewpoints. Accordingly, several journals and professional associations have also been founded to research on innovation. Reflecting the increasing needs for facilitating innovation, many academic institutions provide educational programs for promoting innovative ideas, for example, The Harvard Innovation lab<sup>18</sup>, Design

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<sup>17</sup> [http://www.unicef.org/innovation/innovation\\_73201.html](http://www.unicef.org/innovation/innovation_73201.html)

<sup>18</sup> <https://i-lab.harvard.edu/>

Social Innovation and Sustainability Lab<sup>19</sup>, The Global Innovation Design program<sup>20</sup>, The Entrepreneurship and Innovation Program<sup>21</sup>, and Kaospilot<sup>22</sup>.

Amongst them, the Hasso Plattner Institute of Design, better known as the d.school, at Stanford University is the most representative program. It cooperates with professionals in design thinking as a new mechanism for developing innovative ideas in all areas of life. It is based on the principle developed by D. Kelley, the founder of the design consulting firm IDEO, that innovation takes place when multi-disciplinary groups decide to create a common culture and develop the interface of differing opinions and perspectives. To promote design thinking, d.school proposed 44 methods such as brainstorming, two-by-two matrix, and point-of-view analogy<sup>23</sup>.

The d.school has disseminated its methods through partnership with several research institutes all over the world including the University of Tokyo. The i.school at the University of Tokyo was established in 2009 with the aim of fostering innovative leaders, and is tasked with the development and provision of educational programs for human-centered innovation<sup>24</sup>. 'Innovation' here means not only conventional conceptions of technology-driven innovation but also the creation of any kind of new values: adding values through introducing new ideas, methods, directions, opportunities, and solutions that meet new requirements, through more effective products, processes, services, and technologies that are readily available to users. Its main activities are to provide workshop programs with various social themes: e.g. corporate social responsibility (CSR) of Japanese companies in disaster-stricken areas, the improvement of housework technology for aging society and quality of life, creating new service business ideas in Indian market. The innovation workshop program at i.school encourages participants to generate new ideas based on analogical thinking as leverage into creating new ideas.

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<sup>19</sup> <http://www.desis-network.org/>

<sup>20</sup> <http://globalinnovationdesign.org/>

<sup>21</sup> <http://www.eip.umd.edu/>

<sup>22</sup> <http://www.kaospilot.dk/#>

<sup>23</sup> <http://dschool.stanford.edu/use-our-methods/>

<sup>24</sup> i.school website <http://ischool.t.u-tokyo.ac.jp/english/>

## **1.2. Objectives and the structure of research**

This study focuses on how people generate new ideas using analogical thinking in ideation phase and how to facilitate generating appropriate ideas through the innovation workshop. To design a workshop process that enhances innovation and creativity skills, an objective evaluation method for new ideas needs to be developed.

In response to this, this study aims to:

Firstly, it suggests an evaluation method for the new ideas created using analogical thinking. For developing an evaluation method, it is important to exclude subjective judgements as far as possible.

Secondly, based on the results from the proposed evaluation method, this study identifies factors which enhance appropriateness of ideas in innovation workshops. The factors should be controllable by the workshop facilitation. Thus, the scopes for analysis are including participants' performances in the categorization task as well as their thinking processes in idea generation task.

Lastly, this study will propose a workshop design method that facilitates an appropriate idea creation.

For the first objective, developing an evaluation method for new ideas created through analogical thinking, this research focuses on using analogical thinking for idea generation. To build logic for the development of an evaluation method, a large amount of literature survey has been conducted. And we tested the proposed method with empirical data collected from the outcomes of participants. The literature review includes studies from cognitive science, psychology, computer science, business management, behavioural studies, learning science, creative design research, and educational psychology. Although many of these studies do not directly support a format of workshop in generating ideas using analogical thinking, they provide theoretical and empirical backgrounds by reviewing on the creativity research in line with contexts. For developing an evaluation method in this study, the reviews on the creativity research covers: 1) how analogical thinking enables new idea generation; 2) how they define the key concepts of this studies, such as innovation, creativity, novelty, and appropriateness in each discipline; and 3) what kind of methods were applied to measure those key concepts. Throughout the literature survey on analogical thinking in idea generation, the major two axes for evaluating new ideas

were derived, which are superficial and structural similarity. Based on this, specific methods for analysis were developed on each axis. The proposed evaluation method in this study could be theoretically supported since its logic derived from the extensive review of previous studies. Moreover, it has pragmatic value as for the current phase of this study. The development of a new evaluation method requires a validation. However, the question of how to validate an evaluation method for the new ideas is a problematic issue.

For the second objective of this study, identification of factors which enhance appropriateness of new ideas in innovation workshop, this research firstly conducts the assessment on the new ideas based on the proposed method from the first objective of this study. Then it is followed with two main analyses: the assessment of each participant's performances in the group task, categorizing the given cases of 25 existing services based on the structures of its business mechanisms; and the analysis of each participant's thinking process based on the all notes they created during the innovation workshop. To assess the performance in categorization task, it is required to present an exemplary categorization. Four researchers, who have a high level of knowledge on the given cases, were selected as raters and asked to complete the same categorization task, which was given to the participants in innovation workshop. The exemplary categories were presented by cluster analysis of the results from the four raters and additional literature survey was conducted to validate the result from the four raters.

Also, to analyse each participant's thinking process, their idea generation process were coded in chronological order based on the notes they created for generating an idea. In addition, face to face interviews were conducted after the workshop to find out the creative moment leap, which is a participant produces the most insightful note of idea, by recalling their ideation process with viewing the flow of notes they created. During the interview session, participants indicated the most important notes to generate a new idea as an output of the task. Finally, the relationships between the appropriateness of ideas created and 1) the performance in the categorization task; as well as 2) the thinking process pattern of each participant were studied to identify factors which might enhance appropriateness of idea generation using analogical thinking.

The third objective could be fulfilled by the results from the identification of factors, mentioned in the second objective of this study. To propose a workshop design method for enhancing

appropriateness in idea creation, this research will suggest a couple of measures which enable us to promote thinking skills, and implement those measures in the innovation workshop to test its effectiveness. As a result, this proposed workshop design method would assist researchers and educators who are willing to promote innovation workshops.

### **1.3. Thesis structure**

Chapter 1 describes an introduction for the whole dissertation. It briefly explains the importance of research topic which meets the demands of the times and current academic trend responding to them. Then, it presents an outline of research objectives along with its methodology and the thesis structure.

Chapter 2 firstly introduces theoretical backgrounds and empirical investigations of analogical thinking, which is basic mechanism to be used for generating an idea in this research. After, it reviews the definitions of the key concepts and current evaluation methods regarding to the new ideas. Finally, this chapter examines which factors enable us to create appropriate ideas.

Chapter 3 explains how we sourced data including recruitment of the participants for innovation workshop, the APISNOTE software that records data, and the data coding scheme. In addition, most importantly, this chapter provides a detailed description of each process in the innovation workshop.

Chapter 4 proposes an idea evaluation method based on the logic from the literature survey, and it explains how to measure structural similarity and superficial similarity: cluster analysis of the results from the four professional raters and its validation by literature survey to judge structural similarity; and applying the latent semantic analysis for measuring superficial similarity.

Consequently, based on the results of analysis from the chapter 4, chapter 5 identifies possible factors which have contributed to generate an appropriate idea. In order to find out factors, this study analyzed the relationship between the appropriateness of ideas generated and participants' performances in the categorization task; as well as their thinking pattern in ideation process. It



conducts protocol analysis to assess the performance in the categorization task, and interview survey to analyze thinking process in the idea generation task.

Chapter 6 suggests a workshop design method to be applied for enhancing the appropriateness in generating a idea using analogical thinking. Then, the results from the new workshop design are compared with the results from previous workshops to examine the effectiveness of new workshop design.

Chapter 7 summarizes the outcomes of this research as well as its limitations. In addition, it also discusses future works needed for improving this research and suggesting its further developments.

## 2. Literature review

This research focuses attention on the use of analogical thinking for idea generation, thus, literature review begins by briefly discussing the role of analogical thinking in idea generation including major scientific discoveries and problem solving. Then this chapter outlines the basic mechanism of analogical thinking: superficial similarity; and structural similarity. Key concepts for evaluating the generated ideas, such as innovativeness, creativity or novelty will then be defined and the existing methods of assessment will be introduced. Finally, this chapter examines factors which influence on generating new ideas focusing on the person; the process; and the pressure, in other words, the environmental factor.

### 2.1 Analogical thinking for generating ideas

Numerous previous studies have supported analogical thinking as a key mechanism for creative idea generation because it can foster insight into new domain by analogizing to prior knowledge (Finke, Ward, & Smith, 1992; Gentner et al., 1997; Hesse, 1966; K. J. Holyoak & Thagard, 1989; Koestler, 1964; Perkins, 1997) Welling (2007) defined analogical thinking that “it implies the transposition of a conceptual structure from one habitual context to another innovative context. The abstract relationship between the elements of one situation is similar to those found in the innovative context.” An analogy “serves an explanatory function when it puts new concepts and principles into familiar terms. It serves a creative function when it stimulates the solution of existing problems, the identification of new problems and the generation of hypotheses” (Glynn et al., 1989)

Analogy is a cognitive process of transferring information or meaning from a particular subject (the source) to another particular subject (the target). Gentner and Jeziorski (1993) explained six principles of analogical reasoning as shown in the table 1.

Table 1. Modern principles of analogical reasoning

Structural consistency	Objects are placed in one-to-one correspondence and parallel connectivity in predicates is maintained.
Relational focus	Relational systems are preserved and object descriptions disregarded.
Systematicity	Among various relational interpretations, the one with the greatest depth - that is, the greatest degree of common higher-order relational structure - is preferred.
No extraneous associations	Only commonalities strengthen an analogy. Further relations and associations between the base and target - for example, thematic connections - do not contribute to the analogy.
No mixed analogies	The relational network to be mapped should be entirely contained within one base domain. When two bases are used, they should each convey a coherent system.
Analogy is not causation	That two phenomena are analogous does not imply that one causes the other.

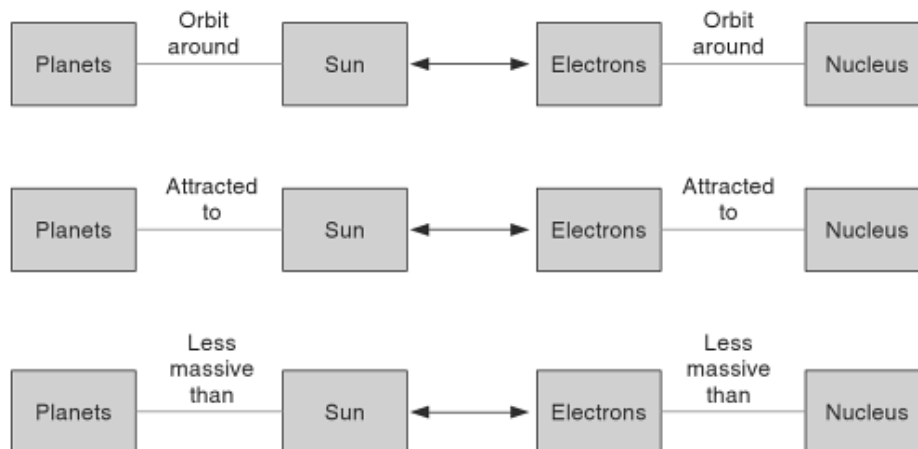
Metaphor is also often referred for explaining the analogical thinking. Both analogies and metaphors express comparisons and highlight similarities, but they do this in different ways (Duit, 1991). An analogy explicitly compares the structures of two domains; it indicates identity of parts of structures. A metaphor compares implicitly, highlighting features or relational qualities that do not coincide in two domains.

Empirical studies which examined how and to what extent analogical thinking influences creative thought are still not enough. However, according to several existing studies on the methods for generating new ideas, analogical thinking has the greatest theoretical supports as the driver of innovative thought beyond doubt. As a consequence, researchers in major disciplines accept the premise of previous studies (Clement, 2008; Goel, 1997; Hofstadter, 2008; K. J. Holyoak & Thagard, 1996) that analogical thinking plays a central role in innovation and creativity.

### **Analogical thinking in major scientific discoveries**

Historically, major scientific findings derived from everyday prosaic things. For example, Newton discovered the law of gravity by observing a falling apple, and Archimedes exclaimed eureka after discovering the principle of displacement from the water overflowing from his bathtub. In psychology, major evidences are historical and they analyze the role analogy in the scientific discoveries. For instance, Bell conceived of the early telephone by analogy with the inner workings of the ear. (W. B. Carlson & Gorman, 1992). Johannes Kepler (1571-1630), today best known for his three laws of planetary motion, was a prolific analogical thinker. Not only in his books but also in his journals and letters, he used analogies constantly (Gentner et al., 1997). In addition, Rutherford was recognizing that the structure of the atom entailed the principles of orbital motion, as exemplified in the solar system (Gentner, 1983). His analogy entails transferring the system of relations between solar and planetary bodies to the nucleus and electron. This example also illustrates the role of analogy in scientific discoveries (see the figure 2.)

Figure 2. Relational mappings between the solar system and hydrogen atom



Source: Nakatsu (2009) Reasoning with Diagrams: Decision-Making and Problem

Clement (2008) examined sources of creative scientific theory formation in the domain of non-formal reasoning. He provided scientific problems to professors and PhD candidates (ten

participants in total) in technical fields and videotaped their problem solving process with think-aloud. For the first task, all participants favored correct answer and eight people generated at least one analogy. As a result of the protocol analysis, the four major processes in a direct analogical inference for solving 'the problem A' were identified: 1) generating tentative analogous case B, 2) establishing confidence in the analogy relation between the A and the B, 3) understanding the case B, 4) inference projection from B to A. Furthermore, with analysis of the think aloud protocol transcript, he concluded that there were at least three types of analogy generation methods: 1) generation via a principle, 2) generation via a transformation, and 3) generation via an association. Among these three methods, the generation via transformation was observed as the most frequently used with 18 out of 31 analogies. Moreover, there were five analogous cases observed clearly novel, generated via transformation.

In addition, Ueda (2000) conducted interview survey to investigate how scientists actually use analogies in their remarkable scientific discoveries. He classified the observed cases of analogy according to the two criteria of similarity and transfer, and he found that four among those six types were actually used in the observed cases.

Many existing research have emphasized the main uses of analogy in the development of scientific theories and indicated why it has played an important role; analogies let people think about complex and vague subjects in simple or familiar terms. For example, to explain the electric circuit for people who are not well aware of it, the analogy of the water flow in a pipe is often used to enable us to understand a new concept in invisible domain more clearly with a well-known visible domain.

### **Analogical thinking for problem solving**

There are considerable numbers of studies have been made on problem solving or hypotheses formation by analogical thinking. People solve problems better if they have experienced associated or similar problems (K. J. Holyoak & Koh, 1987; Novick, 1988; Ross, 1987). In this context, Analogical thinking has been suggested as a basic mechanism inspiring creative tasks, in which people transfer information from well-known, existing categories, i.e., base or source domains to utilize it in constructing their new idea, i.e., the target domain (Finke et al., 1992;

Gentner et al., 1997; Perkins, 1997). Weisberg (1995) identified numerous creative ideas and solutions that information from a previous situation is transferred to the new situation that is analogous to the old. Gentner et al. (1997) claimed that creativity is best realized with deeply structured representations that are relatively firm, structurally guided alterations. The use of analogical thinking is an important for theory formation, design and construction (Sarlemijn & Kroes, 1988). Moreover, Bingham and Kahl (2013) noted that analogical thinking is a highly effective tool for companies and organizations to cope with significant change and innovation.

Gick and Holyoak (1980) conducted an experiment with university students regarding the problem solving using Duncker's radiation problem (Duncker & Lees, 1945)<sup>25</sup>. Participants were provided with a story about a general who is trying to capture a fortress controlled by a dictator and needs to get his army to the fortress at full strength. Because the entire army could not pass safely along any single road, the general sends his men in small groups down several roads simultaneously. Arriving at the same time, the groups join together and capture the fortress. A few minutes after reading this story under instructions to read and remember it along with two other irrelevant stories, participants were asked to solve a Duncker's radiation problem. Without a source analog, only about 10% of them produced the solution. When the general story had been studied, but no hint to use it was given, only about 20% of participants produced the solution. Conversely, when the same participants were then given a simple hint that "you may find one of the stories you read earlier to be helpful in solving the problem," about 75 % succeeded in generating the analogous solution. In other words, people often fail to notice superficially dissimilar source analogs that they could readily use.

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<sup>25</sup> Suppose you are a doctor faced with a patient who has a malignant tumor in his stomach. It is impossible to operate on the patient; but unless the tumor is destroyed the patient will die. There is a kind of ray that can be used to destroy the tumor. If the rays are directed at the tumor at a sufficiently high intensity the tumor will be destroyed. Unfortunately, at this intensity the healthy tissue that the rays pass through on the way to the tumor will also be destroyed. At lower intensities the rays are harmless to the healthy tissue but they will not affect the tumor either. What type of procedure might be used to destroy the tumor with the rays, and at the same time avoid destroying the healthy tissue?

Dunbar (2001) found out that structural analogies are not a rare event in both science and politics. His research team recorded video and audio from three months to a year in leading molecular biologists and immunologists in the United States, Canada, and Italy, as they think and reason at their laboratory meetings. Afterward, they analyze the types of thinking and reasoning that they use for formulating theories, analyzing data, and designing experiments, sentence by sentence. Furthermore, they supplement the meetings with interviews and other documents such as grant proposals, drafts of papers, and one-on-one meetings. They called this approach *the in vivo* cognitive approach, whereas the *in vitro* cognitive approach is bound with experimental conditions. On top of that, they investigated the use of analogy in a naturalistic context of politics with analyzing politicians' and journalists' use of analogy in newspaper articles during the final week of the referendum campaign. Comparing between *in vivo* and *in vitro* approaches, he concluded that analogy seems easy in naturalistic contexts, while it is difficult in the psychological laboratory. People frequently make analogies that are based on deep structural features and have little superficial overlap between the source and the target.

### **Analogical thinking in creative design**

Analogical thinking also appears to play a key role in creative design: analogical design involves reminding and transfer of elements of a solution for one design problem to the solution for another design problem (Goel, 1997). Cross (2011) conducted research to understand how designers think and work, allowing people to identify what is design thinking. After several interviews with professional designers and observation of their working process, he discovered that their inspirations are arisen prosaically by applying an analogy and this analogy-making encourages creative thinking.

Casakin and Goldschmidt (H. Casakin, 1997; H. P. Casakin & Goldschmidt, 2000) investigated empirically if the use of analogy enables subjects perform better in solving problems. In their research, three groups of subjects with varying design experience participated in the experiments: experienced architects, advanced architecture students and novice architecture students. Each subject solved a number of well-defined, which have one correct solution, and ill-defined, which have any number of acceptable solutions, design problems that were presented

under three conditions: a) The design problem was administered with no additional material or commentary; b) The design problem was administered while the subject was also shown a panel with visual displays (approximately two dozen images), some of which could be used as source analogues for the problem, and some that could not be related to it in any way; c) Same as b), but subjects were also explicitly encouraged to identify relevant images among the displays and use them as source analogues in their designing. All subjects were asked to present the solutions to the design problems were expressed in sketch form, on one or more sheets of paper. These sketch-designs were assessed by three judges of experienced architects: quality and creativity of the solutions for the ill-defined problems were evaluated on a scale of five points. The assessment results were reliable because the degree of agreement among the judges was very high and the scores are analysed as show in the table 3. For ill-defined problems solving, all the subjects, regardless of their level of experience, obtained significantly higher scores when using cues, and giving them instructions to use analogy.

Table 2. Design quality scores, novice and experienced designers under different problem solving conditions

		Novice designers (students)				Expert designers (architects)	
		Well-defined		Ill-defined		Well-defined	Ill-defined
		Begin.	Advan.	Begin.	Advan.		
Baseline (control)	No display provided No instructions to use analogy	--	--	2.227	2.58	--	2.809
Design quality improvement	Displays provided No instructions to use analogy	p<.469	p<.541	2.621 p<.039	2.939 p<.092	p<.091	3.236 p<.046
Additional design quality improvement	Displays provided Instructions to use analogy given	p<.063	p<.042	3.463 p<.001	3.731 p<.002	p<.148	3.984 p<.001

Source: Goldschmidt (2001), p213



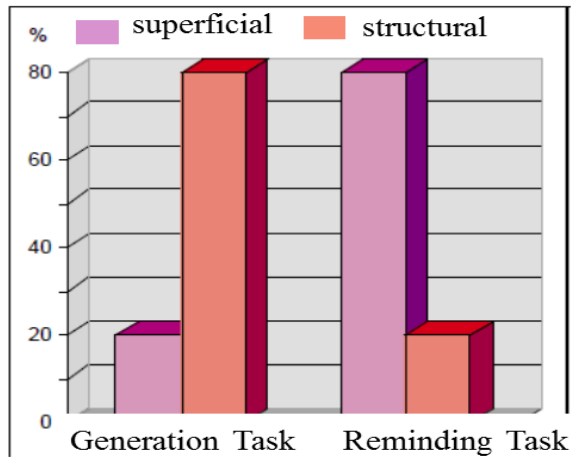
## **2.2 Superficial similarity and structural similarity in analogical thinking**

Dunbar (1995) focused on scientific analogies and he identified three different kinds of analogy as follows: 1) local analogies, one part of one experiment is related to a second experiment ; 2) regional analogies, involving systems of relationships applied in one domain but used in a similar domain ; 3) long distance analogies, a system is found in applied in a different domain. In addition, Nathalie Bonnardel and Marmèche (2004) described that analogy-making allows two kinds of analogies: intra-domain analogies, when the target (e.g. the situation or problem at hand) and the source (a previous similar situation) belong to the same conceptual domain; inter-domain analogies, when the target and the source belong to different conceptual domains.

Blanchette and Dunbar (2000) claimed that analogies are generated by superficial or structural similarities from the memory. They asked 49 participants to produce as many analogies as possible on the topic of pro-zero deficit and anti-zero deficit and they identified structural similarity as the resemblance in the underlying systems of relations between the elements of the sources and the target: Ten different categories of underlying structures were identified through the grouping process, five for each viewpoint (Anti and Pro-zero deficit). For instance, in the anti-zero deficit condition, the most frequently used statement structure was "If cut X, then negative consequence". In this case, the specific objects representing both "X" and "negative consequence" varied in the sources. Likewise, in the pro-zero deficit condition, the most frequently used statement structure was "If Y is not solved, and then negative consequences", and the objects matching to "Y" and "negative consequence" varied in the sources.

In their later study, Dunbar and Blanchette (2001) found out that the generation task motivated people to use more structural similarity. In generation task, subjects were asked to generate sources for a given target, while in reminding task, subjects were given various sources to read and then, given new stories and asked which old stories they were reminded of by the new stories. This study revealed that in the generation task, people can and do use analogical sources that do not have superficial features in common with the target. Most of the analogies were generated (80%) dependent from superficial features of a given target. However, when the task was changed to a reminding task our results mirrored those of research on analogical reminding – people used predominantly superficial features (see the figure 3).

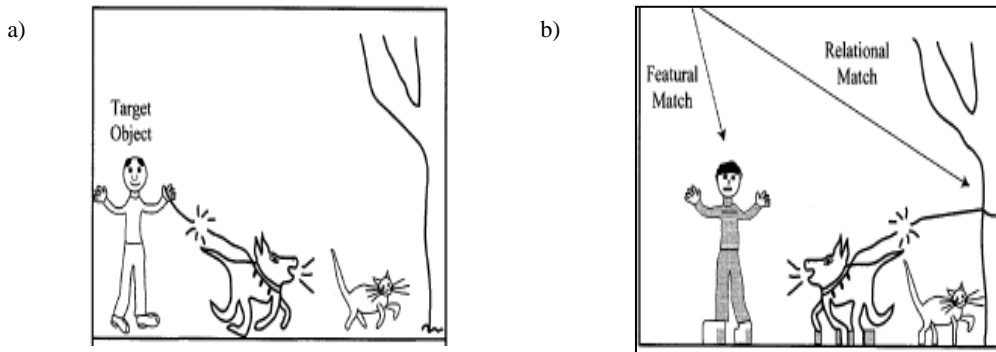
Figure 3. Types of sources used by subjects in experimental situations, as a function of generating analogies or being asked which source they are reminded of



Source: Dunbar and Blanchette (2001)

Superficial similarity refers to the resemblance of their properties between the objects in the source and target (Keane, Ledgeway, & Duff, 1994). For example, when people examined two pictures in the figure 4, and were asked to indicate which object in the picture b) could be match to the boy in the picture a), they are more likely to map it to the man in the picture b) based on superficial similarity while people who consider the relation among the objects and of higher-order relations between relations, i.e. structural similarities, map it to the tree in the picture b).

Figure 4. A picture-mapping paradigm introduced by Markman and Gentner (1993)



Many studies suggest that the structural similarity could be presented by matching the relation of each element in one idea to the other idea by introducing the structure-mapping framework (Falkenhainer, Forbus, & Gentner, 1989; Forbus, Ferguson, & Gentner, 1994; Forbus & Oblinger, 1990; Gentner, 1983). Intra-domain analogies would be based on both superficial similarities and structural similarities between the target and the sources, whereas inter-domain analogies would be based only on structural similarities (or underlying principles) between the target and the sources.

For creative idea generation, it needs to adopt not superficial similarity but structural similarity in using analogical thinking. In other words, long distance analogy, i.e. cross-domain analogy enables us to generate more novel ideas than local analogy, i.e. within-domain analogy, or regional analogy, i.e. similar-domain analogy. The process of structural comparison acts as a bridge by which similarity-based processes can give rise to abstract rules (Dedre Gentner & José Medina, 1998). Carrying out an analogy can lead to a schematic structure in which the domain objects are replaced by variables, while retaining the common relations (Winston, 1982)

Especially for creative designers, cross-domain analogy play important role in creative idea generation. For instance, Le Corbusier, who made frequent use of analogical reasoning, transferred the structural principle of the double-membrane shell to the roof for designing the Ronchamp chapel. Afterwards, adjustments were made to guarantee the proper functioning of this concrete shell to its role as a roof, including insulation, drainage, as well as aesthetic and

structural properties concerning the large overhangs that shape the building with its special silhouette (Goldschmidt, 2001).

Many authors have argued that structural similarity is the crucial defining feature of analogical thinking. The power of analogical thinking is to reveal common structure and to import structure from a well-articulated domain into a less coherent domain makes it the foremost instrument of major theory change (Gentner et al., 1997). Holyoak, Lee, and Lu (2010) defined analogical thinking as focusing on abstract relational categories. Goldschmidt (1995) affirmed that the carrying over of surface features only, without a structural similarity to underpin them, may lead to a false analogy and consequently to a wrong solution to a problem.

## **2.3 Current evaluation methods for new ideas**

It has long been acknowledged that creativity is one of the most complex of human functions and that it is also one of the most difficult psychological constructs to define and measure (Hoccar, 1981). Researchers have been dissatisfied with definitions related to the creativity or innovativeness of new ideas, as well as evaluation methods of assessing new ideas.

To develop an evaluation method, it is important to define the related concepts. Thus, this section reviews definitions on innovation, creativity, novelty, and appropriateness, subsequently, it describes how existing evaluation methods are measuring those concepts.

### **2.3.1 Definitions: Innovation; Creativity; Novelty; Appropriateness**

In early studies, Schumpeter (1934) defined innovation as new combinations of existing resources, which are economically more viable than the old way of doing things. As an economist, he put more emphasis on commercialization role of innovation which differentiating itself from invention. However, innovation is not limited to only in market. For instance, in a domain of technology, innovation can be recognized by the job that the technology in question lets you do (Johnson, 2010). In terms of job, *ceteris paribus*, a discovery that lets user carry out

two new jobs which were impossible before its development is twice as innovative as a discovery that allows user to execute one new job despite the complexity of technology.

There exist various definitions on innovation. Baregheh, Rowley, and Sambrook (2009) collected 60 definitions of innovation from the various disciplinary literatures.<sup>26</sup> They analyzed the frequency of words which appeared in each set of definitions and found that the “new” has been repeated 76 times where there are only 60 definitions of innovation. Davenport (2013) defined simply, “innovation is, of course, the introduction of something new.”

Table 3. A sample list of various definitions on innovation

Barnett (1953)	“An innovation is ... any thought, behavior or thing that is <u>new</u> because it is qualitatively <u>different from existing</u> forms”
Thompson (1965)	“Innovation is the generation, acceptance and implementation of <u>new ideas</u> , processes products or services”
West and Anderson (1996)	“Innovation can be defined as the effective application of processes and products <u>new to the organization</u> and designed to benefit it and its stakeholders”
Kimberly (1981)	“There are three stages of innovation: innovation as a process, innovation as a discrete item including, products, programs or services; and innovation as an attribute of organizations.”
Van de Ven (1986)	“As long as the idea is <u>perceived as new to the people</u> involved, it is an ‘innovation’ even though it may appear to others to be an ‘imitation’ of something that exists elsewhere”.
Damanpour (1996)	“innovation is broadly defined to encompass a range of types, <u>including new product or service, new process technology, new organization structure or administrative systems, or new plans or program</u> pertaining to organization members.”

<sup>26</sup> 18 definitions from business and management (1966 to 2007); nine definitions from economics (1934 to 2004); six definitions from organization studies (1953 to 2008); nine definitions innovation and entrepreneurship (from 1953 to 2007); 13 definitions from technology, science and engineering (1969 to 2005); three definitions from knowledge management (1999 to 2007); and two definitions from marketing (1994 to 2004).

Du Plessis (2007)	Innovation as the <i>creation of new knowledge and ideas to facilitate new business outcomes</i> , aimed at improving internal business processes and structures and to create market driven products and services. Innovation encompasses both radical and incremental innovation.
Becker and Whisler (1967)	Innovation is a process that follows invention, being separated from invention in time. Invention is the creative act, while innovation is the first or early employment of an idea by one organization or a set of organizations with similar goals.

Source: Baregheh et al. (2009), Seidler-de Alwis and Hartmann (2008)

Generally, innovation is referred with creativity. Amabile (1988) claimed that innovation is built on creative ideas as the basic of elements. Subsequently, Amabile et al. (1996) initiated their research based on the thought that “All innovation begins with creative ideas.” Successful implementation of new programs, new product introductions, or new services depends on a person or a team having a good idea, and developing that idea beyond its initial state. They defined creativity as the production of novel and useful ideas in any domain and innovation as the successful implementation of creative ideas within an organization. Likewise, Nyström (1993) viewed innovation as “the result and implementation of creativity. It is process of bringing new ideas into use.”

However, innovation is different from creativity. Innovation certainly requires some level of originality, but not maximum level of novelty, while creative thinking can benefit from maximum level of originality (Runco, 2014), as shown in the figure 5.

Figure 5. Proposed continuum allowing a balance of originality and effectiveness in creative effort



There are myriad definitions on creativity. Remarkably, one common thread in these definitions is the notion of novelty. This is a mandatory characteristic in any creative artifact. Csikszentmihályi (1990) described creativity as something that begins with the individual, who has an idea or product that influences the field, which is a group of appropriate judges, and eventually changes a domain, for example, art, music, science. The creative product must be something different from what the evaluator knows or is expecting (Gomes et al., 2006). Ford (1995) described creativity as having a "subjective judgment of the novelty and value of an outcome of an individual's or a collective's behavior". Stein (1974) defined creativity as “novelty that is useful.” a creative idea as a quality idea that is also novel. In other words, creativity results in generating some novel result, which is useful and different from that which already exists.

Figure 6. Relationships between creative and novel



Source: Dean, D. L., et al. (2006). "Identifying quality, novel, and creative Ideas: Constructs and scales for idea evaluation." *Journal of the Association for Information Systems* 7(10): 646-698.

Novelty is a key construct for measuring the creativity of ideas. Morgan (1953) reviewed a large number of definitions of creativity and showed that the single common element was novelty. The cognitive approach to creativity emphasizes the processes involved in producing effective novelty (Cropley, 1999). Simon (1995) regarded novelty as the core of creativity. He defined creativity operationally, in full accordance with general usage, as novelty that is regarded as having interest or value: economic, esthetic, moral, scientific or other value.

According to the Encyclopedia of creativity (Runco & Pritzker, 1999), novelty is defined as original, innovative, or creative, in other words, it is also described as unusual, new and useful or

domain-changing (Stokes, 1999). MacCrimmon and Wagner (1994) defined a novel idea as one that had not been previously expressed. Dean et al. (2006) defined novelty as the degree to which an idea is rare, original and modifies a paradigm: The rarity of an idea can be determined by counting the number of times an idea occurs in a set of ideas; Originality is defined as the degree to which the idea is not only rare but is also ingenious, imaginative, or surprising; Paradigm relatedness is defined as the degree to which an idea is paradigm preserving (PP) or paradigm modifying (PM). PM ideas are sometimes radical or transformational.

Bruner (1979) implied appropriateness in his definition of creativity as “effective surprise”. Similarly, Mednick (1962) defined creativity as the forming of associative elements into new combinations that meet new requirements or are in some way useful. Sternberg (2001) defined creativity as the potential to produce novel ideas that are task appropriate and high in quality. In the empirical research, usefulness or some other quality of ideas assessed indicative of appropriateness (Harrington, Block, & Block, 1983; Milgram et al., 1978; Mobley, Doares, & Mumford, 1992; O'Quin & Besemer, 1989; Yamamoto, 1965).

### **2.3.2 Evaluation methods on new ideas**

Despite all of this attention to the innovativeness, the assessment method on new ideas is still problematic. The measurement methods for creativity or appropriateness of new ideas used at present are controversial because they involve subjective judgments, are time consuming, lack comprehensiveness, and adopt instruments that have no theoretical grounding (Salcedo, 2006).

In practice, companies or designers usually evaluate innovation ideas with a small group of experts based on the criteria which are defined with their attributes by the purpose of the idea development. However, there is no guarantee that judges will understand and be guided by the sometimes complex definitions, and there is little research that shows the instructions even make a difference (Hocevar, 1981). Probably, each judge considers different criteria according to his or her level of personal creativity and other cognitive characteristics, personality traits, self-expression, enthusiasm, productivity, and expertise.

Blair and Mumford (2007) reviewed the literature on idea evaluation and identified 12 attributes that people use when evaluating ideas: 1) Risky (high probability of incurring a loss); 2) Easy to



understand; 3) Original; 4) Complete description (provides detailed steps needed to make the idea work); 5) Complicated; 6) Consistent with existing social norms; 7) High probability of success; 8) Easy to implement; 9) Benefits many people; 10) Produces desired societal rewards; 11) Time and effort required to implement; 12) Complexity of implementation

For evaluating ideas, it is possible that certain characteristics of the judges may moderate the result of assessment. For example, highly creative people (Basadur, Runco, & Vega, 2000) and people who have substantial expertise working in a domain (Weisberg, 1999) may apply different standards in evaluating ideas. Many researchers have discussed the relevance of idea evaluation, only a few studies have expressly examined how idea evaluation operates (Lonergan, Scott, & Mumford, 2004).

In past studies, numerous kinds of measures have been used to evaluate ideas, and each measure had its own set of limitations. Specifically, in single-dimension measure of idea evaluation, raters may consciously or unconsciously include multiple constructs in a single rating (Dean et al., 2006). Similarly, in multidimensional measures, raters also may consciously or unconsciously be influenced by other dimensions or sub-dimensions. Furthermore, even though the guideline on evaluation is given to raters, different raters may have different biases, point of views, and standards.

Furthermore, risk avoiding behaviors in assessing the new ideas are also problematic. Since Schumpeter (1934) has introduced theoretical definition of innovation as new combinations of existing resources, which are economically more viable than the old way of doing things, people have put more emphasis on commercialization role of innovation which differentiating itself from invention. Rogers and Adhikarya (1979) observed what kind of standards people routinely apply in evaluating new ideas and found that low implementation cost, consistency of the idea with extant systems, and rate of return influenced the adoption of new ideas. Prior studies indicate that people actively seek to eliminate original high risk ideas (De Dreu, 2003; Suri & Monro, 2003). Blair and Mumford (2007) found that people preferred ideas that fit social norms, were likely to produce the desired outcomes quickly, were complex to implement, were easy to understand, and benefited many people. They were likely to reject risky and original ideas. But when they were placed under time pressure, people selected riskier and more original ideas-

suggesting that what people are doing with their extra time is screening out risky and original ideas. However, it is important to recognize these pragmatic, economic standards are not the only attributes people might consider in appraising new ideas.

Distinctly, there are some studies which tried to evaluate the novelty of ideas with less subjectivity. Connolly, Routhieaux, and Schneider (1993) focused on the rarity: the rarer the idea, the lower its rarity score. Connolly, Jessup, and Valacich (1990) conducted computer-based group brainstorming with 72 students to generate ideas for solving problems regarding the parking problems inside the campus. The rarity was determined by counting the number of subjects who proposed the same idea. This research calculated rarity by computing the reciprocal of the number of idea occurrences, in other words, the rarer the idea, the higher its rarity score. However, this approach has limitations because the result will be changed by the number of ideas in an idea pool, and it is not easy to differentiate each idea as repetitive with another idea or slightly different from another idea.

To evaluate the generated ideas using analogical thinking, it is necessary to examine the similarities and differences between elements (Berlyne, 1960). Blanchette and Dunbar (2000) assessed superficial similarity according to the semantic similarity between the source and target in terms of their domain of origin: in their experiment, target was fixed to the deficit problem, analogies coded as within-domain were analogies for which the source was taken from the domains of either politics, economics, or personal finances. Sources from these three domains have a high degree of superficial similarity with the target problem. Analogies with sources from any other domain, such as animal, farming, or eating, were coded as other-domain analogies.

## **2.4 Factors for creative idea generation**

The two most important points to be addressed in this chapter are: 1) what is an appropriate idea generated using analogical thinking; 2) how it is generated. While the chapter 2.2 explains the first point, this chapter covers existing studies regarding to “how the appropriateness of new idea can be enhanced”.

There are many kinds of possible factors which may enhance the quality of idea in terms of the creativity: physical exercise (Steinberg et al., 1997); relaxation for stress reduction (Khasky & Smith, 1999); self-disclosure, sharing private thoughts (Pennebaker, Kiecolt-Glaser, & Glaser, 1997); manipulations of the human brain, such as stimulating using pulses to frontal lobes (Snyder et al., 2003); emotional process such as motivation, attitude, interest (Albert & Runco, 1988); adversity, such as severe frustrations, deprivations and traumatic experiences (MacKinnon, 1992) ; the family such as parents (Runco & Albert, 2005); peer status such as popularity among peer group (Lau & Li, 1996); social influences (R. Collins, 2000).

In creativity studies, the 4Ps (Person; Process; Product; and Press) are widely accepted framework (Rhodes, 1961). This framework have been approached structurally (Guilford, 1959a;1959b), and experimentally (Maltzman, 1960). Amongst the 4Ps, this study, in a perspective of an educational program designer, is focusing on thinking processes, which are able to be instructed through the workshop facilitation. To understand the theoretical background of thinking processes in generating an idea, it is important to grasp the context in early study of creativity.

## **Personality**

In early studies, creativity was not believed to be a normally distributed trait (Nicholls, 1972). Also, creativity tended to be regarded as a fixed inborn trait. Numerous researchers have attempted to delineate a core set of personality characteristics inherent in the creative individual.

In 1949, the IPAR(Institute of Personality Assessment and Research) was founded to conduct research focusing on the relations between personality and performance, with forays into higher levels of human performance such as creativity, aesthetics, leadership, and profession-specific accomplishments. IPAR pioneered the notion that a full understanding of personality requires viewing the individual in a number of different situations. This was accomplished through intensive multi-day assessments, which included administration of self-report inventories, careful observation of behavior in structured and unstructured situations, and detailed in-depth interviews. Along with this trend, Guilford (1950) defined creativity as abilities that can be found in creative people, emphasizing a “person” approach to creativity. Osborn (1953) studied

creative people to see how they came up with ideas and creative solutions and developed Creative Problem Solving (CPS) process. Parnes (1967) confirmed that CPS can be taught, so that people can learn to improve the way they think and solve problems. Afterward, several research projects were conducted on personal characteristics, interrelationships between participants, and their implications for instruction.

Consequently, several instruments were developed to measure the individual difference regarding to creativity. Torrance (1974) found 103 studies designed to enhance creativity, and developed the Torrance Tests of Creative Thinking(TTCT). TTCT is a set of divergent thinking tests that provides scores in fluency (the number of ideas produced), flexibility (the number of different types of ideas produced) and originality (the uniqueness of the ideas) in both verbal and figural form. Kirton (1976) described two cognitive styles, adaptive and innovative and developed the KAI(Kirton Adaptation-Innovation Inventory). Also, there are the Gregorc Style Delineator (Gregorc, 1982), the PEPS; Productivity Environmental Preference Survey (Dunn, Dunn, & Price, 1982), and the MBTI; Myers-Briggs Type Indicator (Myers, McCaulley, & Most, 1985). These approaches are based on a premise that creativity associate with certain types of characteristics as well as certain level of the creative abilities: e.g. openness to experience, tolerance toward ambiguity, resistance to premature closure, curiosity and risk-taking, etc.

Many studies have examined the relationship between 16PF scores and creativity (See the table 4). Consistent predictors of creativity include high scores on Dominance (E+), Social Boldness (H+), and Openness-to-Change (Q1+); low scores on Tough-Mindedness (in the Receptive or open direction) and its traits of Openness-to-Change (Q1+), Sensitivity (I+), and Abstractedness (M+); and somewhat below average scores on Self-Control (unrestrained). (Cattell & Mead, 2008)

Table 4. Primary factors and descriptors in Cattell's 16 personality factor model

Descriptors of low range	Primary factor	Descriptors of high range
Impersonal, distant, cool, reserved, detached, formal, aloof	<b>Warmth</b>	Warm, outgoing, attentive to others, kindly, easy-going, participating, likes people
Concrete thinking, lower general mental capacity, less intelligent, unable to handle	<b>Reasoning</b>	Abstract-thinking, more intelligent, bright,

abstract problems		higher general mental capacity, fast learner
Reactive emotionally, changeable, affected by feelings, emotionally less stable, easily upset	<b>Emotional Stability</b>	Emotionally stable, adaptive, mature, faces reality calmly
Deferential, cooperative, avoids conflict, submissive, humble, obedient, easily led, docile, accommodating	<b>Dominance</b>	Dominant, forceful, assertive, aggressive, competitive, stubborn, bossy
Serious, restrained, prudent, taciturn, introspective, silent	<b>Liveliness</b>	Lively, animated, spontaneous, enthusiastic, happy-go-lucky, cheerful, expressive, impulsive
Expedient, nonconforming, disregards rules, self-indulgent	<b>Rule-Consciousness</b>	Rule-conscious, dutiful, conscientious, conforming, moralistic, staid, rule bound
Shy, threat-sensitive, timid, hesitant, intimidated	<b>Social Boldness</b>	Socially bold, venturesome, thick-skinned, uninhibited
Utilitarian, objective, unsentimental, tough minded, self-reliant, no-nonsense, rough	<b>Sensitivity</b>	Sensitive, aesthetic, sentimental, tender-minded, intuitive, refined
Trusting, unsuspecting, accepting, unconditional, easy	<b>Vigilance</b>	Vigilant, suspicious, skeptical, distrustful, oppositional
Grounded, practical, prosaic, solution oriented, steady, conventional	<b>Abstractedness</b>	Abstract, imaginative, absent minded, impractical, absorbed in ideas
Forthright, genuine, artless, open, guileless, naive, unpretentious, involved	<b>Privateness</b>	Private, discreet, nondisclosing, shrewd, polished, worldly, astute, diplomatic
Self-assured, unworried, complacent, secure, free of guilt, confident, self-satisfied	<b>Apprehension</b>	Apprehensive, self-doubting, worried, guilt prone, insecure, worrying, self blaming
Traditional, attached to familiar, conservative, respecting traditional ideas	<b>Openness to Change</b>	Open to change, experimental, liberal, analytical, critical, free-thinking, flexibility
Group-oriented, affiliative, a joiner and follower dependent	<b>Self-Reliance</b>	Self-reliant, solitary, resourceful, individualistic, self-sufficient
Tolerates disorder, unexacting, flexible, undisciplined, lax, self-conflict, impulsive, careless of social rules, uncontrolled	<b>Perfectionism</b>	Perfectionistic, organized, compulsive, self-disciplined, socially precise, exacting will power, control, self-sentimental
Relaxed, placid, tranquil, torpid, patient, composed low drive	<b>Tension</b>	Tense, high energy, impatient, driven, frustrated, over wrought, time driven.

Source: adapted from Conn and Rieke (1994)

However, many researchers indicate that everyone, to some degree, may hold these characteristics. Nicholls (1972) suggested the concept of creativity as a normally distributed trait. In addition many studies have found a few consistent correlations between personality

characteristics and various measures of creativity (Wolfradt & Pretz, 2001). Dyer, Gregersen, and Christensen (2009), after spending 8 years interviewing senior executives of large companies, found that top executives rarely mentioned an innovative business idea that they had personally generated. Even if two individuals have the same genetic creative ability, one who more frequently engaged in discovery skill will be more successful at creative problem solving.

## **Thinking process**

Since 1970s, focus of the creativity research had moved from the personality to the process. In the 1970s, shortly after funding for IPAR and other personality studies had declined dramatically, a second wave of psychologists began to study creativity in a new way (Feldman, Csikszentmihalyi, & Gardner, 1994).<sup>27</sup> Research psychology was changing dramatically during the 1960s and 1970s. In other words, it is not any more a matter of who is capable to generate creative ideas, but how it is possible to generate creative idea and what is a creative idea as an outcome of the thinking process. Instead of studying traits and personality differences, cognitive psychologists analyze mental processes that are shared by all individuals.

People used to believe that creative idea comes from the sudden moment of insight which involves in unconscious mind. Many of the creativity beliefs argue that we tend to think that ideas emerge spontaneously, from the unconscious mind of the creator. Creativity may sometimes be significantly influenced by serendipity, chance, and accidents (Runco, 2014). Creative inventions and ideas often are found by accident, or at least with some unintentionality. Jones (2011) listed the examples of fifty accidental discoveries in history, for example, coffee, raisins, vinegar, microwave oven, matches, artificial sweeteners, and so on.

However, many cognitive psychologists theorized creative thinking process which contradicts to the belief on the sudden moment of insight. Cognitive psychologists claim that the reason of more creative people existence can be explained by variations in the use of specific, identifiable processes. They examined the representational structures of the mind, their interconnections, and

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<sup>27</sup> In 1992, reflecting this change, the IPAR(Institute of Personality Assessment and Research) changed its name to the Institute of Personality and Social Research. (source: <http://ipsr.berkeley.edu/about.html>)

the mental processes that transform them to explain creativity by showing how it emerges from the cognitive abilities that everyone shares. Recent studies in the fields of cognitive psychology support that creativity takes place over time, and most of the creativity occurs while doing the work.

Psychologists have been studying the creative process for decades, and they've observed that creativity tends to occur in a sequence of stages. Sawyer (2012) proposed eight stages of the creative process as follows:

1. **Find and formulate the problem.** The first step is to identify a good problem and to formulate the problem in such a way that it will be more likely to lead to a creative solution.
2. **Acquire knowledge relevant to the problem.** Creativity is always based on mastery, practice, and expertise.
3. **Gather a broad range of potentially related information.** Creativity often results from alert awareness to unexpected and apparently unrelated information in the environment.
4. **Take time off for incubation.** Once you've acquired the relevant knowledge, and some amount of apparently unrelated information, the unconscious mind will process and associate that information in unpredictable and surprising ways.
5. **Generate a large variety of ideas.** Unconscious incubation supports the generation of potential solutions to the problem, but conscious attention to the problem can also result in potential solutions.
6. **Combine ideas in unexpected ways.** Many creative ideas result from a combination of existing mental concepts or ideas.
7. **Select the best ideas, applying relevant criteria.** The creative process typically results in a large number of potential solutions. Most of them will turn out not to be effective solutions; successful creators must be good at selecting which ideas to pursue further.
8. **Externalize the idea using materials and representations.** Creativity isn't just having an idea; creative ideas emerge, develop, and transform as they are expressed in the world.

Regarding the 2<sup>nd</sup> and 3<sup>rd</sup> stage mentioned above, creativity requires a substantial amount of domain knowledge. Weisberg (1995) examined the role of knowledge in creativity and identified a number of creative ideas and solutions where “information from a previous situation is transferred to the new situation that is analogous to the old”(p.62). However, creativity goes beyond knowledge. Knowledge may provide the basic elements, to generate new ideas, it is important that keeping a certain distance from the old ideas. Thus, while it is universally acknowledged that one must have knowledge of a field if one hopes to produce something new within it, it is also widely assumed that too much experience can leave one in conventional thinking, so that one cannot go beyond stereotyped responding. The relationship between knowledge and creativity is assumed to be shaped like an inverted U, with maximal creativity occurring with some middle range of knowledge.

Taking time and generating a large variety of ideas, mentioned in the 4<sup>th</sup> and 5<sup>th</sup> stage above, are also crucial. Wallas (1926) identified a stage of incubation, during which ideas seem to churn and work in the creative person's head until the required answer pops up. However, in later studies, Mumford and Whetzel (1996) concluded that sudden insights do occur, but explained them in terms of cognitive mechanisms in four areas: representation, constraints, structure, and selective processing

Czikszentmihalyi and Getzels (1988) led a research team for study of the creative process of fine art painters, with his question: “How do creative works come into being?” Aspiring artists were instructed to choose and rearrange the objects in the studio and draw them. They found there are two types of artists. The type 1 artists took only a few minutes to choose a few objects from among the 27 presented and they sketched an overall composition in a couple of minutes. On the other hand, the type 2 artists spent 5 or 10 minutes looking at the 27 objects, turning them around to see them from all angles. Even after sketching, they changed their mind again and put back and choose different one then, 20 or 30 minutes later they came up with a new idea. After an hour they settled on an idea and finally finished sketching in five or ten minutes. As a result, the type 2 paintings were judged to be far more creative, by a team of 5 professors in the Art



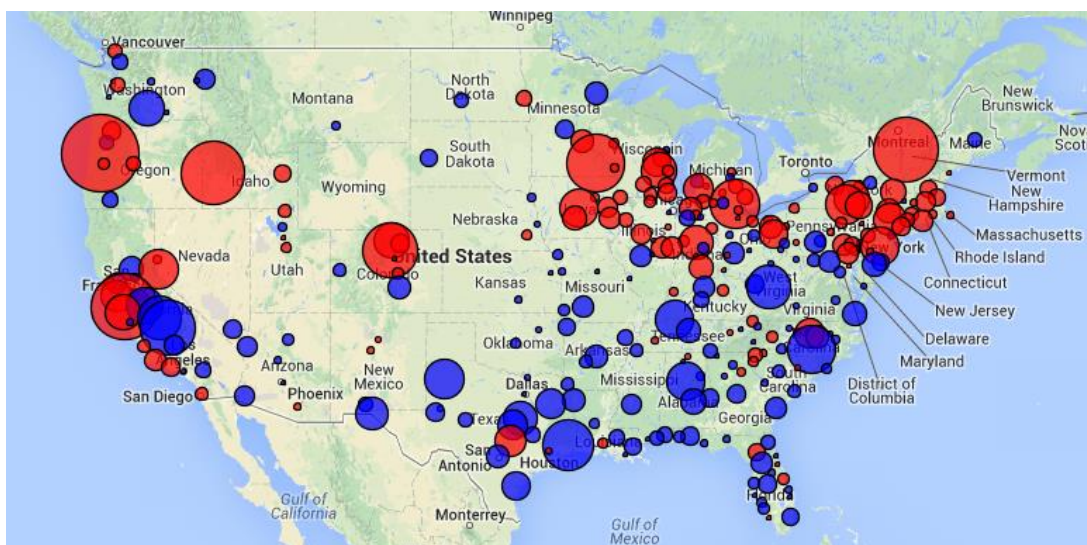
Institute. 5 years after the graduation of participants, Csikszentmihalyi tracked down all 31 of these students and found all successful artists were from Type 2.

For the 6<sup>th</sup> stage, Simon (1995) claimed that new ideas can be created, and is created, by combinations and recombinations of existing primitive components. For example, Langley et al. (1987) used the BACON program as a combinatorial process, which is a generate-and-test system that can create new ideas valuable for science. BACON takes as inputs uninterpreted numerical data and, when successful, it produces as outputs scientific laws that fit the data.

### **Issues in factors for creative idea generation: environmental or individual?**

Amongst various factors, many of recent studies pay attention to person-environment interactions. These researches investigate how a person interacts to a particular environment to be more creative. We have seen that larger numbers of linkages, such as big city, industrial cluster, competition, etc., endorse more innovation. Bettencourt et al. (2010) found out that the bigger cities USA create more innovation in terms of the number of patents, budget for the research and development, the number of creative professionals (See the figure 7).

Figure 7. Ranking of United States Metropolitan Statistical Areas: Patents (2006)



Note 1) Blue bubble indicates negative and red bubble indicates positive value percent deviation from scaling

Note 2) 300 Metropolitan Statistical Areas (MSAs) of the United States filtered from 11,161 originally

Source: [http://tuvalu.santafe.edu/~bettencourt/urban\\_observatory/patents.htm](http://tuvalu.santafe.edu/~bettencourt/urban_observatory/patents.htm)

Johnson (2010) listed up 200 historically important innovation and scientific discoveries since the invention of Gutenberg's printing: finding out the theory of relativity, invention of air conditioner, introduction of World Wide Web, etc.. He adopted the 2x2 matrix framework of Benkler (2006) which demonstrates that we experienced the market-based activities under centralized system or decentralized system, and the centralized economy which are not market-based, however, historically we have less experienced non-market based under decentralized system (see the figure8). For example, most of innovative inventions in the Renaissance era (the 15~17 centuries) such as concave lens, heliocentric theory, modern toilet, parachute, etc. are belongs to the quadrant 3 in the figure 7, which is non-market based and individual. In the consecutive bicentennial (the 17~19 centuries), the major innovative inventions: chronometer, steam engine, spinning machine, calculator, discovery of light spectrum, oxygen, photosynthesis, etc. shifted to more network-based (the quadrant 2 and the quadrant 4) since the development of sharing knowledge through printing. Even though the legislation of the patent law in early 18 century, afterwards, most of innovations such as invention of airplane, computer, contact lenses, sewing machine, vacuum cleaner, washing machine, tape recorder, television, bicycle, etc. were created under collaborative activities. The quadrant 4 is not a standard system in both capitalism and socialism, however, it allows great numbers of innovation contemporarily. Interestingly, despite the introduction of several protection measures such as license, patent, etc., which are against free transfer of ideas and for the profits seeking, financial incentive has not motivated innovators in collaborative system, especially for those who are in the academy.

Figure 8. Four quadrants of innovation



Thus, using analogical thinking for innovation workshop is required for creative idea generation. However, while there are substantial agreement on using analogy plays important role on generating new ideas, there are insufficient studies on how to instruct people to use analogical thinking to create a new idea.

Many of current definitions on quality of ideas are too general to establish an evaluation method of based on an abstract definition in general context, as a consequence, current major evaluation methods involve subjective assessments. Because there is no consensus in theory and definition of creativity or novelty to direct assessment endeavors, it is difficult to establish useful operational definitions, understanding the implications of differences among evaluation methods. Consequently, we should specifically focus on the idea generation mechanism, which is analogical thinking. Therefore, it is important to define which elements constitute the quality of ideas generated throughout analogical thinking, how to assess it, as well as, how to utilize the results from the analysis.

Finally, to propose a workshop design method for enhancing the appropriateness of ideas generated throughout analogical thinking, this study regards factors for appropriate idea generation in the perspective of thinking process, which is controllable by the workshop facilitation, rather than the personalities in including the level of knowledge, which are hard to be controlled by the workshop design. Also, prior to discuss the group creativity, this research focuses on facilitating an appropriate idea generation at an individual level, taking into account that creativity by individuals is a starting point for innovation. Thus, the level of analysis in this study is based on individual data.

### **3. Data collection: The innovation workshop for this study**

The workshops for this study were conducted six times on 46 university students with 20 different nationalities in the University of Tokyo, between the years of 2014-2015. Participants were volunteers from those who took the related courses of the department of engineering, who are registered in the mailing list of the i.school. The subjects were recruited via email communication to be informed about the innovation workshop. Because the innovation workshop program needs a certain level of commitment such as spending at least 4.5 hours as an active participant, and reading 25 business cases as a pre-task, it was difficult to unify the number of participants at each time of the workshop.

#### **3.1 Recruiting participants for the innovation workshop**

The first workshop, which was held in February 2014, was a pilot workshop for developing an evaluation method, as well as finding out possible factors for enhancing appropriateness of generated ideas. Five participants, 4 males and 1 female were recruited from the civil engineering department and the workshop was held in a laboratory meeting room equipped with two shared screens: one for the workshop facilitator; another for the participants.

Since the second workshop, which was held in December 2014, almost all workshops were held in the i.school studio, which equipped with five shared screens for small group, as well as a lecture hall size projector screen for the workshop facilitator. The second workshop was conducted with three participants and all of them were male.

Unlike the previous workshops, the third workshop, held in February 2015, had three groups of a pair: each group has different combination of member: 2 males; 2 females; and 1 male with 1 female. The intention for make a pair as a group to have a discussion and generate idea was to have extensive verbal record than more than three people in a group. According to Miyake (1986), the pair naturally explains not only what they have been thinking about, but why they think it, so that the situation makes a usually invisible process visible. However, against our expectation, the verbal records from a pair were far less than the previous groups in the first and

second workshop in terms of both quantity and quality. Moreover, when the participants were asked to generate idea in a pair for the idea generation task, one pair decided to generate idea individually, and other two groups of pair generated idea mainly by one participant and another participant merely showed agreement to the other.

Therefore, since the fourth workshop, held in April 2015, we allocated three members in each group if possible. Also, diversity within a group such as sex and nationality was considered for the workshop with a large number of participants.

Based on the implications from the results of the first to fourth workshop, we developed new workshop design for the idea generation task (See the chapter 6). Thus, since the fifth workshop, new instruction was given to the participants. For the fifth workshop which was held in June 2015, three male students were recruited, but one of them was not following the instruction at all and failed to generate an idea.

The sixth workshop in July 2015, 21 students were recruited: nine females and twelve males; ten students were from the Global Innovation Design program<sup>28</sup>, a joint Master's program between the Royal College of Art and Imperial College London, and 11 students were recruited from the i.school at the University of Tokyo.

Table 5. The participants for each workshop

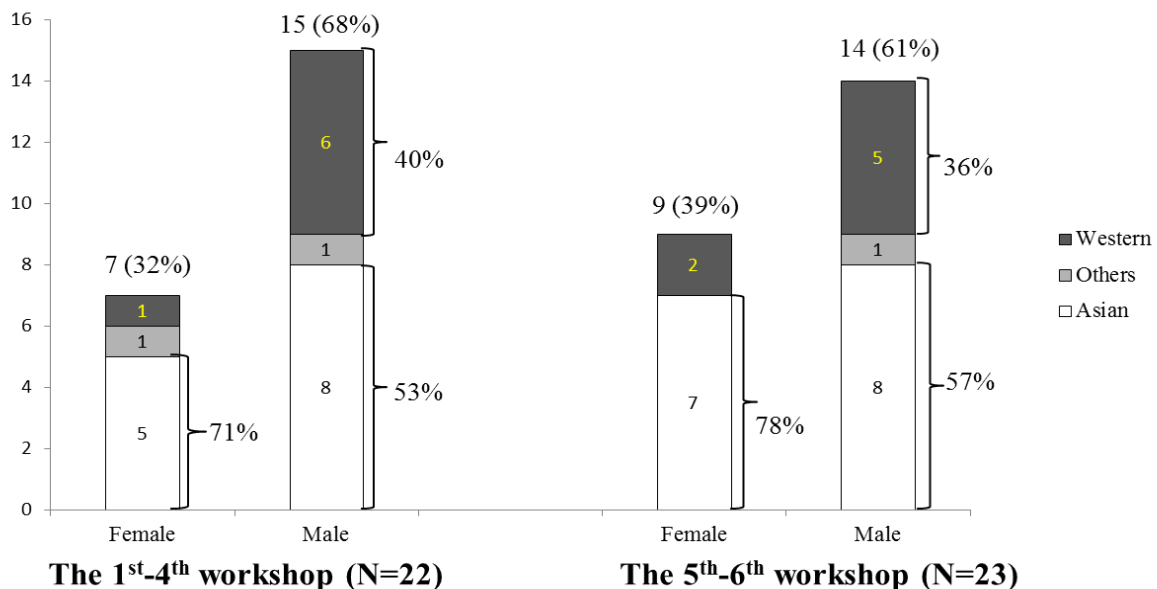
	No. of participants	No. of group	Nationalities
1	5	1	China, France, Guatemala, India, Nepal
2	3	1	Colombia, Pakistan, Thai
3	6	3	Guatemala, Indonesia(2), Kenya, Pakistan, Turkey
4	8	3	Japan(4), Brazil-Japan, India, France, Norway
5	2	1	Japan, India
6	21	5	Japan(11), China(2), China-US, Austria, Belgium, Brazil, France, Germany, UK, US

<sup>28</sup> <http://www.rca.ac.uk/schools/school-of-design/global-innovation-design/>

Total	45	14	20 different nationalities
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It is unfair to compare the results of participants between before and after applying the new workshop design if the participants were recruited under different condition. For the generalizability of samples in this study, we recruited participants and group them as a team under equal condition as much as possible. As show in the figure 9, 22 participants were recruited for the 1<sup>st</sup> – 4<sup>th</sup> workshops: 32% of them were females; others were males, and 23 participants were recruited after applying the new workshop design: 39% of them were females. In addition, diversity in the cultural background of participants, in terms of their origin countries, was similar between the previous workshops and the workshops after applying the new workshop design. Participants from Europe or America were coded as ‘Western’, participants from Asian countries were coded as ‘Asian’, participants from African countries or dual nationalities between two different background such as Chinese-American, or Brazilian-Japanese were coded as ‘others’.

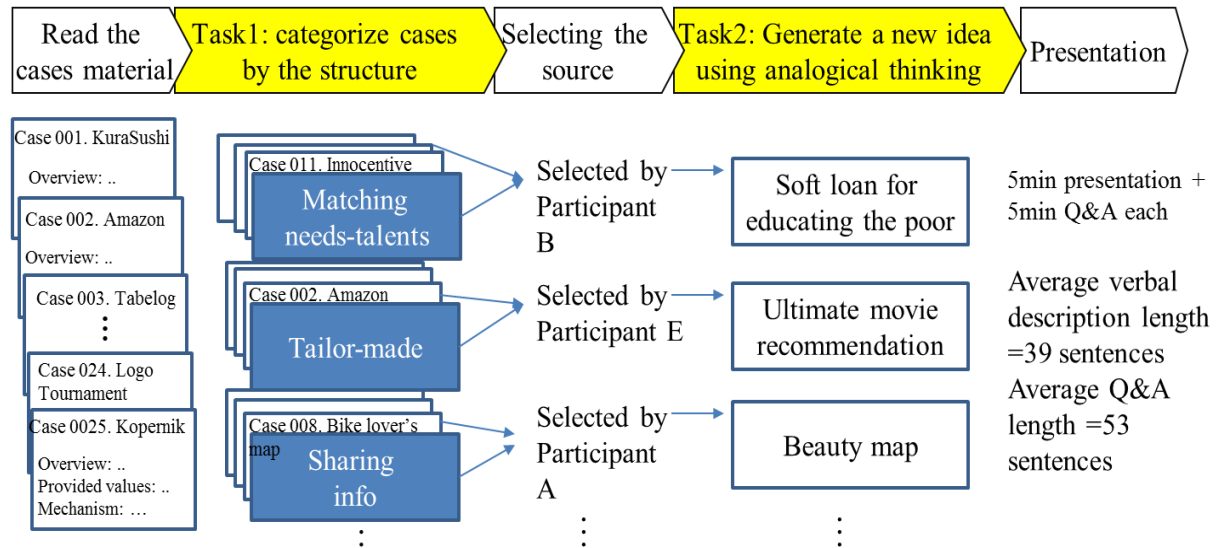
Figure 9. Demographic of participants



## 3.2 The innovation workshops process

The innovation workshop consists of a pre-task and two main tasks (see the figure 10): 1) a pre-task for acquiring knowledge on the existing business cases; 2) a categorization task for learning underlying mechanism by abstracting the previously acquired knowledge; 3) an idea generation task for creating new service idea using analogical thinking based on the categorization they created in previous task. The categorization task was carried out through group discussion, however, the generation task was performed individually. Each process is described in the following sub-sections.

Figure 10. The workshop process and sample results of each process from the first workshop



### 3.2.1 Pre-task: Acquiring knowledge on the collective intelligence services

The collective intelligence service has received much attention in the field of innovation. The MIT has established the MIT Center for Collective Intelligence (<http://cci.mit.edu/>), to research on how people and computers can be connected so that, collectively, they act more intelligently than any person, group, or computer has ever done before.



There exist many types of collective intelligence. The term appears in sociobiology (Passino, Seeley, & Visscher, 2008), systems design (Vanderhaeghen, Fettke, & Loos, 2010), psychology (Woodley & Bell, 2011), complexity sciences (Schut, 2010), cognitive studies (Trianni et al., 2011), computer sciences and semantics (Lévy, 2010), social media (Shimazu & Koike, 2007) and crowdsourcing in business (Howe, 2008). Traditional study of collective intelligence focused on the inherent decision making abilities of large groups (Lévy, 1997). Today, the field of collective intelligence is being advanced by researchers from areas as diverse as artificial intelligence (Lieberman, Smith, & Teeters, 2007; Singh et al., 2002), business (Ipeiritis, Provost, & Wang, 2010; Wolfers & Zitzewitz, 2004), art (Edmunds, 2006; Koblin, 2009). However, in the innovation workshop, we focus on the collective intelligence service as a business model.

According to Malone, Laubacher, and Dellarocas (2009), collective intelligence service is a business model creating value from large and loosely organized groups of people working together electronically. Malone et al. (2009) defined the term, collective intelligence very broadly as: "groups of individuals doing things collectively that seem intelligent." According to an often-cited definition, collective intelligence is a form of universal, distributed intelligence, which arises from the collaboration and competition of many individuals (Lévy, 1997). Glenn (2009) defined collective intelligence as an emergent property from synergies among three elements: 1) data/info/knowledge; 2) software/hardware; and 3) experts and others with insight that continually learns from feedback to produce just-in-time knowledge for better decisions than any of these elements acting alone.

In the innovation workshops, a pre-task was given to all participants to read the 25 collective intelligence business cases study (see the table 6). The cases used in the innovation workshops consist of well-known services such as Amazon.com, or Google Japanese input, as well as unfamiliar services to the participants but popular in Japan, such as Tabelog, @Cosme. These cases were collected by students who were registered as regular members in the i.school. Originally, there were 71 examples (see the table 11), however, 25 cases were selected by an instructor for the categorization task.

Table 6. The 25 collective intelligence service cases presented to the participants of innovation workshop in this study (alphabetical order)

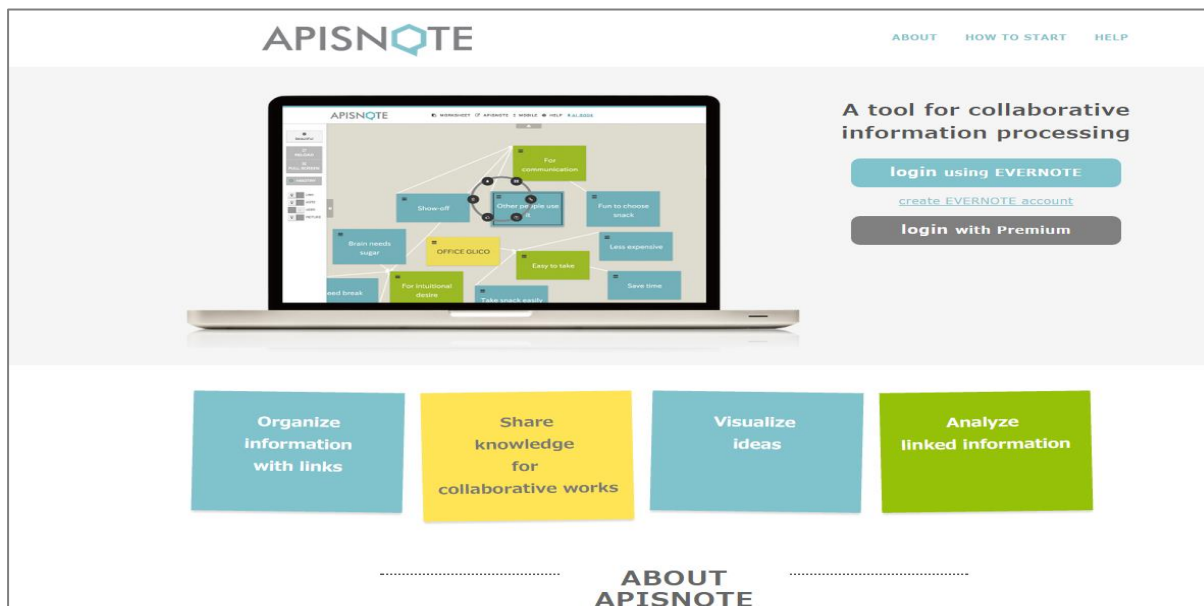
No	Case	Case description regarding the mechanism
1	4travel.jp	Sharing their own travel experience with possibility of helping others to make decision on their travel.
2	Amazon.com	Recommending books to customers for their interests
3	@ cosme www.cosme.net	Products are ranked and rated by the users comments, and this is more reliable rather than advertisement or commercial.
4	Bike lover's MAP www.bicyclemap.net	A lot of people post useful information (e.g. preferred routes, parking, slopes, toilets) for the user with the bike maps, You can find the optimal route with GPS search
5	Conyac https://conyac.cc/ja	It matches people need translation with people who speak that language around the world. Users can make small income by translating a few sentences.
6	Cook pad cookpad.com	Share your own recipes posted on the community and attract participants.
7	Creative agency for everyone http://www.recruit.jp/service/it_tr ends/c-team.html	A service featuring the new practice of crowdsourcing, allowing anyone to become a creator and create ads for clients. Banner ad proposals can be solicited from the online community by any users then posted on the website. Providing more exposure to the best-performance based on click rate facilitates a higher click rate for the overall banner campaign.
8	Dating expert http://www.date2.jp	Build a database of the actual information from experiences concerning lovers and dating to assist users dating skills or planning for the date out activities.
9	Google Japanese Input https://www.google.co.jp/ime/	Since its dictionaries are generated automatically from the Internet, it is much easier to type personal names, Internet slang and Anime, Comics and Games terms.
10	InnoCentive www.innocentive.com	The seekers (the people who have a problem) disclose the issues with bounty on the website it supports them to find the solver(those who have the technology to solve the problem) till the solver propose a draft resolution for the seeker get satisfied by the prize money.
11	Katariba café cafe.katariba.ne	Providing a place to speak about the future career and build the relationship with university students.
12	Kopernik www.kopernik.ngo	It provides the efficient matching system between supply and demand for inexpensive low tech products in developed and developing countries.

		It efficiently operates as a platform for collecting funds on online and collecting the practical idea from all over the world at the same time, to avoid waste of costs.
13	KuraSushi	Demand forecasting system and a analysis of customers database, Waste management system by the IC chip that is affixed to the back of the plate
14	Lancers www.lancers.jp	The online Marketplace providing matching service with freelance designer with clients for designing logos or webpages.
15	Lang-8 lang-8.com	Building the database and matching users. And Users can check the list of members who need proofread of their own language.
16	Logo Tournament logotournament.com	Client can easily request to the designers all over the world. For designers, it would be a chance to raise their name value in the world
17	Open ideo https://openideo.com	Sponsor company presents the social issues of the world, and various people can post how to solve it.
18	POS system	For management, it gives suggestion on selling goods, understanding consumer trends, future projection.
19	Price.Com	It collects the dealer price info, and show it in the order of lowest prices, and also collects the reviews from users.
20	Rakuten Travel travel.rakuten.co.jp	on-line hotel reservation service with information such as the available hotels of your destination, schedule, budget, reviews from customers.
21	Tabelog tabelog.com	We can see the rank of restaurant and its information posted by the user.
22	User creating weather news	You can report the weather information from mobile phone conveniently.
23	Wedding Park www.weddingpark.net	Users can search their wedding venue candidate upon the lists of 4,000 nationwide wedding venues info about area, condition, advantage, reviews, photos, videos, rankings.
24	Yahoo Weather weather.yahoo.co.jp	Users can easily click on the weather of their location and this data is integrated to DB.
25	YOMIURI ONLINE Comments	Every user can read all the helpful posts for free of charge at any time. To avoid insulting, it check the wording before posting. So, compared with other sites, users feel safe to use.

### 3.2.2 Warm-up: Introduction for using the APISNOTE

All participants were asked to bring their own laptop for the workshop to connect the shared screen, and to carry out the tasks using the software, APISNOTE<sup>29</sup>. The APISNOTE is a powerful tool not only for collaborative information processing, but also for recording thinking process in an individual level. During the categorization task, which requires group conversations, the APISNOTE is displayed on a large shared-screen. The entire workshop process was recorded in video files as well as the text format by the APISNOTE, which is software that allows all participants to record their idea notes and share them to others who is connected on the system. The APISNOTE records the time when each note was created, so that it can trace the process of generating a new idea.

Figure 11. The APISNOTE main page

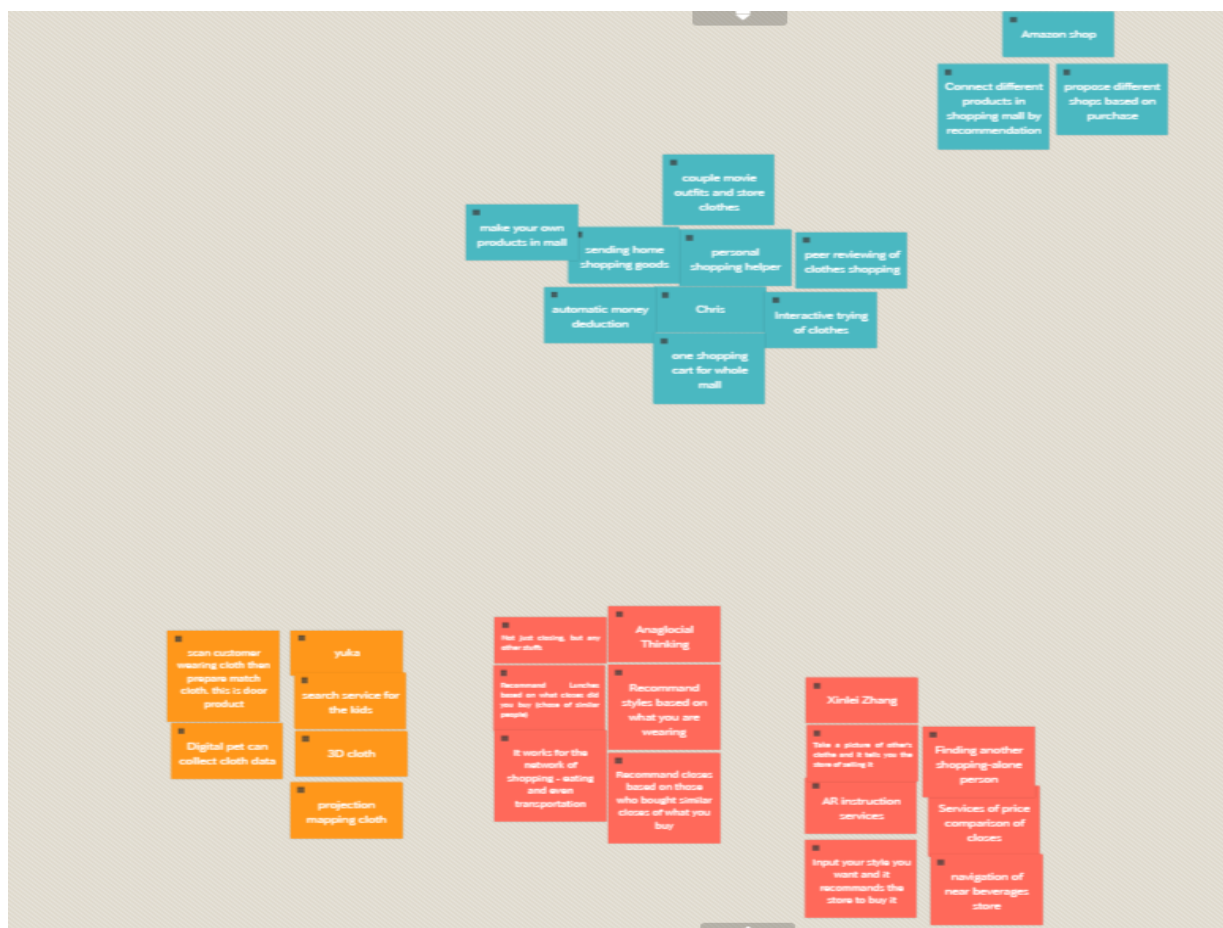


A warm-up task was given to each participant to allow them to be familiar with using the APISNOTE, as well as generating ideas. Same as the sticky note, users can freely choose the color of a note for their preference. In the warm-up session, each participant chooses their

<sup>29</sup> <http://apisnote.com>

preferred color of notes for generating ideas (see the figure 12). The warm-up task is consist of two parts: 1) creating new service ideas in a shopping mall within five minutes, as many ideas as possible; 2) creating a new service idea in a shopping mall by analogical thinking within three minutes, one idea only, as best as possible in terms of quality of an idea. Before asking subjects to fulfill the second warm-up task, and the instruction was given to make them understand what analogical thinking is, and how they can generate ideas using analogical thinking.

Figure 12. Sample results from the warm up task



After completing the warm-up tasks, a workshop facilitator asked participants which task was easier to generate an idea, in almost all cases, subjects responded that they felt easier to generate

new ideas in the second condition, which is, using analogical thinking, rather than the first condition, which is, no limitation in thinking mechanisms.

### **3.2.3 Categorization Task: The basis of cues for the idea generation task**

There have been lots of studies that suggest categorization is importantly related to analogical reasoning (Bowdle & Gentner, 2005; Gentner & Markman, 1997; Hesse, 1966; K. J. Holyoak & Thagard, 1997; Sternberg, 1977). Categories are defined by a set of exemplary cases, and their structures. Categorization is believed to arise from exposure to relevant exemplars and deep, elaborative processing intended to reveal the central features or common properties of members in the category (Chi et al., 1989; Schmeck & Grove, 1979; Ward, Byrnes, & Overton, 1990). These categories and the associated examples are used in problem solving through analogical thinking based on specific cases drawn from the activated categories (Gick & Holyoak, 1983; Medin, 1989). D Gentner and J Medina (1998) have shown that the use of analogy, especially by novices, contributes to the learning of new abstract concepts and to the extension and application of previously acquired knowledge.

According to Bruner (1979), in the course of cognitive development, people come to understand events, experiences or knowledge by generalized abstract properties, and that these are the basis of belonging together. The abstract properties that are common to a number of individual exemplars define a category or concept. The process of assigning events, experiences or knowledge to categories is referred to as coding. Coding is a special form of production of novelty involving "going beyond the information given". Categories based on abstract, complex properties, offer permeable category boundaries, allow association in multi layers, and encourage the building of complex networks, and those enable to generate an appropriate idea. Coding based on higher levels of generalization and abstraction offers increased chances of effective novelty (Cropley, 1999).

During the workshop, participants were asked to categorize each case based on the underlying mechanism of the business through group discussion and confer the title of each category (see the figure 14) within about 40 minutes. Since the second workshop, the concept of superficial

similarity and structural similarity was introduced as an instruction, using the examples of Amazon.com and Kura Sushi.

The subjects were instructed as follows (transcribed from the workshop):

*“Before you start, I’ll give you information. If you compare the Amazon, and the Sushi bar , they have no superficial similarity. When I say superficial similarity, Amazon is web service and Sushi is real service. And, food - bookstore, so they are different. That means superficial similarity is low. But, structural similarity, which means a service mechanism, is same. They have the history of purchase and recommendation, in a sense, they have structural similarity. We believe that we can create innovative service or ideas with high structural similarity and low superficial similarity. So you are going to create the group of services based on structural similarity. Not superficial similarity, do you understand?”*

*Then, I think when you read the case study material, you must have found that some of the services are similar. Based on your sense, you create services, a group of services, and then you create title note to each group like amazon and sushi bar to tailor-made proposal (showing the figure 13). You’re going to give a title with a gray note. This is what you’re going to do. It’s a group work, so you discuss each other.”*

Figure 13. Instruction given for the categorization task

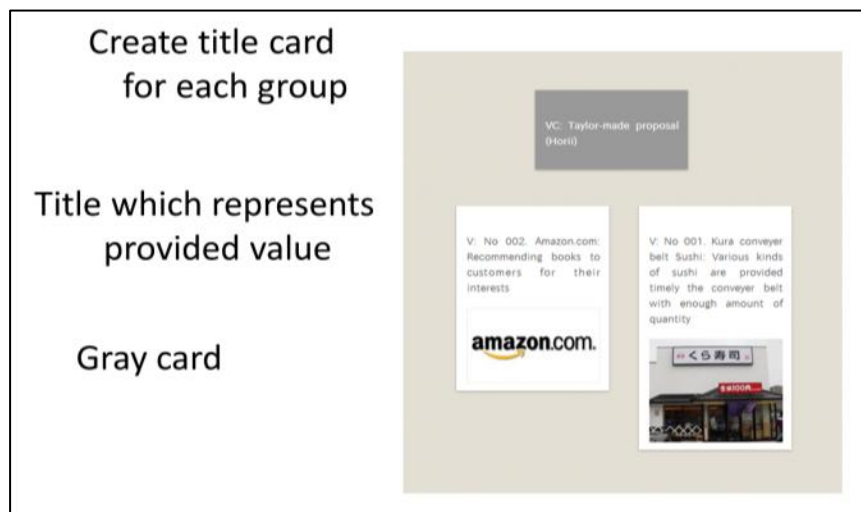
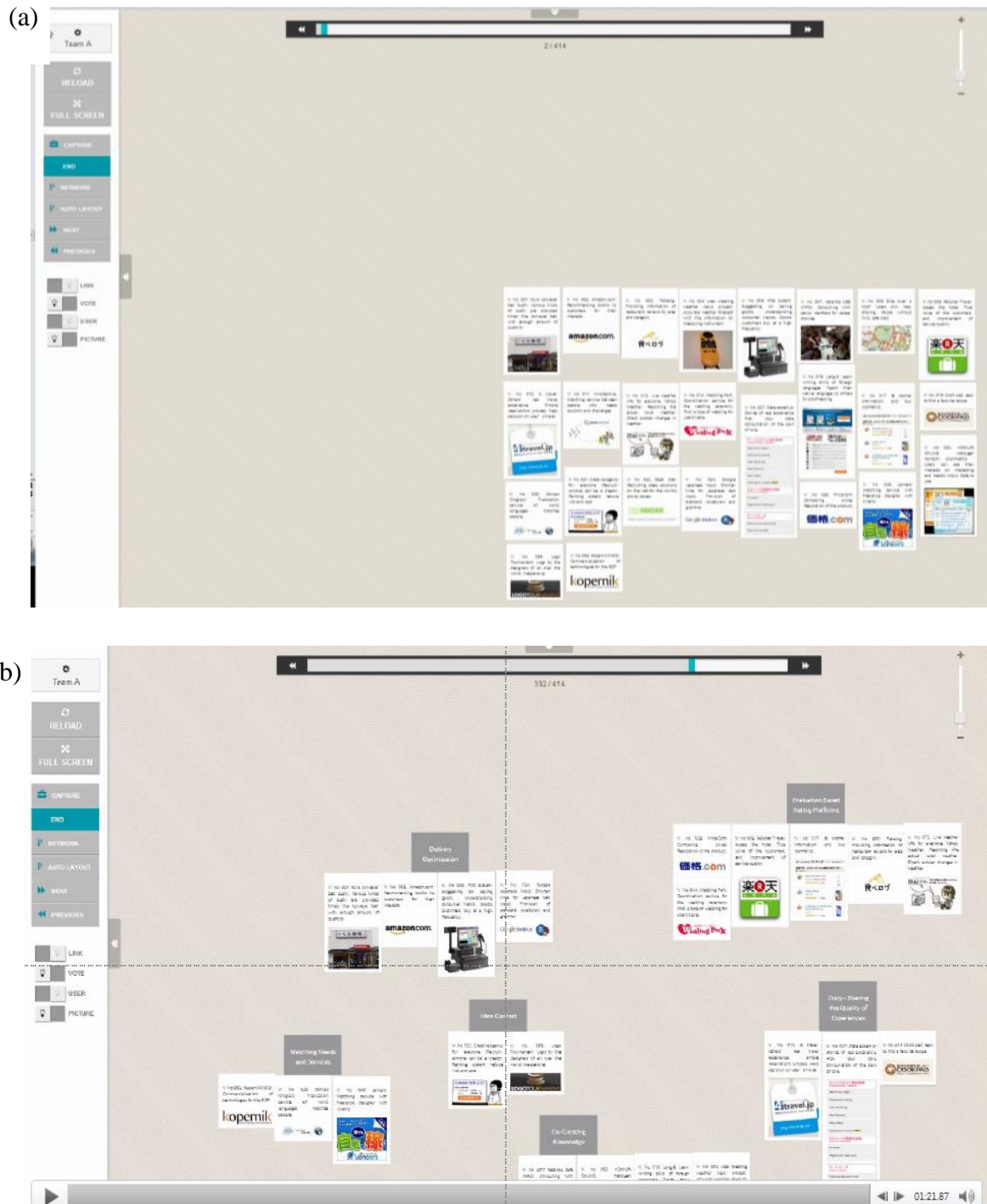


Figure 14. (a) The categorization task given; (b) sample results of the task from the APISNOTE record



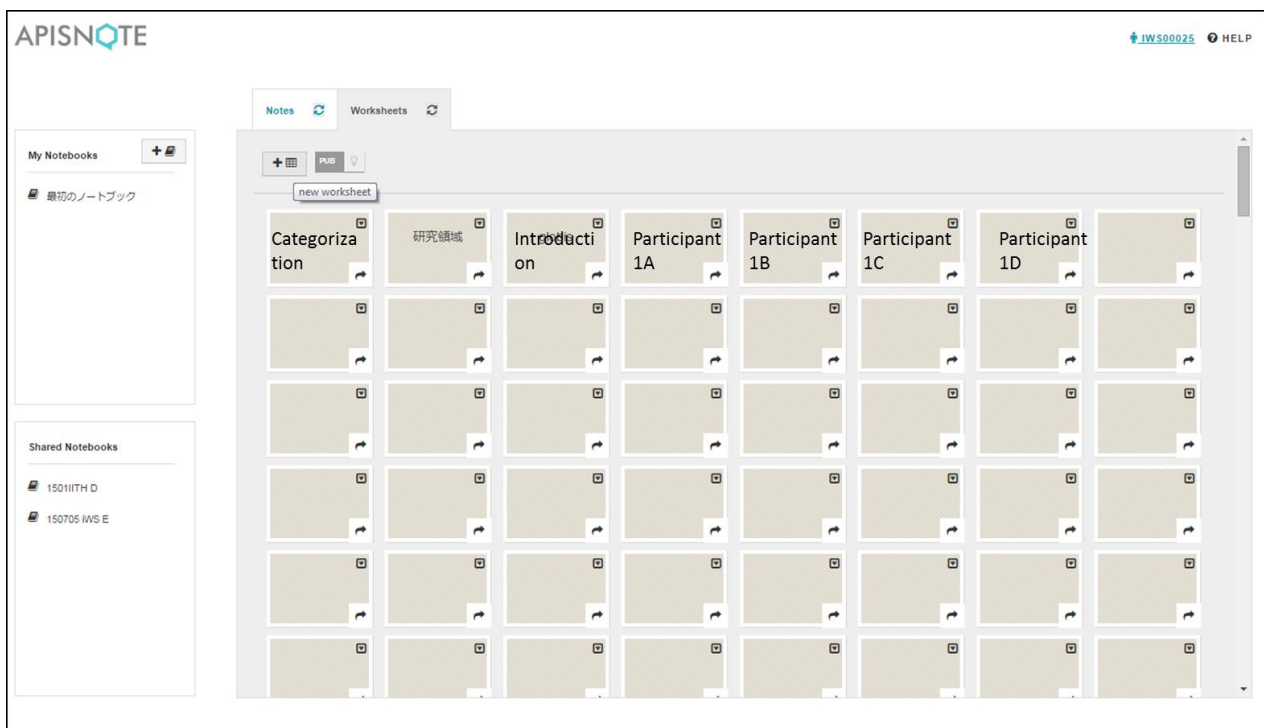


After each workshop, all the verbal contents from the categorization task were transcribed as the appendix A. Categorical knowledge is accessed and used when the participants generated new ideas. The labels of category and their subordinating cases were retrieved as cues during the idea generation task.

### 3.2.4 Generation Task: creating new service ideas using analogical thinking

The generation task was carried out individually. Each participant had to bring his or her own laptop for using the APISNOTE, and they were asked to create their own worksheet to perform the generation task individually (see the figure 15).

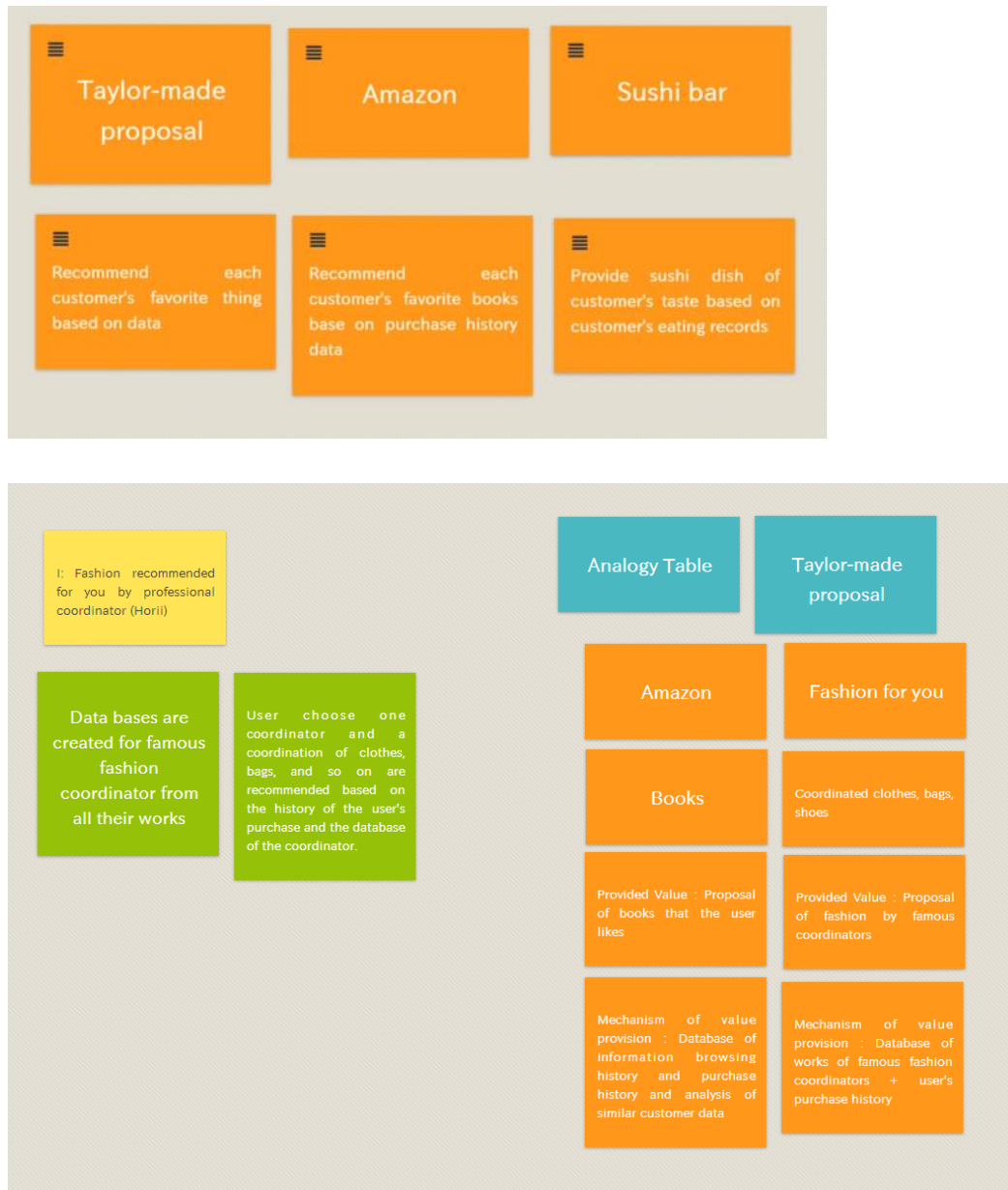
Figure 15. Creating an individual worksheet in the APISNOTE



After creating an individual worksheet, participants were instructed to use the analogy table for the idea generation task (see the figure 16). Each participant was asked to create new service

ideas using analogical thinking sourcing from the title of the category as well as selected cases upon his or her preference.

Figure 16. The analogy table sample for instruction



Participants created 27.33 notes in average for generation task; min=10, max=60, stdev=12.2. 43 ideas were created in total, from the 6 workshops: 41 ideas from individual ideation; but 2 ideas from collaborative ideation by a pair. In this study, the unit of analysis is the individual. Thus, for data analysis, each participant was coded as “# of the workshop - # of the group + the letter in an alphabetical order”. (see the table 7).

Table 7. A list of the generated ideas from the innovation workshops

Subject	Title of idea	Description	Selected source ideas
1A	Ultimate movie recommendation	All users has to rate the samples of movies they watched. Then, it customized the personal data and recommends movies which you haven't watched using taste matching algorithm.	Amazon.com, online dating
1B	Beauty map	It's a website, we can find people look similar to us, by input of personal data like the eye-shapes. We can follow their way to do make-up; And it provides information of where we can buy what kinds of cosmetics; also, which make-up is good for special situation like for a party or for a work.	Bike lover's MAP, @cosme
1C	Soft loan for educating the poor	An online platform which motivates the rich people for investment for the fund to educate the needed people all over the world. It's long-term investment, like 15-25 years old. It has a monitor system to get constant feedback whether the loan only utilize for education or not.	Kopernik
1D	Quick geek fix	A mobile app that users who have some trouble with computer software, explain the problem with the location info, then they find nearby people who can fix it for a small money. They meet each other in public place(e.g. McDonalds) with device, then after the service, users post review on the person who fix for his credibility.	InnoCentive, Tabelog, Ekiten
1E	City microscope	A mobile app to tell user valuable information of the current status of the cities' road, not only for congestion, congested area, but also share information about accidents, the location of the	Conyac

		thieves, natural disasters.	
2A	Fill out my forms	A website that foreigners in Japan who has to fill out the public documents in Japanese, upload a scanned form and send it to Japanese buddy. Buddy will explain how to fill in each blank.	Lang-8
2B	Wifi finder	A map based online application that shows nearby free wifi. Users share free wifi spot and strength on the map.	Bike lover's MAP
2C	PET finder	An online platform that provides a database of dumpsites of plastic bottles. Users take picture of PET bottle with GPS info, and people who need PET bottle can find a suitable demand for PET bottles and recommend them the location PET bottles based on the price they are willing to pay.	Wedding Park
3-1A	Blood donation	A database of hospitals that recommends the most suitable family members to donate blood based on ages and medical history.	KuraSushi , Amazon
3-1B	Cut & fill	It provides a list of construction sites based on location info. And it also shows the soil information of near-by location, then, it matches supply and demand for land fill based on location.	Wedding Park
3-2A	job finder for graduate	A web service that links people who newly graduated or job seekers with small scale companies, database is sourced from the LinkedIn.	Lancers
3-3A	e-database for shopping mall	A web service that recommends each customer mostly purchased items as a good combination based on their purchase behaviors.	Amazon.com
4-1A	Moral and sex education	A global website for moral education and sex education to broaden the perspective by various people's posting about how to solve the world's issue.	Open idea, Yomiuri comments
4-1B	Childcare	A web service that matches people who need childcare service with people who can respond to their needs.	Conayc, Logo tournament
4-1C	Immersive education in	A psychological and physically customized knowledge service for a school where students are	Kopernik, Katariba café

	micro worlds	immersed in certain special domains, such as a multidisciplinary mentoring knowledge service to the students' education.	
4-2A	Education coaching	It helps children to decide his future career based on his performance in school and preferences, it recommends which courses to focus on and propose new tests customized for each student.	KuraSushi, Google Japanese Input
4-2B	Services for education	Small group education service about studying very bizarre and minor topics which are generally liked by a very few people, less demands at a particular place are tracked, then, it forms a small study group by connecting people from other different places to give an online education service on that topic.	Logo Tournament, InnoCente
4-2C	Elite education	Gather idea of how to educate the child, e.g. how to study TOEIC, TOEFL, etc. Users can see previous consultation of other users and choose their favourite ideas, and contact the person directly for an education consulting service.	Creative agency for everyone, Open ideo
4-3A	Head hunting	A portal, offered by head hunters, that recommends new employees based on contacts, information on continuous assessments, filtered by customer specifications	KuraSushi , Amazon.com, POS system
4-3B	Job searching	Matching a person in need for a job with a specific advisor who can help them in finding a job.	Katariba café, Lancers, Lang-8
5A	Job training by expertise	It builds a database of specialists who can teach business skills for a job, it matches them with students who enter company next year and want to learn necessary skill regarding their jobs.	Lang-8
5B	House finder for professionals/students	It builds a database of available houses, based on workplace location and budget, it also has database of people who looks for apartment as a flatmate, user can search house with flatmate with common interests. It matches roommates as well as houses/rooms	Uber, Creative agency, Bike lover's map, Date2, Amazon
6-1A	What is he/she like?	It is a genuine dating platform that friends on the Facebook write the self-introduction of the friend who searches for a lover so that it gives the real	Bike lover's MAP, Linked in

		voices in finding lovers.	
6-1B	No garbage life	It is a sharing groceries system for cooking, mainly for those who live alone. It is difficult for them to use all of what they bought. If there is something unused after several days, it will be used as compost in farms.	Open ideo
6-1C	Remote Chef	A platform to allow crowd-sourced creation amongst professionals to pick one as your chef, based on his/her specialty, we can discuss recipes, and decide a menu (or ask for inspiration) make an appointment (guests coming to visit), buy ingredients, prepare necessary equipment.	Tabelog
6-1D	Cross-collaboration in specific fields	A platform to allow crowd-sourced creations amongst professionals, specialized freelance work, e.g. advanced materials companies with manufacturers. It enables companies to find collaborators in specific fields to develop innovative solutions based on their experiences.	OpenIDEO
6-2A	Group travel planning	Users plan a trip together, on the shared map, schedule with money are calculated. Then, based on this, a number of travel agencies bids on that travel package. So users can select optimized package based on their needs.	Bike lover's map
6-2B	artSpace	It is a virtual exhibition space, curated by online participation, can walk through virtually. But the artists are not mentioned, until after you look at the art pieces to judge them transparently. Popular work is pushed up through voting (like a Reddit).	Reddit
6-2C	Everyone's PARTY	Parties are run & created by volunteers every weekend: theme, concepts all decided depending on volunteers at that time. Volunteer leaders may choose theme and other staffs do what they can contribute: food, music, movie, etc. Meeting space can be provided by sponsors.	Bike lover's map
6-2D	Dog sharing	It matches the dog owners unwilling to go outside and the dog lovers eager to take dogs for a walk. It solve troubles for dog owners, and satisfies dog lovers, and dogs themselves will be happy too!	Conyac

6-3A	Machine Learning Charity Impact Analysis	Machine learning researches each charity funding and their impact. It measures objectively how well the charity fund is achieving their stated goals, and recommends complementary causes that help facilitation each other.	Amazon
6-3B	Service platform for new mothers	Users can search information about raising child, doctors and people who care children and mothers can register their knowledge and new mothers can read and communicate with them.	wedding park
6-3C	Japanese Hospital Rating System	We can see the rank of hospitals and their information posted by the user, reviewers can interact with each other through the exchange of hospitals' information such as service quality, waiting time...	Tabelog
6-3D	Crowdsourced Refugee Housing	It matched the average people who want to help and refugees or homeless people by providing their extra flats or extra rooms, and help them adjusting to new country and culture.	Spareroom.co.uk
6-3E	Custom, handmade tailor goods by craftsmen	This system is to inform craftsmen for custom, handmade tailor goods backed with machine learning algorithms. So that we could buy each shopping mall original products, order hand-made items designed at the studio in the mall, tailors register the specialized items.	Google Japanese input
6-4A	Matching old people's house to international students	Matching the old people always suffer from loneliness to the young students who are around 20s always struggling to find spare houses (especially for international who wants to practice language also).	Wedding Park, Conyac, Innocentive, Lancers, AirBnB
6-4B	Starting business	Customers post future problems and make a team to think about how to resolve them. This service also supports its commercialization. Customers continue to brush up the ideas in a team to create a prototype gathered in a team. Investors choose interesting ideas.	bike Lovers Map, Open IDEO
6-4C	Collaborative diagnosis	When people feel sick, they input data such as photos, blood pressure, electro cardiogram, body temperature, etc, measured with their home-diagnosis devices. Then, professionals or	OpenIDEO

		experienced patients collectively diagnose and find a solution for their health issues.	
6-4D	Studying abroad	Providing the information of the family willing to take care of the kids who are studying abroad alone. Match up the two families who have kids studying in each other's country.	Wedding park
6-5A	Renting room for artists	It is a room rental network for artists who have difficulty in living but who can work in any places, and room providers who support them for fostering creativities.	
6-5B	Psychologist Tournament	Users post their problem and how much they are willing to pay for good advice, psychologists submit their solution or diagnosis of the problem for free. The user gets responses and selects their favorite advice.	Logo tournament
6-5C	Crowdsourcing divorce settlement	A Couple decided to get a divorce ask their issues to worldwide juries. Each side makes their case and the collective juries vote on which person they choose to side with. The percentage split of the jury then becomes the percentage split of the assets for the divorce.	Quora, Reddit
6-5D	Blood matching	Blood matching service between a patient and a donator using a pre-registration system, it also shows the life story of a donator.	Katariba café

In the third workshop, participants were able to generate an idea in collaborate with the other group member in a pair or alone. Among the three groups of a pair, two pairs generated an idea as a pair, and one pair generated an idea individually. For those two groups of pair, the process of generating an idea was not found to be collaborative creation, but close to one active initiator and a follower. For example, the participant 3-2B suggested many different ideas in the early stage, however, none of those suggested ideas were refined or developed by discussion. In this group, the domain for the new idea was set by the participant 3-2A, when he suggested his idea of 'job hunting' first time and the participant 3-2B agreed with him (see the table 8). Thus, in those cases, the level of analysis was focused on the individual who actually generated the idea.



Table 8. Example of the early stage of generating an idea by a pair discussion

Time	Subject	Discourse
01:44:02	3-2A	we can first think about the problems and ... I don't know..
01:44:20	3-2B	divorce, haha.. Hmm..
01:44:31	3-2A	we want to be similar to that.. Properly, we can collect some data, give some services.. What do you think?
01:44:43	3-2B	yeah
01:44:47	3-2A	something like that.. Can you think of something else?
01:45:01	3-2A	ok.
01:45:12	3-2B	what's this...?
01:45:14	3-2A	this match...
01:45:20	3-2B	dispatch police..
01:45:36	3-2A	or, procedure for assigning employees... I didn't know that . Can you...
01:48:37	3-2B	Who are looking for the apartment, it's not history because, they cannot came to japan by themselves
01:52:51	3-2B	Service based on the ...
01:53:38	3-2B	Apartment based on data collection..
01:53:44	3-2A	Yeah, community..
01:53:55	3-2B	e.g. by (inaudible)
01:54:05	3-2A	pattern. Park.??
01:54:08	3-2B	So, they can promote place, They can promote, share movie. Friend want to join, like subscribing, like youtube
01:54:33	3-2B	and if it reaches a certain number, you can make a community, with different.. Create event...
01:55:06	3-2B	What do you? Tell me..
01:55:32	3-2A	I'm thinking about job hunting.

### 3.2.5 Follow-up

To analyze factors for enhancing appropriateness of ideas generated using analogical thinking, face to face interview session was followed after the workshop.

After the first workshop, as a trial, interviews were conducted 5 days after the workshop for 1.5 hours per each subject, including the two type personality tests as well as personal intelligence test on visual analogical thinking. All the participants were asked to complete three online tests: Eysenck personality test<sup>30</sup>; Cattell's 16 Personality Factors test<sup>31</sup> (see the table 4); Odd one out test of the Cambridge Brain Science.<sup>32</sup>

In addition, participants were asked to ruminate on their ideation process during the idea generation task, provided cue from the APISNOTE which shows all the history of ideation process with the actual time record on each note they created during the workshop. They were asked to explain their flow of thinking how they came up with idea by each note they created using the APISNOTE, then each participant was asked to indicate the creative leap moment for idea creation (see the figure 19). The sixth workshop was conducted with 21 participants from different locations. Thus, it was difficult to conduct personal interviews after the workshop. Instead, we ask them to indicate the creative leap moment after the idea generation task by marking on the APISNOTE, and adding extra notes that describe how they reach the creative leap moment.

In the fields of creative design studies, 'creative leap' is a significant concept, often reported as arising as sudden illuminations (Cross, 1997). In design process, the creative leap is characterized as a sudden perception of a completely new perspective on the situation different

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<sup>30</sup> Eysenck (1967; 1990) proposes that there is a biological basis for introversion-extraversion: introverts have higher levels of activity in the cortico-reticular loop, and thus are chronically more cortically aroused, than extraverts. Neuroticism is based on a separate biological system related to the visceral brain that produces autonomic arousal. Eysenck distinguishes arousal produced by reticular activity, the basis for extraversion, which he calls "arousal," from autonomic arousal, the basis for neuroticism, which he calls "activation." Other work shows that psychoticism (i.e., tough mindedness) is not a dimension of temperament at all, but rather of character (Strelau & Zawadzki, 1997). The test is available on <http://similarminds.com/eysenck.html>

<sup>31</sup> The test is available on <http://personality-testing.info/tests/16PF.php>

<sup>32</sup> The test is available on <http://www.cambridgebrainsciences.com/browse/reasoning/test/oddoneout>

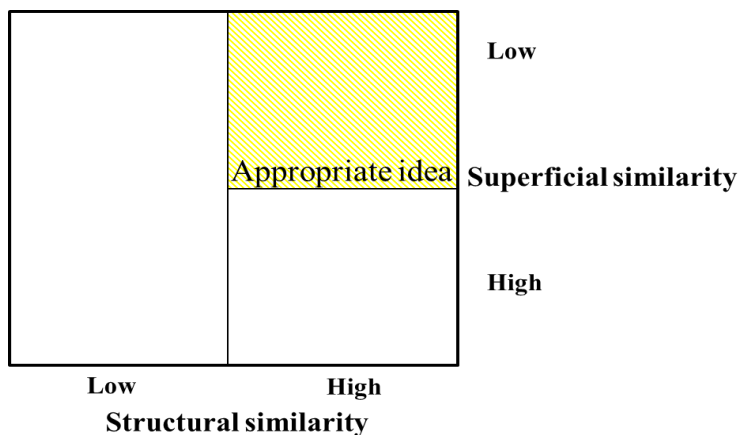
from what we previously understood (Dorst & Cross, 2001). The creative leap is able to identify a point during the ideation process at which the key concept or key element began to emerge. Retrospective accounts of creative moments in ideation decided by the participants themselves may not be perfectly reliable. However, some empirical studies of creative design focus on this creative leap moment. For example, Akin and Akin (1996) focus on the analysis of the 'aha!' moment, which is a well-known phenomenon associated with creativity, in other words the sudden mental insight.

After the analysis of the first workshop, it was found that the deliberation before reaching the creative leap moment is more significant than the results from three personality tests, in explaining factors for enhancing the appropriateness of new idea. Therefore, since the second workshop, the follow up session focused on identifying the creative leap moment after the retrospective recall procedure using the history function of the APISNOTE, which shows the creation of each note step by step based on the time series.

#### 4. Proposal of an evaluation method for the generated ideas

Developing an evaluation method is a multi-phase process. As an initial step, the evaluator must determine the scope of construct. In this study, a focus is placed on generation of ideas using analogical thinking. In this regard, to construct an evaluation method, most importantly, it needs to be determined that what constitute the quality of ideas generated by analogical thinking. In the context of a new idea generation by analogical thinking, idea quality consists of two distinct dimensions: superficial; and structural analogies (Blanchette & Dunbar, 2000; Dunbar & Blanchette, 2001). If the ideas are created based on a structural similarity from the source ideas, it increases the chances to take advantage of the effective mechanisms already demonstrated by systems such as, for example, Amazon.com, or Google. However, this approach does not guarantee the development of an appropriate idea generation. In an appropriate idea generation, it is expected to keep the structural similarity but to be superficially different with already existing cases. In other words, it should be far from the existing domains, but it is a possible member of existing category of the mechanism. In this study, a new idea that has high structural similarity and low superficial similarity with existing cases is defined as an appropriate idea. Consequently, the appropriateness of a new idea is evaluated form superficial similarity and structural similarity as shown in the figure 17 (Kim & Horii, 2015).

Figure 17. The proposed evaluation method



As presented in the figure 17, the highlighted quadrant is for the ideas generated with representing the structure of source cases deeply in a semantically different domain, in other words, it has low superficial similarity and high structural similarity from the source cases. This area is for the new ideas of participants who could generate an appropriate idea by importing structural features from the example cases and applying it in different domain. On the other hand, if an idea is generated with implying the structural features of source cases but applying it in a similar domain or not having a structural similarity from existing cases, this method does not evaluate it as an appropriate idea.

After defining the dimensions of evaluation, an evaluator must design the scale of the assessment. Superficial similarities are measured by semantic similarity between the domains of source cases referred and the created idea using the latent semantic analysis. Landauer, Foltz, and Laham (1998) used the latent semantic analysis (LSA) to measure superficial similarity. LSA is a method for quantifying the similarity between words (or even whole passages) on the basis of statistical analyses of a large corpus of text (Prabhakaran, Green, & Gray, 2014). It is based on the vector space model from information retrieval (Salton & McGill, 1983). Technically, this measure of semantic similarity corresponds to the cosine of the angle between vectors corresponding to the terms within a given semantic space, which is derived through analyses of all of the contexts in which the word tends to be present or absent in that topic space (Laham, 1997; Landauer & Dumais, 1997). Here, a given corpus of text is first transformed into a term  $\times$  context matrix, displaying the occurrences of each word in each context (Wandmacher, Ovchinnikova, & Alexandrov, 2008).

#### **4.1 The judgement of structural similarity**

Suzuki, Ohnishi, and Shigemasu (1992) have shown that similarity judgments depend on level of expertise and goals. Expert and novice subjects were asked to solve the Tower of Hanoi puzzle, and judge the similarity between the goal and various states. The Tower of Hanoi is widely used as an experimental and diagnostic tool in the neuropsychology literature to gauge problem solving abilities. The puzzle consists of three pegs and several disks of varying size. Given a start state, in which the disks are stacked on one or more pegs, the task is to reach a goal state in

which the disks are stacked in descending order on a specified peg. There are three constraints on the transformation of the start state into the goal state. (1) Only one disk may be moved at a time. (2) Any disk not being currently moved must remain on a peg. (3) A larger disk may not be placed on a smaller disk. Experts' similarity ratings were based on the number of moves required to transform one position to the other. Less expert subjects tended to base their judgments on the number of shared superficial features. Similarly, Hardiman, Dufresne, and Mestre (1989) found that expert and novice physicists evaluate the similarity of physics problems differently, with experts basing similarity judgments more on general principles of physics than on superficial features (Sjoberg, 1974).

Structural similarities are judged by investigating if the new ideas were generated using the structure of source ideas or not. It requires to present exemplary structures of the existing cases to judge structural similarities. In this study, to present exemplary categories for judging structural similarity, four researchers, 1 assistant professor and 3 PhD candidates of the innovation science research group in our laboratory, categorized the source cases individually. As a result, 26 category labels were created, each rater created 6.5 labels in average (stdev=2.21, Min=5, Max=9) for 25 cases (see the table 9). Subsequently, cluster analysis was conducted (method = median, distance = squared-Euclidian) and 26 labels were clustered into four groups of category as shown in the figure 18.

The category I including matching demand and supply (rater A), matching parties (rater B), working like intermedium (rater C), advice from experienced people (rater C), matching need and seed (rater D), supporter (rater D). The category II including review and ranking (rater A), market big data (rater B), integrating service information from different firms and rank them (rater C), objective evaluation, professional raters and read only users (rater D), showing off experiences (rater D). The category III including users' information sharing (rater A), community of interests(rater B), information sharing between users (rater C), ask users to provide solution (rater C), a platform where people share their thoughts (rater C), give and take (rater D), collaborative knowledge creation (rater D). The category IV including customized recommendation by the analysis of database(rater A), date collection (rater A), find tendencies (rater B), individual big data (rater B), using artificial intelligence to forecast and enhancing

efficiency (rater C), tailor-made based on big data (rater D). Two category labels of the rater D: competition of creators; and utilizing busy bodies were not included in any of those categories.

Figure 18. The result of cluster analysis from 26 category labels on 25 cases by the four raters

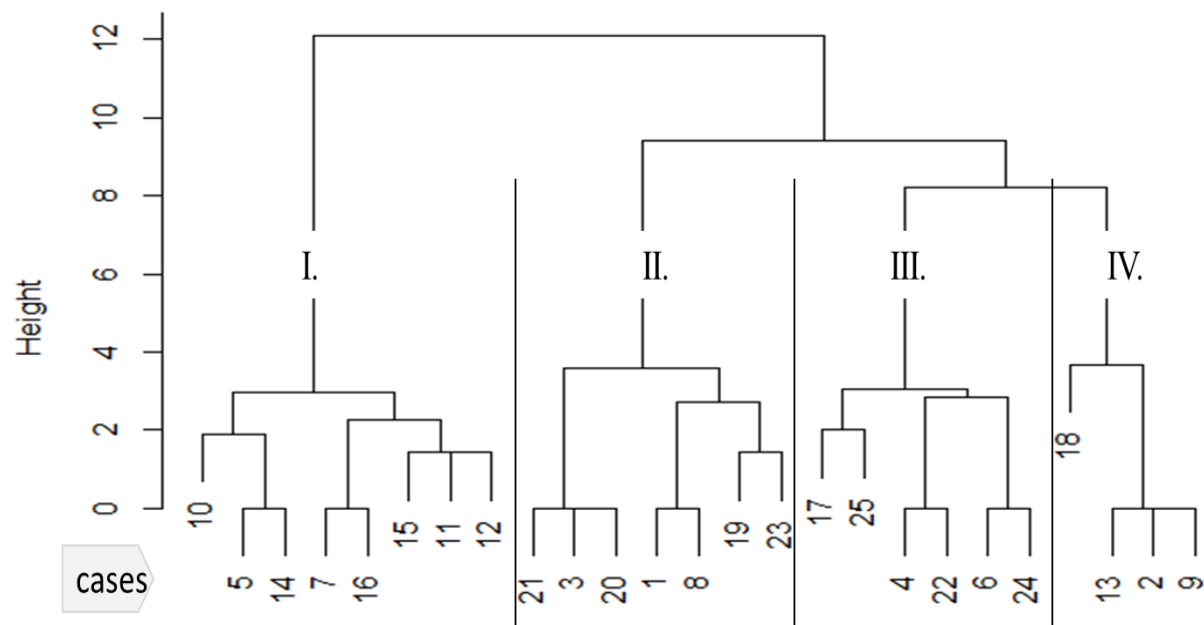


Table 9. The result of categorization on the 25 cases by four raters

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Rater	Row Labels	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
A	1 Customized recommendation by the analysis of databases	1								1				1												
A	2 Date collection																		1							
A	3 Matching demand and supply				1	1	1	1			1	1	1		1	1	1									
A	4 Review and Ranking	1		1					1											1	1	1		1		
A	5 Users' information sharing			1	1	1												1					1	1	1	1
B	6 Community of interests			1	1	1												1				1	1	1	1	1
B	7 Find tendencies		1							1				1												
B	8 Individual big data																		1							
B	9 Market big data	1		1					1												1	1	1		1	
B	10 Matching parties					1		1			1	1	1		1	1	1									
C	11 A platform where people share their thoughts																									1
C	12 Advice from experienced people					1		1				1	1		1	1	1									
C	13 Ask users to provide solution/ working like intermediate										1							1								
C	14 Collecting data from market																		1							
C	15 Information sharing between users	1	1	1	1	1	1	1	1												1	1	1	1	1	1
C	16 Integrating service information from different firms and rank them																			1					1	
C	17 Using AI to forecast and enhancing efficiency		1							1				1												
D	18 Collaborative knowledge creation																	1								
D	19 Competition of creators							1										1								
D	20 Give and take			1													1							1		
D	21 Matching needs and seeds					1					1				1											
D	22 Objective evaluation, professional raters and read only users	1																		1	1	1				
D	23 Showing off experiences		1				1																	1	1	1
D	24 Supporter												1													
D	25 Tailor-made based on big data		1							1				1					1							
D	26 Utilizing busy bodies											1														1



The results of categorization in the figure 18 are supported by the previous studies on collective intelligence or collaborative intelligence(CI). CI can encompass several types of mechanism based on the state of the system (Devadasan, 2011; Quinn & Bederson, 2011). According (Devadasan, 2011), the CI can be classified into four types based on the interaction between individuals in the system and they are aligned with the results of categorization in the figure 18: 1) coordination for matching customers to suppliers, which is compatible with the category I in the figure 15; 2) collect and combine knowledge to improve users' decision, which is compatible with the category II; 3) cooperation of multiple users for carrying out the task, which is compatible with the category III; 4) accumulation of data to find the patterns for predicting of decision, in other words, data mining, which is compatible with the category IV.

Since information and communication technologies developed drastically and majority of population can have access to the internet which allows us to be connected each other easily, it enables online human participation in the computational process, and it is called "human computation". Quinn and Bederson (2011) reviewed numerous existing definitions and examples related to human computation. For instance, Crowdsourcing defined as "the act of taking a job traditionally performed by a designated agent (usually an employee) and outsourcing it to an undefined, generally large group of people in the form of an open call" (Howe, 2008). Social computing is defined as "... applications and services that facilitate collective action and social interaction online with rich exchange of multimedia information and evolution of aggregate knowledge..." (Parameswaran & Whinston, 2007). Data mining is defined as "the application of specific algorithms for extracting patterns from data." (Fayyad, Piatetsky-Shapiro, & Smyth, 1996). And he found that collective intelligence applies only when the process depends on a group of participants while human computation is not. Also, it is a super ordinate concept of social computing and crowdsourcing, because both are defined in terms of social behaviour. Data mining encompasses with the concept of collective intelligence, because some applications benefit from groups while others do not. What most distinctive point between collective intelligence and human computation, human computation does not enclose online discussions or creative projects where the initiative and flow of activity are directed primarily by the participants' inspiration: for example, the goal of Wikipedia project is not to create novel

contents, but to gather existing knowledge from a neutral point of view as an encyclopedia<sup>33</sup>. In contrast, collective intelligence allows the creative ability of humans.

After reviewing the related research on the classification of collective intelligence, and applying their categorization reference into the results from the four raters (see the table 10), this study suggests the four categories as shown in the figure 19.

Table 10. Cases belonging to the categorization of four raters

	case	Category I	Category II	Category III	Category IV	Competition of creator	Utilizing the busy bodies	total
1	InnoCentive	4						4
2	Conyac	4						4
3	Lancers	4						4
4	Creative agency for everyone	3				1		4
5	Logo Tournament	3				1		4
6	Katariba café	3					1	4
7	Kopernik	4						4
8	Lang-8	3		1				4
9	at cosme		3	1				4
10	Rakuten Travel		3	1				4
11	Tabelog		3	1				4
12	Price.Com		3	1				4
13	Wedding Park		4					4
14	4 travel		3	1				4
15	Dating expert		3	1				4
16	Cook pad		1	3				4
17	Yahoo Weather			4				4
18	Bike lover's MAP			4				4
19	User creating weather news			4				4
20	Open ideo			4				4
21	YOMIURI ONLINE Comments			3			1	4
22	Amazon.com				4			4

<sup>33</sup> [https://en.wikipedia.org/wiki/Wikipedia:Five\\_pillars](https://en.wikipedia.org/wiki/Wikipedia:Five_pillars)

23	Google Japanese Input				4			4
24	KuraSushi				4			4
25	POS system				4			4
	total	28	23	29	16	2	2	100

Figure 19. Four structural categories of collective intelligence services

Classification of Collective intelligence in Quinn & Bederson(2011)	Cases belonging to the four raters' categorization
<b>I. Crowd sourcing</b> "the act of taking a job and outsourcing it to an undefined, generally large group of people in the form of an open call."	<b>I. Matching, Intermediate people</b> •100% agreed: Innocentive, Conayc, Lancers, Kopernik •75% agreed: Creative agency, Logo tournament, Katariba, Lang-8
<b>II. Human computation</b> "...using human effort to perform tasks that computers cannot yet perform,."	<b>II. Reviews or rating on the integrate info</b> •100% agreed: Wedding park •75% agreed: @cosme, Rakutel travel, Tabelog, 4 travel, Price.com, Date expert
<b>III. Social computing</b> "... services that facilitate collective action and social interaction online with evolution of aggregate knowledge..."	<b>III. Share knowledge, collaboration</b> •100% agreed: Bike map, live weather news, Open ideo •75% agreed: Cook pad, Yahoo weather, Yomiuri comments
<b>IV. Data mining</b> "the application of specific algorithms for extracting patterns from data."	<b>IV. Analyze big data</b> •100% agreed: Amazon, Google Japanes, Kura sushi, POS

Services in the category I intermediate an individual user to another individual user depending on their specific needs or skills. For example, Conyac provides a service that intermediates a client who need translators with those who want to translate for them with payment. Similarly, Katariba café also provides a service that intermediates high school students who need advice for future career with university students who would like to give advice.

The services in the category III have distinctive characteristic from the category II in the sense that the users create novel contents in cooperative manner. On the other hand, the services in the

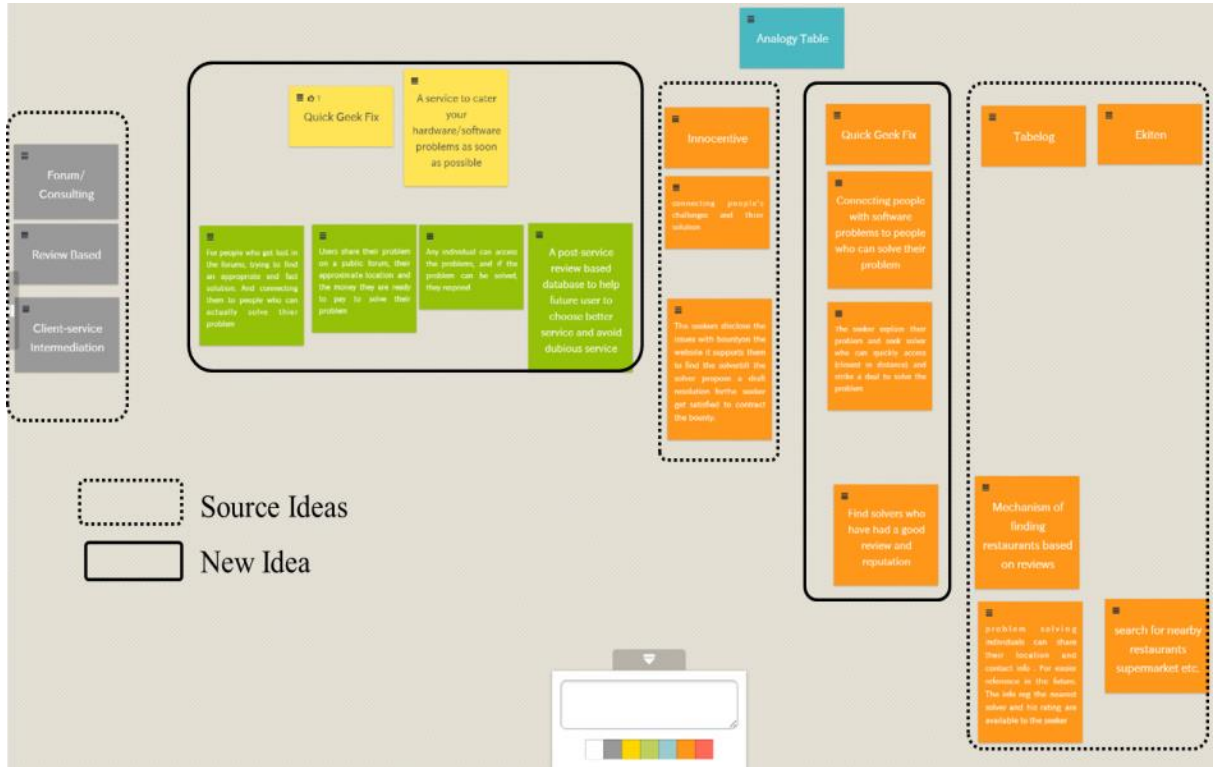
category II provide the integrated list of information and users merely add reviews on the prepared list. For example, both ‘User creating weather news’ and ‘Yahoo live weather’ provide weather information based on user’s participation, however, the former service is entirely depending on user’s input while the latter service provides weather information from the news agency and users can give a vote based on what kind of weather they currently situated. Also, other services in the category II, such as ‘@cosme’, ‘Tablelog’, ‘Price.com’, ‘Rakuten travel’, ‘Wedding park’, they all provide integrated list of items such as cosmetics, restaurants, devices, hotels, wedding venues, and each user can add the reviews from their experiences or check possible options for deciding their purchases. On the contrary, services in the category III, such as ‘Bike lover’s map’, ‘Cook pad’, ‘Yomiuri online comments’ provides information created by users who contributed to the community with their original knowledge or information.

Services in the category IV analyse the large amount of data collected from all the other users and recommend the optimized options to an individual user. For instance, Amazon.com analyses the database of purchase records from all the users and recommends specific items for each user which best fit with his or her taste. Similarly, Kura sushi also analyses purchase records of all the consumers and recommends specific dishes for current consumers which best fit with their taste. In addition, Google Japanese Input analyses the database of vocabularies used by all the users and recommends specific words to be typed for each user which best fit with his or her context in writing.

Consequently, structural similarity between the new idea and the source ideas needs to be judged. Participants were asked to select the category and cases from the categorization task, then generate new idea using analogical thinking. During the idea generation task, participants were asked to complete the analogy table with selected source idea(s) parallel with their new idea. To judge the structural similarity, the source ideas are based on the cases written in the analogy table. As shown in the figure 20, this participant selected three categories which are in gray notes, and three cases which are in orange notes in the dotted line boxes. The sample idea is a matching system that connects people who needs help for their electronic devices to people who can solve their problem. The source ideas he selected for idea generation include ‘intermedium’ as for a business structure; also ‘innocentive’ case which belongs to the category I: coordination. Thus, structural similarity between this new idea and the source ideas was assessed

as ‘High’, because the idea was generated using the same business structure with the source ideas.

Figure 20. A sample result of the idea generation task shown in the APISNOTE



Not all the participants generated new idea which has high structural similarity with any of those four categories. For example, as described in the table 7, participant 2B generated a new idea, titled ‘Beauty map’, the participant explained her idea as follow:

*“It’s a website, we can find people look similar to us, by input of personal data like the eye-shapes or a distance between two eyes. Then, we can find other users who have similar shape of face, and follow their way to do make-up. And it provides information of where we can buy what kinds of cosmetics, also, which make-up is good for special situation like party. My idea is like the bike lover’s map. somehow my idea still comes from the @cosme.”*

This new idea is difficult to be categorized as any of four exemplary categories, because the mechanism of this new idea is complex, as it seems to analyse the big data of users for a

customized suggestion similar to the category IV, however, according to the description from the participant, it also provides integrated information of products and stores, and this structure is similar to the category II,. In addition, this new service provides advices for special situations, which is similar to the category III.

Table 11. The examples of structural similarity between the ideas generated by participants and the referenced source ideas

Subject	New idea	source ideas	Structural Category		Analogical thinking <sup>34</sup>	structural similarity
			sources	new idea		
1A	Ultimate movie recommendation	Amazon.com, online dating	IV	IV	High	High
1B	beauty map	Bike lover's MAP, at cosme	III, II	None	Low	Low
1C	soft loan for educating the poor	Kopernik	I	I	High	High
1D	quick geek fix	InnoCentive, tabelog, ekiten	I	I	High	High
1E	city microscope	Conyac	I	III	Low	High
2A	fill out my forms	Lang-8	I	I	High	High
2B	wifi finder	Bike lover's MAP	III	III	High	High
2C	PET finder	Wedding Park	II	None	Low	Low
3-2AB	job finer for graduate	Lancers, amazon	I	I	High	High
3-1A	blood donation	KuraSushi, amazon	IV	IV	High	High
3-1B	cut&fill	Wedding Park	II	None	Low	Low
3-3AB	e-database for shopping mall	Amazon.com	IV	IV	High	High
4-1A	moral education and sex education	Open ideo, Yomiuri comments	III	III	High	High

<sup>34</sup> Analogical thinking skill is regarded differently from importing the structural similarity from source ideas.

4-1B	childcare	Conayc, Logo tournament	I	I	High	High
4-1C	Immersive education in microworlds	Kopernik, Katariba café	I	None	Low	Low
4-2A	personal education	KuraSushi, Google Japanese Input	IV	IV	High	High
4-2B	Services for education	Logo Tournament, InnoCentive	I	I	High	High
4-2C	elite education	Creative agency for everyone, Open ideo	I	None	High	Low
4-3A	career change	KuraSushi , Amazon.com, Google Japanese Input, POS system	IV	IV	High	High
4-3B	a job advisor	Katariba café, Lancers, Lang-8	I	I	High	High

## 4.2 The measurement of superficial similarity: the latent semantic analysis (LSA)

As mentioned in the introduction of chapter 4, superficial similarity is measured by the semantic similarity between the domains of source cases referred and the created idea. Measurement of text similarity has been used for a long time in application of the natural language processing and related areas (Corley & Mihalcea, 2005).

Amongst them, LSA is a mathematical, as well as a statistical technique for extracting and representing the similarity of meaning of words and passages by analysis of large bodies of text. It allows us to define the meaning of words as a vector in a high-dimensional semantic space. The raw data for LSA are meaningful passages and the set of words each contains. A matrix is constructed whose columns are words and whose rows are documents. The cells of the matrix are the frequencies with which each word occurred in each document. The data upon which the analyses reported below are based consist of a training corpus of about 11 million words, yielding a co-occurrence matrix of more than 92,000 word types and more than 37,000 documents (Kintsch, 2001).

Key words for targeting users or providing services of each business case should be considered to decide the specific semantic words of domain. To compute similarities by the latent semantic analysis, less ambiguous terms of domain need to be selected. Thus, the terms of the most obviously providing services, products, or targeting users which constitute the domain in each business case selected with specific, less ambiguous terms. As a consequence, we extracted words for domain in specific concept that can avoid ambiguity: for example, ‘dating’ is selected rather than ‘date’ which has several homonyms, in this regard, ‘typing’ is selected rather than ‘type’, also, abstract terms, such as beauty, love, were avoided as much as possible.

In addition, to measure how new ideas are generated in the domain of superficially far from existing ideas, it is important to generate a large pool of existing cases. For building a pool of existing cases of collective intelligence service, we asked the regular students of the i.school to search and gather together all cases they know regarding to the collective intelligence services. As a result, 71 cases were collected as shown in the table 12.

Table 12 . The words selection for the domain of 71 cases

No.	Category	case	In Japanese	Domain1	Domain2
1	I	Katariba café	カタリバカフェ	High school	university
2	I	Lang-8	Lang-8	language	proofread
3	I	Conyac	コニャック	translation	
4	I	Creative agency for everyone	みんなのクリエイティブエージェンシー（リクルート）	advertisement	
5	I	Happy Campus	ハッピーキャンパス	homework	university
6	I	Couch Surfing	カウチサーフィン	travel	lodging
7	I	Lancers	ランサーズ	job	
8	I	BOOK OFF	BOOK OFF	book	
9	I	Kopernik	Kopernik	technology	poverty



10	I	Social funding Maneo	ソーシャルレンディングサービス「maneo (マネオ)」	fund raising	investment
11	I	Trippiece	Trippiece	trip	
12	I	Donor Voice	Donor Voice	fund raising	donation
13	I	Coconala	Coconala	skills	
14	I	KAYAC, healty coin service	面白法人カヤック「元気玉」サービス	idea	
15	I	InnoCentive	InnoCentive	innovation	
16	I	Logo Tournament	Logo Tournament	logo	
<b>I</b>		Total cases	16		
17	II	WikiLeaks	ウィキリークス (WikiLeaks)	confidential	
18	II	Price.Com	価格.com	price	shopping
19	II	Rakuten Travel, voice of users	楽天トラベル 口コミ・お客様の声	travel	hotel
20	II	at cosme	@ c o s m e	cosmetic	
21	II	Jalan .net	じゃらん	travel	hotel
22	II	Foursquare	Foursquare	location	
23	II	AKB Election	AKB 総選挙	celebrity	
24	II	Miss Contest	ミス・コンテスト	beauty	pageant
25	II	Tabelog	食べログ	restaurant	
26	II	Wedding Park	ウェディングパーク	wedding	
27	II	TripAdvisor	TripAdvisor	trip	
28	II	Mom's voice	ママこえ	childcare	
29	II	4 travel	4 travel	travel	
30	II	Campus for Everyone	みんなのキャンパス	university	class

31	II	Nico Nico Douga	ニコニコ動画	cartoon	video
32	II	Ekiten	エキテン！	metro	shops
33	II	Yahoo Weather	Yahoo 天気情報「みんなで実況今の天気」	weather	
34	II	Hatena Bookmark	はてなブックマーク	bookmark	
35	II	Dating expert	デート通.jp	dating	
II		Total cases	19		
36	III	walking around the world	地球の歩き方	travel	
37	III	Job hunting diary for Everyone	みんなの就職活動日記（通称：みん就）	job	university
38	III	4010 Towa Service Station	道の駅四万十とおわ	farmer	
39	III	Agricultural Co-op	農業協同組合	agriculture	
40	III	fishery co-op	漁業協同組合（漁協）	fishery	
41	III	Academic Society	学会	academic	
42	III	Collective Housing	コレクティブハウジング	housing	
43	III	Statistics for Industrial Association	工業会統計	statistics	
44	III	Google Person Finder	Google Person Finder	person	disaster
45	III	Muji, crafts community	無印良品ものづくりコミュニティー	consumer	
46	III	Open ideo	Open ideo	social issue	idea
47	III	Innovation Jam	Innovation Jam	innovation	idea
48	III	Check A Toilet : Universal Design Toilet Map	Check A Toilet ユニバーサルデザイントイレマップ	toilet	
49	III	GREE	GREE	game	

50	III	User creating weather news	ウェザーニューズのサポーター参加型企画	weather	
51	III	Bike lover's MAP	自転車大好き MAP	bicycle	route
52	III	Google docs	Google docs	document	
53	III	Cook pad	クックパッド	recipe	
54	III	NRI Social planet	Social Planet	social issue	
55	III	uncyclopedia	uncyclopedia	joke	humor
56	III	2 channels	2ch ( 2 チャンネル )	opinion	gossip
57	III	Interests share	関心空間	hobby	
58	III	e-woman roundtable	イーウーマン 円卓会議	social issue	opinion
59	III	YOMIURI ONLINE Comments	YOMIURI ONLINE 発言小町	advice	personal issue
60	III	Flickr	Flickr	photos	
61	III	quora.com	quora.com	questions	idea
62	III	NHK Gag show	着信御礼！ケータイ大喜利	comedy	TV show
III		Total cases	27		
63	IV	KuraSushi	無添くら寿司	sushi	
64	IV	Amazon.com	Amazon.com	shopping	book
65	IV	Google Japanese Input	Google 日本語入力	typing	vocabulary
66	IV	SPYSEE	あの人検索 SPYSEE	person	
67	IV	Business Microscope	ビジネス顕微鏡	monitoring	employee
68	IV	The Global Public Health Intelligence Network		epidemic	
69	IV	POS system	POS system	shopping	
70	IV	T Card	T カード	consumer	shopping
71	IV	Google Search	google 検索	information	

IV	Total cases	9		
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In this study, appropriateness of new idea generated by analogical thinking is defined as domain-changing by applying similar structural feature from the source ideas. Therefore, we compute semantic similarity between the domains of idea created by participant and all the other domains using similar structures. For computation option, we selected the topic space of “general reading up to first-year college (300 factors)” and term-to-term matrix comparison type. The latent semantic analysis application (<http://lsa.colorado.edu>) computes the similarity between the contextual-usage meanings of words as calculated by the cosine of the included angle between vectors assigned to those words within a semantic space. Kintsch (2001) mentioned that “Intuitively, the vector length tells us how much information LSA has about this vector. Words that LSA knows a lot about, because they appear frequently in the training corpus, in many different contexts, have greater vector lengths than words LSA does not know well. Function words that are used frequently in many different contexts have low vector lengths. LSA knows nothing about them and cannot tell them apart since they appear in all contexts.” Semantic similarity values were used in the main parametric analysis. Specifically, these values allowed us to identify the superficial similarity between the domains of a new idea and those of existing business cases as shown in the table 13.

Table 13 . Superficial similarity between the new ideas and the source ideas calculated by LSA

Category IV		New idea Domain	Existing domains		sushi	restaurant	shopping	typing	celebrity	monitoring	epidemic	consumer	search	information	bookmark	book	vocabulary	employee
Subject	Superficial similarity		Similarity (Max)	Vector Length	0.06	0.51	0.6	0.73	2.07	1.57	0.33	2.02	0.6	2.5	0.06	2.3	0.85	1.97
1A	0.26	movie	0.26	0.65	0.04	0.26	0.15	-0.04	0.15	0.06	0.03	0.07	0.07	0.07	0.04	0.14	0.02	0.02
3-1A	0.21	blood	0.21	3.53	-0.02	0.04	0.02	0.02	0.11	0.21	0.13	0	0.05	0.02	0.04	0.03	0.01	-0.01
3-3AB	1	shopping	1	0.6	0.01	0.37	1	0.03	0.06	0.07	0.02	0.31	0.09	0.11	0.08	0.04	0.02	0.04
4-2A	0.18	performance	0.22	2.83	0	0.07	0.07	0.22	0.12	0.03	0.08	0.05	0.17	0.1	0.08	0.22	0.14	0.19
		coaching	0.13	0.25	0	0.13	0.03	0.09	0.05	0.07	0.02	0	0.07	0.09	0.02	0.03	0.09	0.08
4-3A	0.28	job	0.35	2.07	-0.01	0.29	0.12	0.21	0.15	0.01	0.02	0.05	0.14	0.16	-0	0.05	0.06	0.35
		career	0.21	1.22	0.02	0.17	0.08	0.21	0.15	0.06	0.07	0.07	0.16	0.16	-0	0.1	0.07	0.11

Category I		New idea		Existing domain		university	poverty	high school	job	language	translation	advertisement	homework	lodging	book	technology	innovation	fund raising	trip	skills	idea	logo	travel	investment	donation	
				Similarity (Max)	Vector Length																					
Sub ject	Superficial similarity	ID	Domain	repair	0.2	0.63	0.05	0.02	0.14	0.2	0.03	0.08	0.08	0.06	0.17	0.06	0.15	0.06	0.05	0.14	0.1	0.03	0.08	0.14	0.02	0.1
				computer	0.31	3.57	0.06	0	0.07	0.08	0.08	-0.01	0.04	0.15	-0.04	0.05	0.31	0.11	0.06	0	0.03	0.05	0.03	0.03	0	0.01
				the poor	0.71	1.08	0.12	0.71	0.2	0.16	0.08	0.06	0.12	0.12	0.28	0.09	0.05	0.03	0.17	0.11	0.12	0.11	-0	0.14	0.04	0.1
				scholarship	0.65	0.21	0.65	0.16	0.41	0.12	0.07	0.13	0.01	0.12	0.15	0.09	0.18	0.12	0.1	0.14	0.05	0.09	0.07	0.02	0.06	0.03
2A	0.18	IC	official	0.22	2.51	0.1	0.06	0.15	0.12	0.11	0.13	0.21	0.22	0.06	0.12	0.1	0.08	0.07	0.12	0.03	0.15	0.11	0.09	0.02	0.08	
				0.25	0.09	0.14	0.09	0.07	0.06	0.25	0.15	0.02	0.05	0.1	0.02	-0	0.09	-0.02	0.12	0	0.09	0.1	0.12	0.03	0.05	
				foreigner	1	2.07	0.13	0.08	0.25	1	0.05	-0.03	0.14	0.09	-0.01	0.05	0.07	0.09	0.16	0.12	0.41	0.12	0.05	0.09	0.07	0.01
				job	0.93	2.51	0.41	0.1	0.93	0.27	0.09	0.08	0.06	0.45	0.15	0.13	0.08	0.11	0.08	0.18	0.23	0.09	0.01	0.08	0.03	0.17
3-2AB	0.64	graduate school	0.22	3.32	0.05	0.17	0.22	0.12	0.14	0.05	0.04	0.08	0.14	0.07	0.07	0.08	0.1	0.14	0.21	0.17	0.02	0.07	0.03	0.05		
			child care	0.32	2.95	0.32	0.08	0.21	0.11	0.13	0.11	0.03	0.23	0.03	0.15	0.2	0.1	0.09	0.13	0.17	0.2	-0	0.12	0.02	0.04	
			study group	0.3	0.71	0.11	0.3	0.15	0.1	0.18	0.06	0.01	0.05	0.03	0.03	0.04	0.07	0.07	0	0.1	0.08	0.07	0.03	0.04	0.04	
			minority	1	2.07	0.13	0.08	0.25	1	0.05	-0.03	0.14	0.09	-0.01	0.05	0.07	0.09	0.16	0.12	0.41	0.12	0.05	0.09	0.07	0.01	
4-1B	0.22	job	advice	0.25	0.4	0.22	0.16	0.19	0.2	0.03	0.17	0.25	0.21	0.16	0.13	0.06	0.12	0.13	0.17	0.18	0.15	0.06	0.08	0.11	0.07	
			advice	0.25	0.4	0.22	0.16	0.19	0.2	0.03	0.17	0.25	0.21	0.16	0.13	0.06	0.12	0.13	0.17	0.18	0.15	0.06	0.08	0.11	0.07	
			advice	0.25	0.4	0.22	0.16	0.19	0.2	0.03	0.17	0.25	0.21	0.16	0.13	0.06	0.12	0.13	0.17	0.18	0.15	0.06	0.08	0.11	0.07	
			advice	0.25	0.4	0.22	0.16	0.19	0.2	0.03	0.17	0.25	0.21	0.16	0.13	0.06	0.12	0.13	0.17	0.18	0.15	0.06	0.08	0.11	0.07	

Category III		New idea	Existing domain	dairing job	service station	agricul- ture	fishery	research	statistics	social innovation	toilet game	weather	bicycle	docu- ment	recipe	joke	opinion	hobby	advice	photos	quest- ions	unive- rsity	farm dis- ter	cons- umer	idea	route	humor	gossip	person- al issue								
Superficial Subject	similarity	Domain	Similarity (Max)	Vector Length																																	
1E	0.38	roadway	0.38	0.25	0	0	0.15	0.03	-0.02	0.01	0.06	0.03	0.05	0.02	0.01	0.08	0.04	0.11	0.38	0.97	0.92	0.47	0.26	0.93	0.21	0.4	0.19	1.95	1	1.01	0.28	2.02	1.34	0.88	0.21	0.18	1.58
2B	0.23	telecommu- nication	0.23	0.06	0	0.1	0.23	0.06	-0.03	0.02	0.03	0.08	0.09	0.05	0.02	0.14	-0	0.14	-0.03	-0	-0.06	-0	-0.05	-0.01	-0.02	0.01	-0	0	0.06	0.02	-0	0.04	0.05	-0.03	0.03	0.05	
4-1A	0.29	ethics	0.25	0.37	0.01	0.1	0.17	0.05	-0.05	0.25	0	0.07	0.03	0.25	0.08	0.04	-0	0.03	-0.04	0	0	0.03	0.17	0.05	0.17	0.03	0.05	0.05	0.23	0.02	0.09	0.07	0.05	0.07	0.16	0.14	0.24
		sex education	0.32	3.2	0.17	0.2	0.1	0.1	-0.02	0.31	0.16	0.19	0.13	0.32	0.15	0.13	0.02	0	0.03	0.03	0.02	0.05	0.17	0.03	0.16	0.01	0.09	0.32	0.01	0.02	0.07	0.11	-0	0.08	0.06	0.27	

Pairwise comparisons in a form of matrices were made between all the word pairs of existing cases within category as shown in the table 14. The average value of semantic similarities of the most similar pairs of cases within the category is measured for setting the threshold of deciding “high” and “low” in evaluation. For example, there are 9 existing business cases in the category IV, which is ‘big data analysis’, and the number of possible combinations in a pair is  $n(n-1)/2 = 45$  pairs. Among those pairs, each case has a highest similar pair, in total there are 9 pairs that has highest similarity each other. The threshold value was computed from the average value of semantic similarities of those 9 pairs. In the example of the category IV, it is the average value of  $[0.19, 0.52, 0.09, 0.14, 0.13, 0.06, 0.66, 0.66, 0.14] = 0.29$ . According to this calculation, each category has its threshold value as follows: 1) Category I = 0.33; 2) Category II= 0.58; 3) Category III = 0.31; 4) Category IV = 0.29.

Table 14. The matrices of semantic similarity among the existing cases within a same structural category

Category IV: Big data (N=9)		KuraSushi	Amazon.c	Google Ja	Spysee	Biz micros	Global he	T card	POS	Google search	Max
Average similarities of the most similar pairs: 0.29		sushi; restaurant	shopping; book	typing; vocabulary	celebrity; relationship	monitoring; employee	epidemic	shopping; consumer	shopping	information; search	
KuraSushi	sushi; restaurant		0.12	0.02	0.05	0.03	0.00	0.12	0.19	0.05	0.19
Amazon.com	shopping; book	0.12		0.05	0.03	0.04	0.03	0.35	0.52	0.10	0.52
Google Japan	typing; vocabulary	0.02	0.05		0.04	0.04	0.01	0.01	0.03	0.09	0.09
Spysee	celebrity; relationship	0.05	0.03	0.04		0.10	0.05	0.02	0.03	0.14	0.14
Biz microscope	monitoring; employee	0.03	0.04	0.04	0.10		0.03	0.05	0.06	0.13	0.13
Global health	epidemic	0	0.03	0.01	0.05	0.03		0.00	0.02	0.06	0.06
T card	shopping; consumer	0.12	0.35	0.01	0.02	0.05	0.00		0.66	0.09	0.66
POS	shopping	0.19	0.52	0.03	0.03	0.06	0.02	0.66		0.10	0.66
Google search	information; search	0.05	0.10	0.09	0.14	0.13	0.06	0.09	0.10		0.14

Category I: intermedium (N=16)		Katariba café	Lang-8	Conyac	Creative agency for	Happy Campus	Couch Surfing	Lancers	BOOK OFF	Kopernik	Social funding	Trippiece	Donor Voice	Coconala	KAYAC, healthy con	ImmoCenti	Logo	Max
Average similarities of the most similar pairs: 0.33		high school;	language	translation	advertisment	homework ;	travel; lodging	job	book	technology ;poverty	fund raising;	trip	fund raising;	skills	idea	innovation	logo	
Katariba café	high school; university		0.09	0.11	0.06	0.46	0.11	0.19	0.14	0.14	0.07	0.17	0.12	0.16	0.13	0.16	0.01	0.46
Lang-8	language	0.09		0.47	0.02	0.06	0.02	0.05	0.06	0.08	0.02	0.05	0.01	0.21	0.11	0.04	0.00	0.47
Conyac	translation	0.11	0.47		0.01	0.12	0.04	-0.03	0.16	0.05	0.02	0.06	-0.03	0.11	0.08	0.12	-0.06	0.47
Creative agency for	advertisement	0.06	0.02	0.01		0.06	0.06	0.14	0.08	0.01	-0.01	0.03	0.04	0.05	0.16	0.02	0.12	0.16
Happy Campus	homework; university	0.46	0.06	0.12	0.06		0.03	0.11	0.20	0.11	0.03	0.15	0.09	0.08	0.12	0.07	0.01	0.46
Couch Surfing	travel; lodging	0.11	0.02	0.04	0.06	0.03		0.04	0.04	0.10	0.11	0.34	0.10	0.05	0.11	0.01	-0.03	0.34
Lancers	job	0.19	0.05	-0.03	0.14	0.11	0.04		0.05	0.08	0.12	0.12	0.09	0.41	0.12	0.09	0.05	0.41
BOOK OFF	book	0.14	0.06	0.16	0.08	0.20	0.04	0.05		0.08	0.07	0.12	0.05	0.09	0.16	0.04	0.06	0.20
Kopernik	technology; poverty	0.14	0.08	0.05	0.01	0.11	0.10	0.08	0.08		0.11	0.05	0.06	0.17	0.07	0.30	0.00	0.30
Social funding	fund raising; investment	0.07	0.02	0.02	-0.01	0.03	0.11	0.12	0.07	0.11		0.07	0.35	0.09	0.05	0.21	0.14	0.35
Trippiece	trip	0.17	0.05	0.06	0.03	0.15	0.34	0.12	0.12	0.05	0.07		0.09	0.05	0.18	-0.01	-0.01	0.34
Donor Voice	fund raising; donation	0.12	0.01	-0.03	0.04	0.09	0.10	0.09	0.05	0.06	0.35	0.09		0.05	0.05	0.05	0.08	0.35
Coconala	skills	0.16	0.21	0.11	0.05	0.08	0.05	0.41	0.09	0.17	0.09	0.05	0.05		0.08	0.14	0.00	0.41
KAYAC, healthy con	idea	0.13	0.11	0.08	0.16	0.12	0.11	0.12	0.16	0.07	0.05	0.18	0.05	0.08		0.10	0.01	0.18
ImmoCentive	innovation	0.16	0.04	0.12	0.02	0.07	0.01	0.09	0.04	0.30	0.21	-0.01	0.05	0.14	0.10		0.04	0.30
Logo	logo	0.01	0.00	-0.06	0.12	0.01	-0.03	0.05	0.06	0.00	0.14	-0.01	0.08	0.01	0.04			0.14
Tournament																		

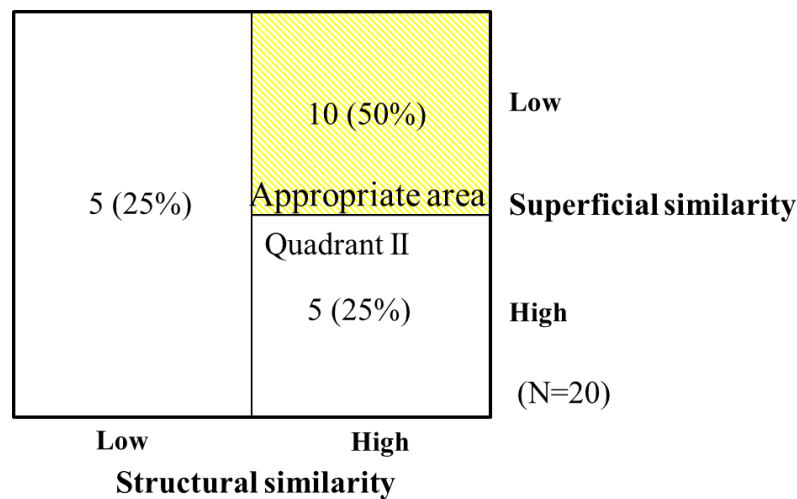
[illegible]



### 4.3 Results

20 new ideas were generated as the outcomes from four innovation workshops. According to the proposed evaluation method, 10 out of 20 ideas were assessed as appropriate ideas as shown in the figure 21).

Figure 21. The results of outcomes from the innovation workshops based on the proposed evaluation method



As we can see from the results, analogical thinking does not always promote domain-changing. 25% of participants were able to import the structural features from the source cases, however, unable to apply it to the new domain, which are superficially far from the existing domains. Other 25% of participants failed to apply the structural similarity from the any source cases. It could be assumed that those participants generated the ideas not from during the workshop using analogical thinking as instructed, but from the inherent idea in long-term memory and failed to match the analogue with the source cases. Similarity-based access to long-term memory most often produces mundane literal, i.e. superficial similarity matches (Gentner et al., 1993 ; Reeves & Weisberg, 1994; Ross, 1989). K. J. Holyoak (1985) also noted that superficial similarity plays larger part, when there is a lack of understanding of the conceptual ideas underlying the problems.

#### **4.4 Issues in validation of the proposed method**

To propose a new evaluation method, it needs to respond to threat to validity inherent in the design of evaluation method. Therefore, validation procedures are claimed to justify it. However, validity is generally achieved through accumulated evidence. A conclusion is valid when there is sufficient evidence and/or reasons to reasonably believe it is so (Polkinghorne, 2007). The purpose of the validation process is to convince readers of the likelihood that the support for the findings from a proposed method is strong enough that it can serve as a basis for understanding of and action in the related studies. This requires providing sufficient justification to readers for the claims we make. However, this study does not deal with large enough quantitative data, but the verbal and written descriptions given by participants. It is possible that certain data given by participants has obscure aspects. To overcome those drawbacks of data, this study tried to clarify each process of evaluation with detailed description, so that it can be repetitively applied in future studies and tested.

In general point of view, methods should be applicable and codifiable in a wide variety of circumstances by other researchers. The flaws of incorrect methods "are bound to manifest themselves in the vast multiplicity of their applications"(Rescher, 1977). A possible reason for the lack of validation of an evaluation method is the philosophical and methodological problems involved in validating methods (Moody, 2003). Rescher (1977) claimed that human knowledge consists of two types: 1) knowledge that, which define statements or assertions about the world; 2) knowledge how, which define ways of doing things. And he argues that an entirely different approach is required to validate methodological knowledge. In other words, if the methods have not truth value, but pragmatic value, it cannot be true or false, but only effective or ineffective. The validity of a method can only be established by applicative success in practice.

In this study, the objective of validation should not be to demonstrate that the method is "correct" but that it is rational practice to adopt the method based on its pragmatic success. However, despite its applicative success in practice, it requires to compare the results of the proposed evaluation method and those from the evaluation in terms of 'novelty', 'impact', and 'feasibility' of the generated ideas by judgement from experts or novices. Therefore, in future study, the

evaluation method will be improved to be a reliable and valid measure of the appropriateness in idea generation using analogical thinking.

## **5. Identification of factors for an appropriate idea generation**

In the previous chapter, the results illustrated that an appropriate idea does not automatically occur whenever people were asked to generate an idea using analogical thinking after make them understand source ideas and build the knowledge on their structural features. Therefore, this study investigated what are the factors for an appropriate idea generation. For identifying factors, this study focuses on the factors which are controllable by workshop facilitation. Thus, all the data which are available from the workshop were analysed: each participant's performance in the categorization task; pattern in thinking process during the generation task. In addition, personal interview surveys were conducted after the workshop. Consequently, three factors were considered to have a significant relationship with the appropriateness of ideas generated using analogical thinking: 1) categorization skill; 2) deliberation before reaching the creative leap moment; and 3) having trial and error in setting a domain to be solved.

### **5.1 Performances in categorization as a factor of an appropriate idea generation**

Despite the importance of analogical thinking, several questions were raised regarding the generation of new ideas from the source ideas and its structural mapping. One key question concerns the role of categorization in structural mapping. Many researchers have suggested that categorization may be importantly related to analogical reasoning (Bowdle & Gentner, 2005; Gentner & Markman, 1997; Hesse, 1966; K. J. Holyoak & Thagard, 1997; Sternberg, 1977). Generally, analogy research has treated categorization as an end result of analogical reasoning. Gentner and Markman (1997), for example, argue that determining that two items or situations are analogous is an important criterion in deciding that the two entities are members of a common category.

During the categorization task, participants created the labels for categories they classified as a group. For example, as shown in the table 15, the participant 2B initiate a category which is based on the mechanism of matching service, *"How about start from the service that make some matching? For example, the case no.16?(2B)"* and the participant 2A initiate a category based on the large data collection from users to provide information for other users. *"the other one, their structure is based more on collecting the from the large group And then passing that information to a single person(2A)"*. The refined and decided the final labels of their categories as 'service

chain: provider-middle man-consumer’ and ‘General public as resource’ through their discussion. The performance in categorization task is assessed by which labels of categories a participant created, and how many cases were classified under those labels, and how many of them actually fit under those categories. In the 1<sup>st</sup>- 4<sup>th</sup> workshops, there were eight groups in total, and each group created 5.5 labels on average, overall, 79% of cases were categorized correctly. Thus, if a subject categorized cases in the labels he or she created with more than 79% of correctness, his or her categorization skill was assessed as “high” (see the table 16).

Table 15. Example of the categorization by discussion

Time	Duration(sec.)	Subject	Discourse
00:28:13	26	2A	Do you have any initial idea?
00:28:15	2	2C	Not particularly
00:28:24	9	2B	I wonder how much we can create.
<b>00:28:52</b>	<b>28</b>	<b>2B</b>	<b>So how about start from the services that make some match, matching</b>
00:29:02	10	2A	matching?
00:29:04	2	2A	which one?
<b>00:29:07</b>	<b>3</b>	<b>2B</b>	<b>for example, No.16. match</b>
00:29:25	18	2B	And there's another one..
00:29:41	16	2A	I think I, when I read this, I recognized 3 types of structures.
00:29:54	13	2A	So, one is e.g. the one you have in the left, those services ,
00:30:04	10	2A	They are, they connect one person.
00:30:07	3	2A	Should we?... for another person?
<b>00:30:11</b>	<b>4</b>	<b>2A</b>	<b>But then, the other one, their structure is based more on</b>
<b>00:30:22</b>	<b>11</b>	<b>2A</b>	<b>collecting the from the large group</b>
<b>00:30:30</b>	<b>8</b>	<b>2A</b>	<b>And then passing that information to a single person</b>
00:30:37	7	2A	What's your think?
00:30:39	2	2C	This is from the , maybe, consumer's point of view.
00:30:43	4	2C	from the business point of view, which is like No.59, what they do is like, they create a competition, and the one who wins, he will be using that service
00:30:54	11	2C	instead of giving the content to someone.
00:30:57	3	2C	for more something to do more particular one
00:31:05	8	2C	They create like an open competition, and they get a better result, so this is from the point of view of business
00:31:12	7	2C	some of them are from the consumer's point of view, the you get a better result or something.

Table 16. Performance in categorization task and idea generation task in the 1<sup>st</sup>-4<sup>th</sup> workshop

Subject	Created label	No. of Cases		(B)/(A)	Categorization skill	Appropriateness of a new idea
		All (A)	Fit (B)			
1A	Clients-Creators Intermediation	7	6	91%	High	High
	Review based	4	4			
1B	Collective intelligence	7	5	55%	Low	Low
	Information distribution	4	1			
1C	Frequency based	4	4	100%	High	Low
	Monitoring	1	1			
1D	Forum/Consulting, Ask question to users/Find users to solve a problem	8	7	88%	High	High
1E	None	0	0	0%	Low	Low
Group 1 <sup>35</sup>		35	28	80%	High	
2A	General public as resource	14	13	93%	High	High
2B	service chain: provider-middle man-consumer	8	8	100%	High	High
2C	Increase efficiency of business	3	3	100%	High	Low
Group 2		25	24	96%	High	
3-1A	Frequency analyzer	4	4	86%	High	High
	Option provider	2	1			
	Info Exchange	4	3			
	connector	4	4			
3-1B	Feedback based on opinion	4	4	75%	Low	Low
	info sharing	4	2			
Group 3-1		22	18	82%	High	
3-2A	mass data	8	4	72%	Low	Low

<sup>35</sup> In the first workshop, as a pilot, 36 cases were given for the categorization task.

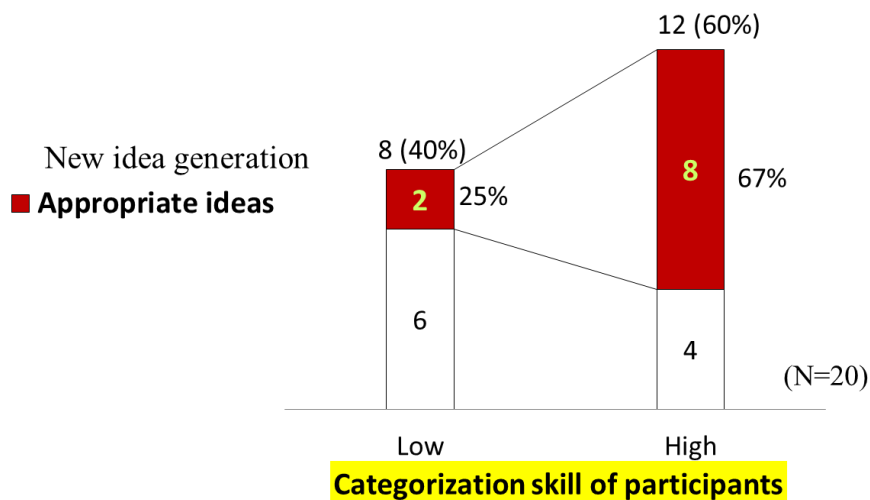
	matching	2	2			
	user review	8	7			
3-2B	sourcing	6	5	83%	High	N/A <sup>36</sup>
Group 3-2		24	18	75%	Low	
3-3A	public reviews	4	2	50%	Low	Low
	sharing experience	4	3			
	sharing ideas	6	2			
3-3B	consultation	4	4	73%	Low	N/A
	recommendation	7	4			
Group 3-3		25	15	60%	Low	
4-1A	on-time information	4	2	67%	Low	High
	suggestion	2	2			
4-1B	recommendation to both sides	4	3	64%	Low	High
	solution-giver	7	4			
4-1C	expert's service	2	2	75%	Low	Low
	predicting suggestion	6	4			
Group 4-1		25	17	68%	Low	
4-2A	linking supply and demand	3	3	100%	High	High
4-2B	crowd sourcing and reviewing	4	3	82%	High	High
	expert advice	3	2			
	improving customer experience through recommendations	4	4			
4-2C	information	3	2	82%	High	High
	information and evaluation	8	7			
Group 4-2		25	21	84%	High	
4-3A	places review	4	4	82%	High	High
	pool of knowledge	3	2			

<sup>36</sup> In the two pair groups of group 3-2; and group 3-3, subjects were generated idea in pair, but main idea creation was performed by the participant 3-2A; and the participant 3-3A.

	solution application	2	2			
	solution creation	4	2			
	tailor-made	4	4			
4-3B	matching	3	3	100%	High	Low
	review & comparison	2	2			
Group 4-3		22	19	86%	High	
Total		203	160	79%	Average	

Consequently, the relationship between the participant's performance in categorization task and the appropriateness of a generated idea is identified. As shown in the figure 22, eight out ten appropriate ideas were generated by the participants with higher skills in categorization. 12 participants out of 20 showed high performance in categorization task, and 67% of them generated an appropriate idea, while only 25% of the low performance group in categorization task generated an appropriate idea.

Figure 22. Relationship between categorization skill and appropriate idea generation





In order to generate an appropriate idea using analogical thinking, understanding the underlying mechanism of source ideas is essential to expand a span of idea by breaking the conventionalized semantic relations within domains (Gentner, 1983; K. J. Holyoak & Thagard, 1996). For example, when a participant selected Amazon.com as a source idea, it is necessary to understand the business mechanism of “customized proposal based on the analysis of data from other consumers shopping behaviors”, instead of focusing on the domain of “shopping”.

## **5.2 Thinking process in ideation as a factor of appropriate idea generation**

During the process of generating an idea, creators probably have experience of the sudden illumination, which is called the creative leap, or mental leap. For example, in creative design task, designers may clearly recognize breakthroughs or significant concept generation points, exclaiming ‘Ah-ha!’, ‘Eureka!’ or ‘Good idea!’. Cross (1997) pointed out that the sudden illumination is more like building a ‘creative bridge’ between the problem space and the solution space and expression of the concept actually ‘accumulates’ a lot of prior concepts, examples and discussion. Clement (2008) classified ‘breakthrough’; ‘scientific insight’; and ‘pure Eureka event’, and defined each term as follows: a breakthrough is a process that produces a key idea, which is an important component of a solution, and that overcomes a barrier that can block progress toward a solution; a scientific insight is a breakthrough occurring over a reasonably short period of time leading to a significant structural improvement in one’s model of a phenomenon; a pure Eureka event as an extremely sudden, reorganizing, extraordinary break away from the subject’s previous ideas. Here, “extraordinary” refers to processes such as unconscious that are different from normal thinking. If the idea came to mind unexpectedly and does not appear to be connected to the subject’s previous ideas during the process, this would constitute an evidence for an extraordinary and presumably unconscious thinking process.

However, it should be considered that whether this subject’s accomplishment is the result of a smooth incremental, buildup from previous ideas or it is sudden extraordinary break with the subject’s previous ideas. Clement (2008) concluded that the subject who created a novel idea in his experiment should be characterized as an impressive scientific insight triggered by a series of analogies, not as a pure Eureka event. In addition, after reviewing the literature on insight in

creative thinking, Perkins (1981) claimed that there is no convincing body of evidence that insights occur via special or extraordinary processes.

We assume that the creative moment should come after deliberation. In other words, longer incubation or more efforts before the moment of insight may help us to improve the performance in generating an idea. Therefore, it is important to investigate the thinking process while generating new ideas. In this study, thinking process in the idea generation task can be identified with analysis of the record from the APISNOTE, and interview survey (see the figure 23 and 24).

Figure 23. An example of ideation process shown in APISNOTE



In the interview, each participant indicated the note that makes the creative leap during the generation task. Based on the record in the APISNOTE, each process was coded as ‘mechanism’; ‘source retrieval’; ‘domain setting’; ‘domain refining’; ‘title’; and ‘others’ (see the table 17).

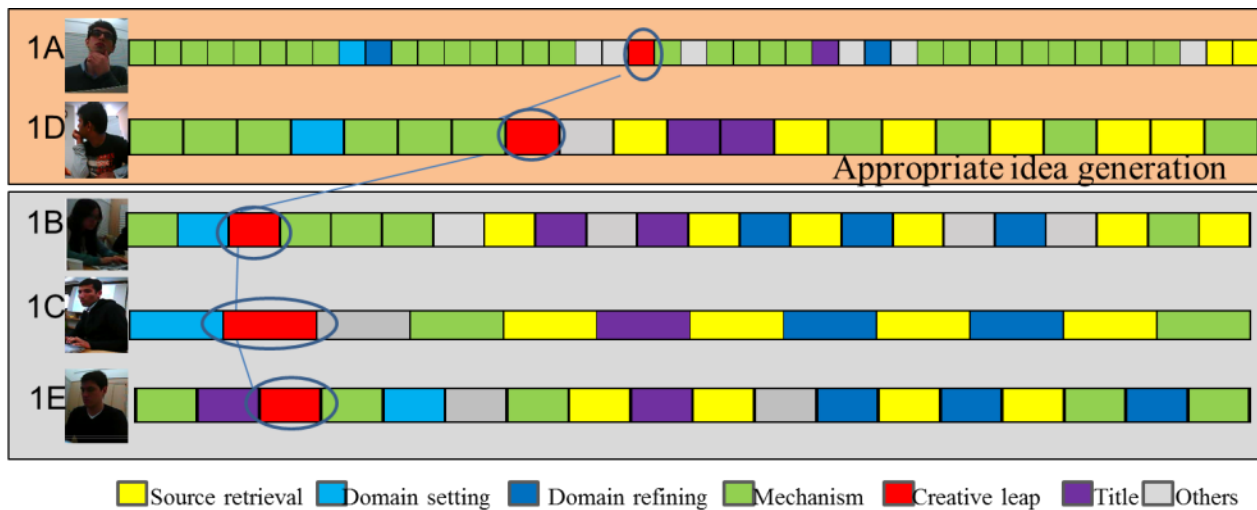
Table 17. A sample of coding for idea generation process

No.	time record	time spending	Created Notes	Coding
1	15:24:51		service chain: provider-middle man-consumer	Selecting mechanism
2	15:24:51	00:00:00	Case: Katariba cafe	Source retrieval
2	15:24:51	00:00:00	Case: Creative agency for everyone	Source retrieval
2	15:24:51	00:00:00	Case: Innocentive	Source retrieval
2	15:24:51	00:00:00	Case: Conyac	Source retrieval
2	15:24:51	00:00:00	Case: Kopernik	Source retrieval
2	15:24:51	00:00:00	Case: Lancers	Source retrieval
2	15:24:52	00:00:01	Case: lang-8	Source retrieval
2	15:24:52	00:00:00	Case: Logo tournament	Source retrieval
3	15:25:11	00:00:19	professional people as resource	Mechanism
4	15:34:22	00:09:11	young people sometimes need help with homework	Domain setting 1
5	15:34:54	00:00:32	homework coaching can be provided by many students	Domain refining
6	15:35:09	00:00:15	It's also possible to do it online	Mechanism
7	15:37:40	00:02:31	convenient - no need to arrange meeting place. Also no travel costs	Mechanism
8	15:38:21	00:00:41	Coaches: must at least have a high school diploma	Mechanism
9	15:41:24	00:03:03	homework coach matching service	Title
10	15:42:27	00:01:03	aligning reported mechanism	Mechanism
11	15:52:57	00:10:30	In Japan, people sometimes need assistance filling out complicated forms (especially foreigners)	Creative leap
12	15:53:27	00:00:30	There are many people who are good at filling out forms	Domain setting 2
13	15:54:59	00:01:32	Not all foreigners have Japanese bilingual friend to help them fill out forms	Domain refining
14	15:55:19	00:00:20	Forms can be scanned/photographed easily	Mechanism
15	15:56:32	00:01:13	Fill-my-form buddy matching service	Title
16	16:00:34	00:04:02	there are many foreign students in Todai	Domain setting 3
17	16:01:10	00:00:36	Sometimes, when they go back to their country, they have many belongings which they should get rid of	Domain refining
18	16:02:18	00:01:08	many new students could use those belongings	Domain refining
19	16:04:16	00:01:58	Todai-portal for (foreign) students to share & buy belongings	Title
20	16:13:49	00:09:33	Analogy table	Analogy table

21	16:16:10	00:02:21	Fill-my-form buddy matching service	Title
22	16:16:52	00:00:42	Japanese people proficient at filling our forms can register in a website	Mechanism
23	16:19:20	00:02:28	consumers scan/photograph form and send it to buddy. Buddy will explain how to fill in each blank	Mechanism
24	16:23:20	00:04:00	A randomly chosen provider verifies work. A commission is paid by the consumer.	Mechanism
25	16:24:31	00:01:11	People proficient at translation	Source retrieval
26	16:25:35	00:01:04	People proficient at bureaucracy	Domain refining
27	16:26:01	00:00:26	Work can be delivered digitally	Mechanism
28	16:26:31	00:00:30	Alternative to design companies which may charge high commission.	Mechanism
29	16:28:24	00:01:53	Alternative to consulting firms which charge high fees and are not accessible online.	Mechanism

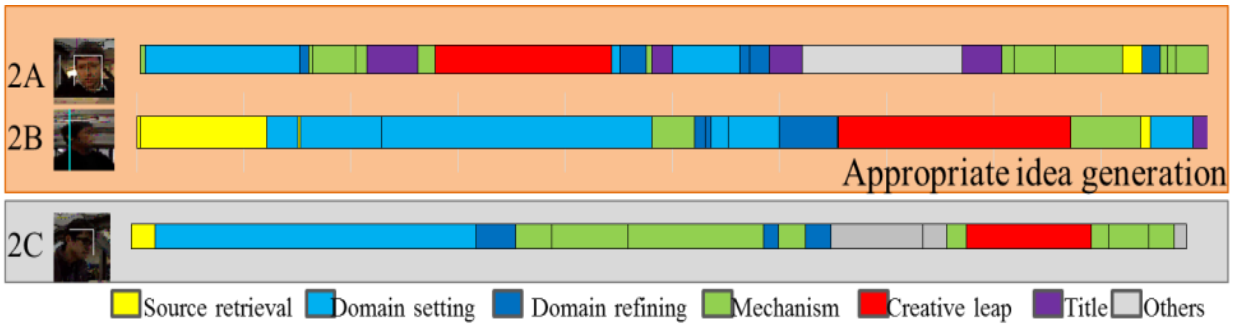
Figure 24. Thinking processes of each participant in the generation task: the 1<sup>st</sup>-4<sup>th</sup> workshop

a) The first workshop(N=5)

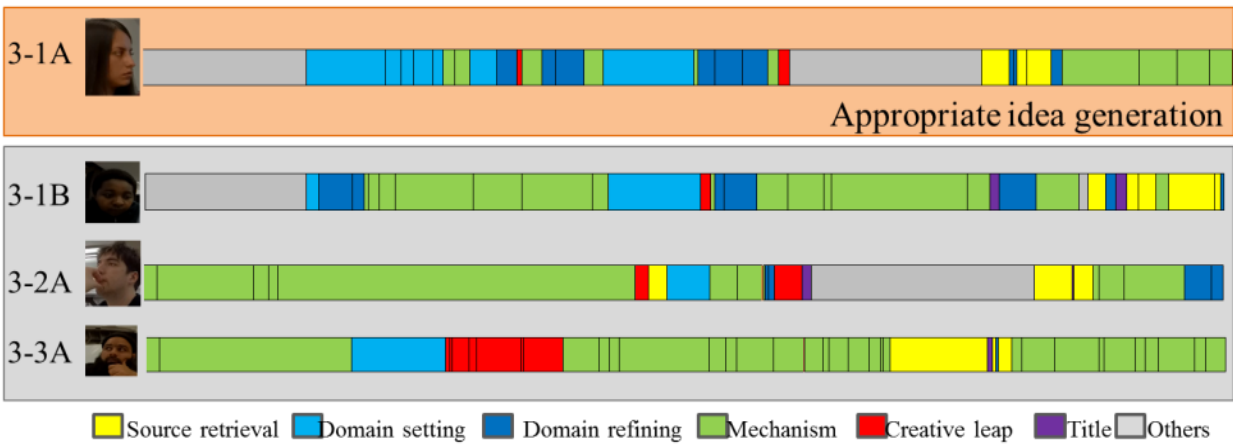


Note) Recording of time for creation of each note has been available since the second workshop. Thus, each sequence is evenly distributed in terms of time, for coding of the first workshop. However, since second workshop, each sequence was coded based on the spent time for creating each note.

b) The second workshop(N=3)

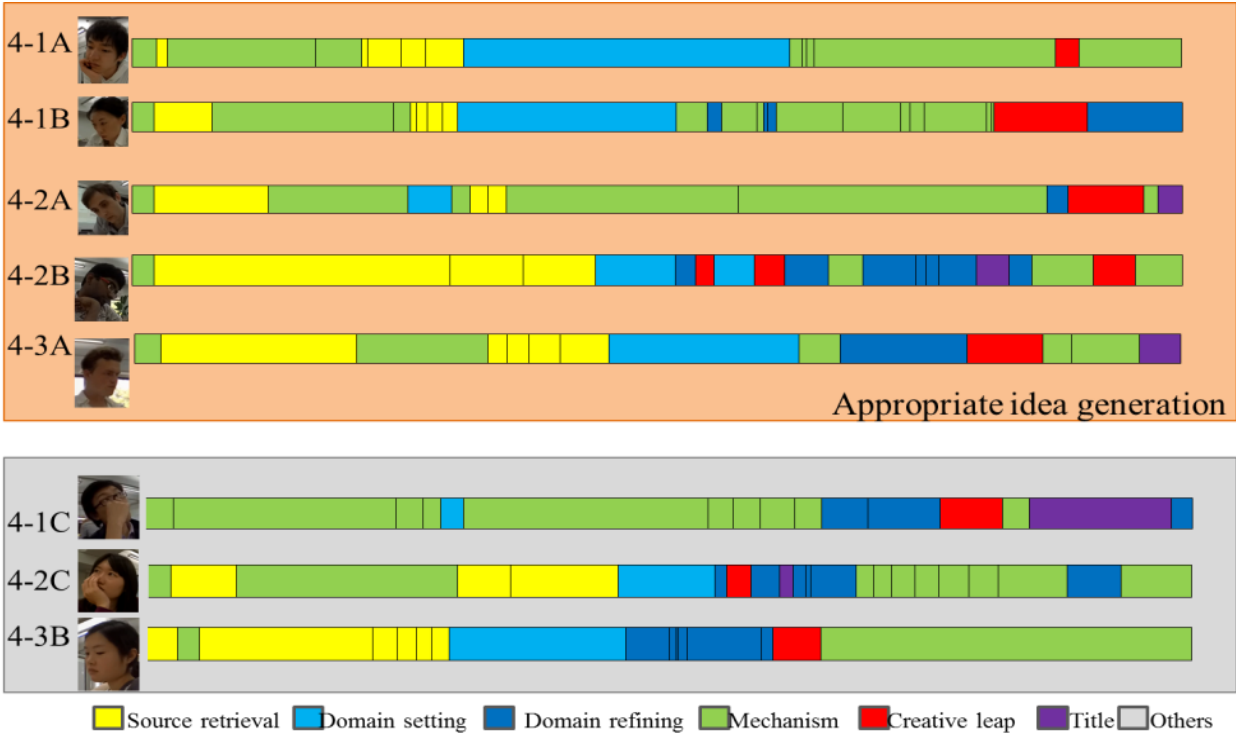


c) The third workshop(N=4)



Note) There were three groups of a pair in the third workshop. Two ideas were generated individually, the other two ideas were generated in a pair.

d) The fourth workshop



The degree of deliberation before reaching creative leap was defined as at which sequence of creating notes, a participant reached the creative leap moment(s) among all the ideation process in terms of the number of notes he or she created. If a participant indicated that he or she had the creative leap moment more than once, the average value was adopted. According to the histogram analysis (see the figure 25), it was found that five participants had ‘low’ level of deliberation, and the other 15 participants had ‘high’ level of deliberation before reaching the creative leap moment (see the table 18).

Figure 25. Histogram analysis of participants’ deliberation before reaching creative leap moment

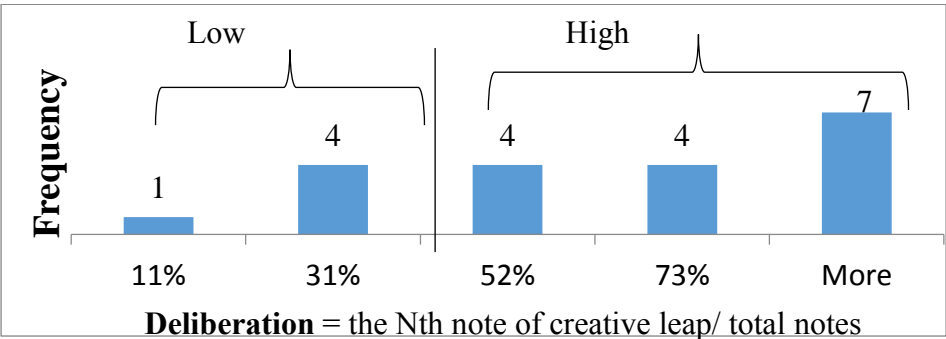
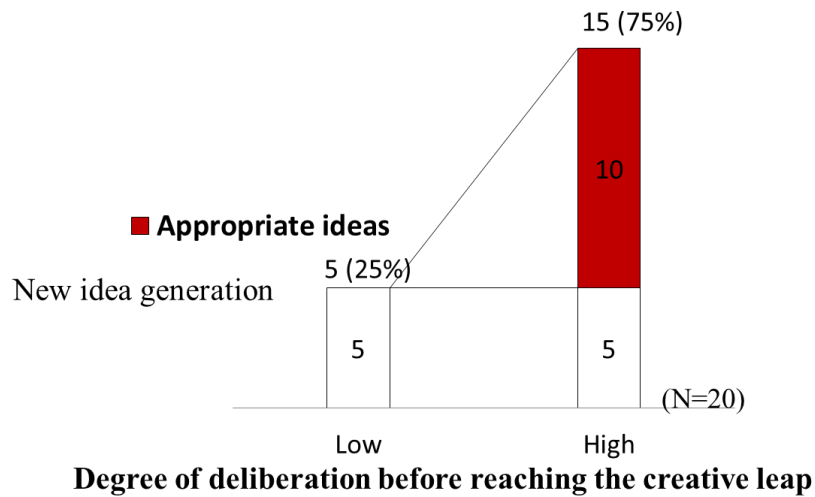


Table 18. The degree of deliberation before reaching the creative leap moment (in terms of the Nth order) and the appropriateness of a new idea

Subject	the Nth note of creative leap (A)	total notes (B)	A/B	Deliberation	Appropriateness of new idea
1A	18	38	47%	High	High
1B	2	19	11%	Low	Low
1C	3	12	25%	Low	Low
1D	8	22	36%	High	High
1E	3	17	18%	Low	Low
2A	10	27	37%	High	High
2B	12	18	67%	High	High
2C	13	16	81%	High	Low
3-2A	15	26	58%	High	Low
3-1A	21	32	66%	High	High
3-1B	12	33	36%	High	Low
3-3A	10	41	24%	Low	Low
4-1A	13	15	87%	High	High
4-1B	9	12	75%	High	High
4-1C	13	17	76%	High	Low
4-2A	22	24	92%	High	High
4-2B	17	19	89%	High	High
4-2C	6	21	29%	Low	Low
4-3A	9	13	69%	High	High
4-3B	15	16	94%	High	Low

Accordingly, the relationship between the deliberation before reaching the creative leap moment and the appropriateness of generated idea has been identified as shown in the figure 26.

Figure 26. Relationship between degree of deliberation before reaching the creative leap stage and the appropriate idea generation



Therefore, it is found that deliberation in the early stage of idea generation is prerequisite for appropriate idea generation. However, another factor should be explained for the 33% of participants who had deliberation could not generate an appropriate idea. In interviewing participants, we realized that participants who generate an appropriate idea reflected on their creative leap moment associating with the alteration in domains for a new idea.

*“First, I thought about homework coaching idea, but I didn’t think it’s novel, then I turn back to the mechanism I selected, then, I thought another idea about my own experience, and it could be solved with this mechanism. (2A)”*

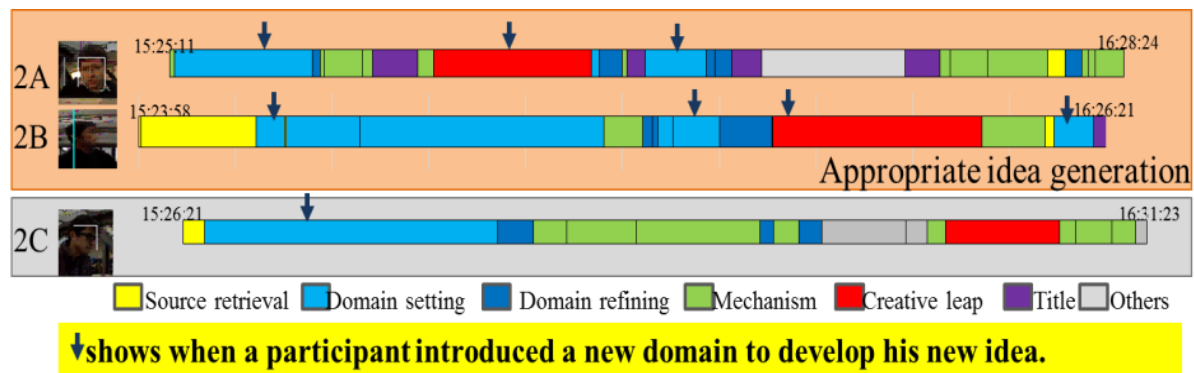
*“First, for the map based database, I thought about the toilet information on the map, then when I see this bike map image, the wifi map came to my mind. (2B)”*

*“My creativity started with the medical examination, to start with this. I would say, it’s from this mechanism, “Frequency analyser”, and this fitness shaking bed as an alarm then I turned to blood donation idea. I think those two.(3-1A)”*

From the interview survey with participants who generated an appropriate idea, it was found that ‘having trial and error’ is a crucial process for generating an appropriate idea.



Figure 27. Example of coding for participants' trial and error before deciding the domain for a new idea



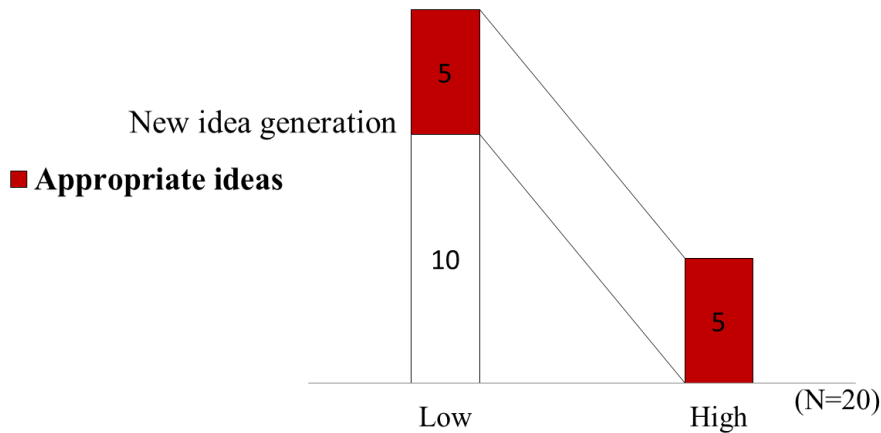
The degree of trial and error was measured by the number of domains considered for generating a new idea. If a participant considered more than three domains for generating a new idea, it is assessed as 'high'. Also, if a participant deleted his or her previous notes more than five times before coming to think of the domain of the new idea, it was also regarded as having trial and error. The results from the 1<sup>st</sup> to 4<sup>th</sup> workshops, five out of twenty participants showed high degree of having trial and error in deciding a domain for a new idea (see the table 19) and all of those five participants generated an appropriate idea (see the figure 28). Thus, we can conclude that having high degree of trial and error before deciding the final domain for a new idea has significant relationship with the appropriateness of a generated idea.

Table 19. The degree of trial and error in finding the domain and the appropriateness of a new idea

Subject	New idea	No. of domains considered	No. of deleted notes before introducing a domain	Degree of trial and error	Appropriateness of new idea
1A	Ultimate movie recommendation	1	5	High	High
1B	beauty map	1	0	Low	Low
1C	soft loan for educating the poor	1	0	Low	Low
1D	quick geek fix	1	0	Low	High

1E	city microscope	1	0	Low	Low
2A	fill out my forms	3	0	High	High
2B	wifi finder	6	0	High	High
2C	PET finder	1	0	Low	Low
3-2AB	job finder for graduate	1	0	Low	Low
3-1A	blood donation	6	0	High	High
3-1B	cut&fill	2	0	Low	Low
3-3AB	e-database for shopping mall	1	0	Low	Low
4-1A	moral education and sex education	1	0	Low	High
4-1B	childcare	1	0	Low	High
4-1C	Immersive education in microworlds	1	0	Low	Low
4-2A	personal education	1	0	Low	High
4-2B	Services for education	3	0	High	High
4-2C	elite education	1	0	Low	Low
4-3A	career change	1	0	Low	High
4-3B	a job advisor	1	0	Low	Low

Figure 28. Relationship between trial and error before deciding the domain for a new idea and the appropriateness of idea generated



**Degree of having trial and error in finding the domain for a new idea generation**

In conclusion, three main factors were found for enhancing the appropriateness of ideas generated using analogical thinking: 1) categorization skill; 2) deliberation before reaching the creative leap moment; 3) having trial and error for finding the domain of new idea generation. According to the results from four workshops with 22 participants, 60% of participants showed high level of categorization skill, 75% of participants showed high level of deliberation before reaching the creative leap moment, however, only 25% of participants had high level of trial and error in finding the domain of new idea.

Many studies indicate that when people facing complex problems, they tend to focus on a familiar ideas rather than to make efforts to think creatively (A. M. Collins & Loftus, 1975; Mednick, 1962; Tversky & Kahneman, 1974). This is mainly due to the limitations of working memory, in terms of its capacity (Brown, 1958; Miller, 1956). Baddeley (1997), who studied the role of memory and knowledge as basic cognitive mechanism of generating an idea, found that human have at least two types of memory: long-term memory as the storage area for an accumulation of knowledge; whereas working memory is the smaller, temporary workspace for items that are under active consideration at the moment. Because of limitations in the capacity of human's working memory, we need a new workshop design and the facilitator that enable us to overcome those limitations.

Although there exist numerous studies which suggest several methods that have been demonstrated to encourage people to create new ideas, there are not enough research which

empirically identify factors for enhancing the appropriateness of new ideas, and how the facilitator stimulate people to strengthen those factors by developing a workshop design. Therefore, this study suggests a specific workshop design that effectively promotes participants to have more trial and error in finding the domain for new idea generation, of course this will lead participants have more deliberation before reaching the creative leap moment in their thinking process for an idea generation.

## **6. A proposal for workshop design**

Goldschmidt (2001) noted that even though it is possible to train people to retrieve and activate that knowledge using analogical thinking in appropriate manner, in other words, applying high structural similarity with low superficial similarity between source and the target ideas, it is much harder than other training methods. In addition, Chupin (1998) reported a pedagogic experiment in which students of architecture are given cross-domain analogies with which they are required to work. Unfortunately the report does not give any information on the effect of this experimental procedure on students' performance. To overcome those drawbacks of existing research, this study proposes a workshop design and implements it to students to examine effectiveness of the proposed workshop design.

Our aim of the innovation workshop is to help participants using analogical thinking to generate appropriate ideas. According to the result of analysis in the chapter 5, it is found that there are three main factors for enhancing the appropriateness of ideas generated using analogical thinking: 1) categorization skill, 2) deliberation before reaching the creative leap moment, 3) trial and error in finding the problem domain. Therefore, a workshop design method should be developed for encouraging participants to promote each factor. However, categorization skill is hard to be trained through the workshop facilitation. It presumably results from personal level of knowledge, and group dynamics during the categorization task. Thus, this study focuses on the thinking process as a controllable factor by the workshop facilitation.

### **6.1. A workshop design proposal to promote thinking process for an appropriate idea generation**

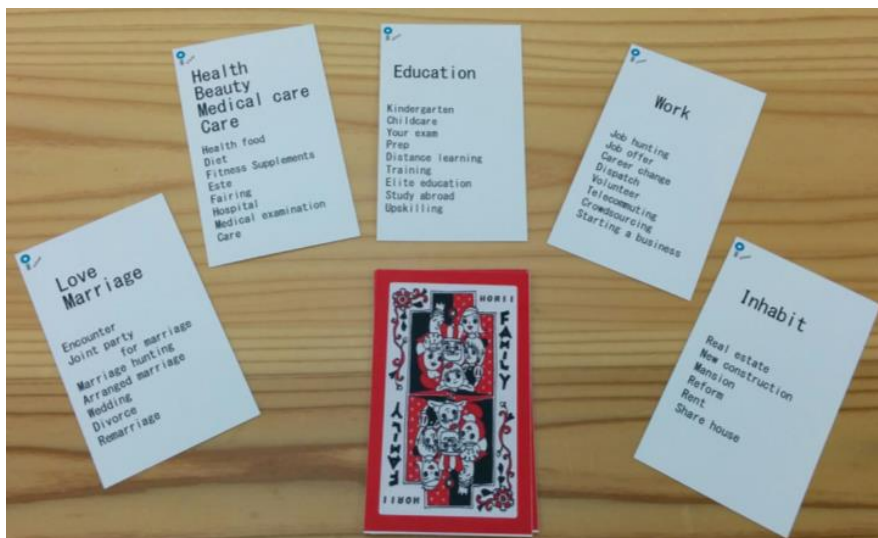
Deliberation for generating an appropriate idea does not impede serendipity, in other words, the accidental discovery of something valuable. Historically, conditions for new idea generation are both deliberate and accidental, for the reason that experience cannot be completely controlled and chances always may happen. Regardless the unexpected role of serendipity, training measures for participants and their deliberate efforts encourage generating appropriate ideas. Proposal of a workshop design regarding to thinking process for enhancing appropriateness using

analogical thinking is crucial, because if a workshop design method was carefully constructed, participants' deliberate efforts will perform better to discover new and original things.

Various researchers from diverse disciplines argued on providing external stimuli to initiate serendipitous flashes of insight (N. Bonnardel, 2000; Dugosh et al., 2000; Santanen, Briggs, & Vreede, 2004). Stimuli exhibit new potential analogies that otherwise would not be taken into consideration, which is a principle that is found in various approaches for generating an idea.

In this research, a workshop design is proposed to encourage participants to be actively involved in the process of generating ideas during the early stage of the generation task, in other words, having a deliberation before reaching the creative leap, or having a trial and error before deciding the domain for a new idea. Thus, the final domain selection step needs to be followed after self-reflection on the divergent ideation process which enables a participant to reach out further domains. Since the 5<sup>th</sup> workshop, new workshop design was developed and implemented, in order to foster deliberation before reaching the creative leap moment, and trial and error in finding the domain for a new idea generation. We presented the domain cards to participants to help them finding diverse domains for a new idea generation (see the figure 29).

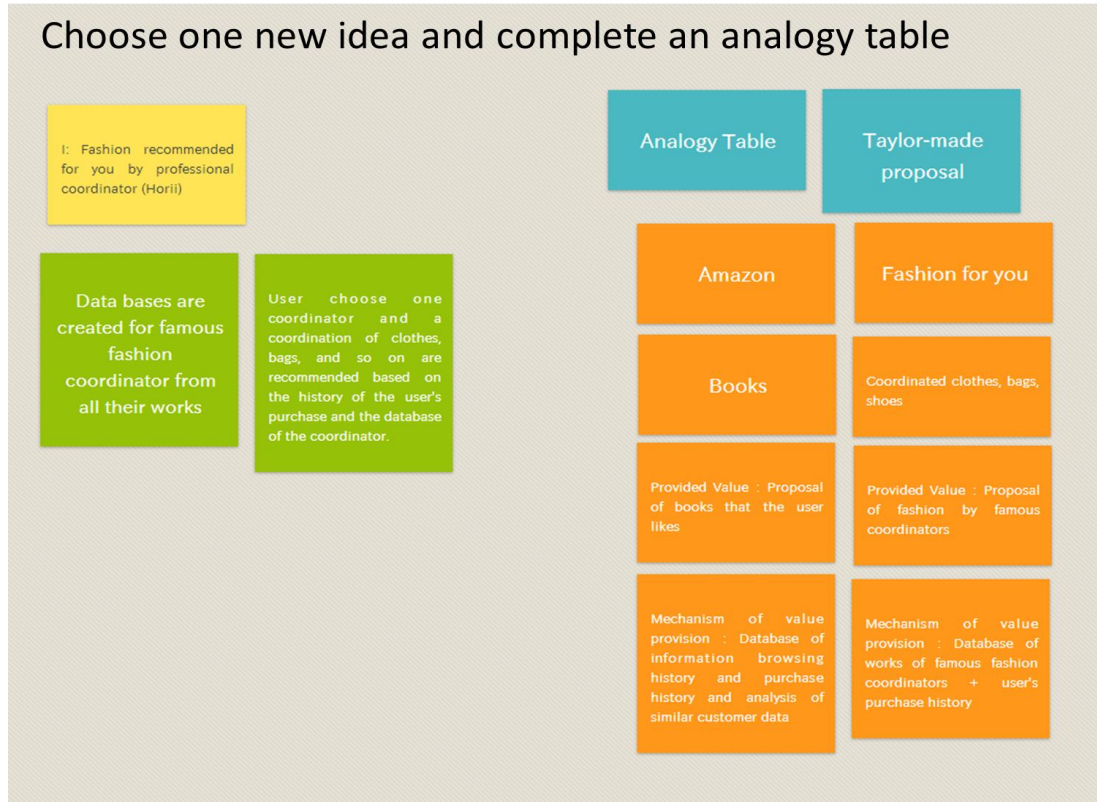
Figure 29. Domain cards presented for finding the domain for new idea generation



Presenting numbers of domain candidates is not enough for encouraging participants to have high degree of deliberation before reaching the creative leap, as well as having trial and error in finding a domain for the new idea generation. The additional instruction was given for facilitating deliberation and having trial and error. Participants were asked to generate five new ideas as diverse as possible in terms of its business domain for 15 minutes, then completing a new idea generation using analogical thinking (see the figure 30).

Figure 30. Instruction for improving thinking process





## 6.2. Results

The proposed workshop design asks all participants to generate five new ideas in yellow notes as diverse as possible, by referencing the given domain card, and they were encouraged to record what they are thinking about those new ideas using white notes, within 15 minutes. After, they were asked to select one idea among those five ideas to generate a new idea using analogical thinking (see the figure 31).

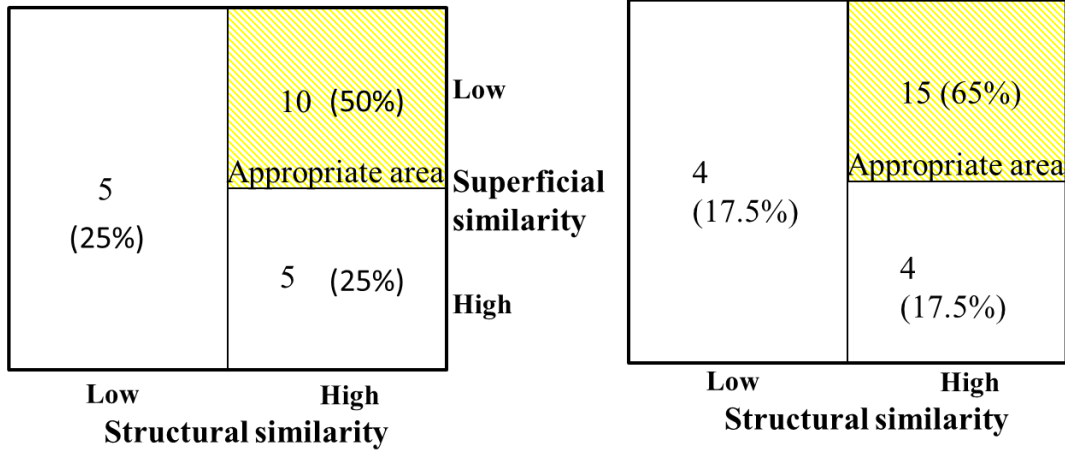
Figure 31. A sample result of the idea generation task after applying the proposed workshop design





**The 1<sup>st</sup>-4<sup>th</sup> workshop (N=20)**

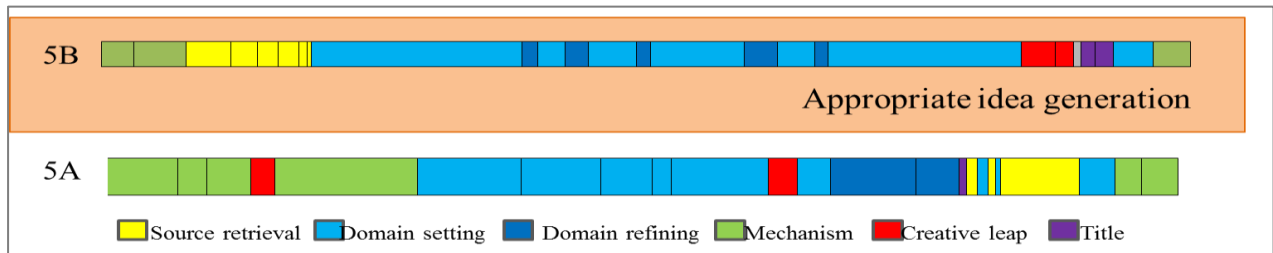
**The 5<sup>th</sup>-6<sup>th</sup> workshop (N=23)**



The proposed workshop design increased participant's level of deliberation. 91% of participants had high degree of deliberation before reaching the creative leap moment under the new workshop design, while 75% of participants appeared to have high degree of deliberation in the previous workshops (see the figure 33 and 34).

Figure 33. Thinking processes of each participant in the generation task: the 5<sup>th</sup> – 6<sup>th</sup> workshops

a) the 5<sup>th</sup> workshop (N=2)



b) the 6<sup>th</sup> workshop (N=21)

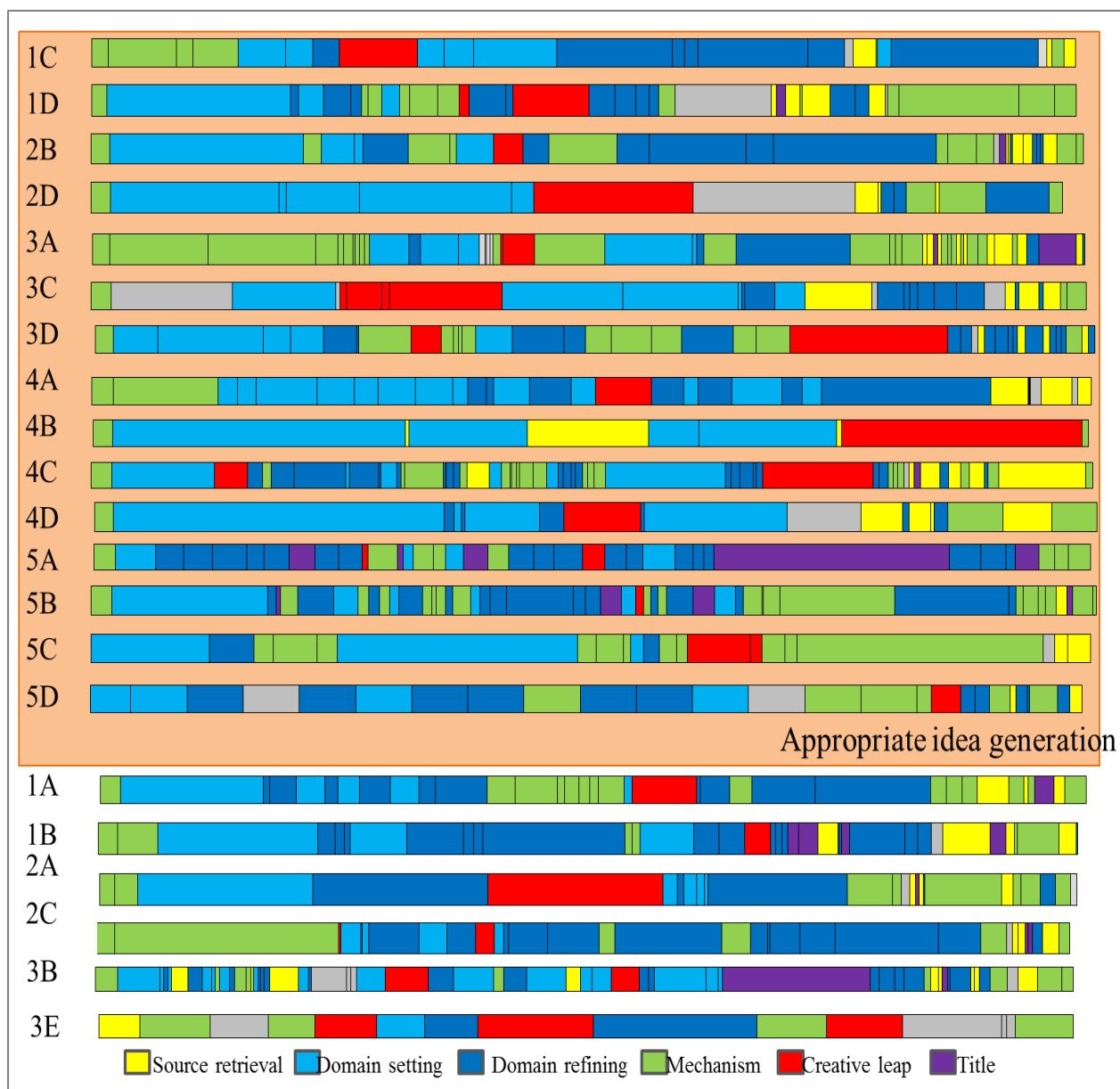


Table 20. The degree of deliberation before reaching the creative leap moment and the appropriateness of a new idea

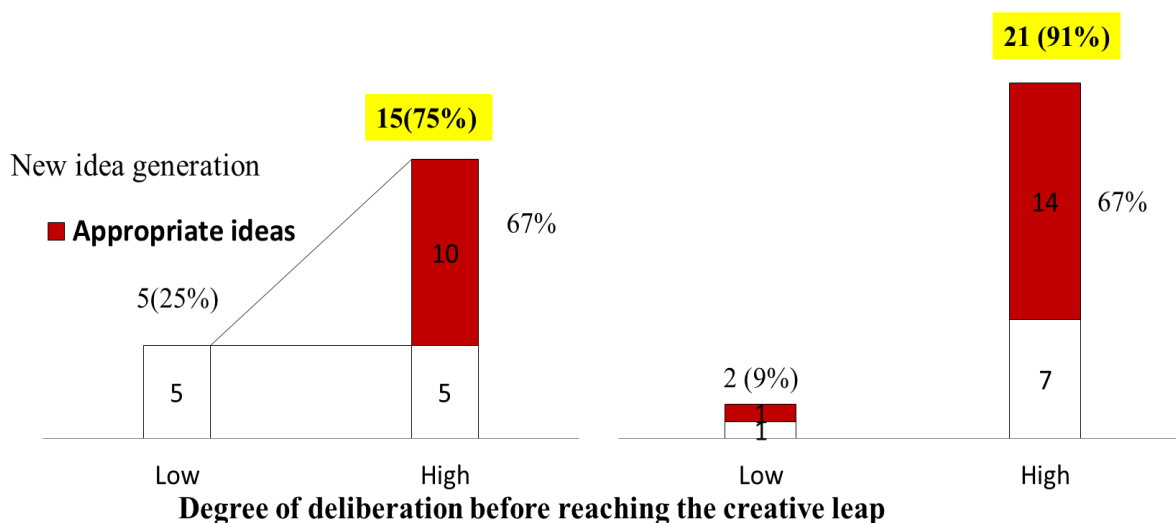
Subject	the Nth note of creative leap (A)	total notes (B)	A/B	Deliberation	Appropriateness of new idea
5A	9	24	37.5%	High	Low
5B	20	26	76.9%	High	High
6-1A	21	36	58.3%	High	Low
6-1B	16	37	43.2%	High	Low
6-1C	8	25	32.0%	High	High

6-1D	15	35	42.9%	High	High
6-2A	8	25	32.0%	High	Low
6-2B	10	32	31.3%	High	High
6-2C	7	32	21.9%	Low	Low
6-2D	7	17	41.2%	High	High
6-3A	20	51	39.2%	High	High
6-3B	32	60	53.3%	High	Low
6-3C	7	30	23.3%	Low	High
6-3D	16	40	40.0%	High	High
6-3E	8	15	53.3%	High	Low
6-4A	16	31	51.6%	High	High
6-4B	9	10	90.0%	High	Low
6-4C	23	60	38.3%	High	High
6-4D	8	19	42.1%	High	High
6-5A	17	37	45.9%	High	High
6-5B	26	47	55.3%	High	High
6-5C	15	22	68.2%	High	High
6-5D	17	26	65.4%	High	High

Figure 34. Comparison of the degree of deliberation between before (the 1<sup>st</sup>-4<sup>th</sup> workshops) and after (the 5<sup>th</sup>-6<sup>th</sup> workshops) the application of new method

The 1<sup>st</sup>-4<sup>th</sup> workshop (N=20)

The 5<sup>th</sup>-6<sup>th</sup> workshop (N=23)



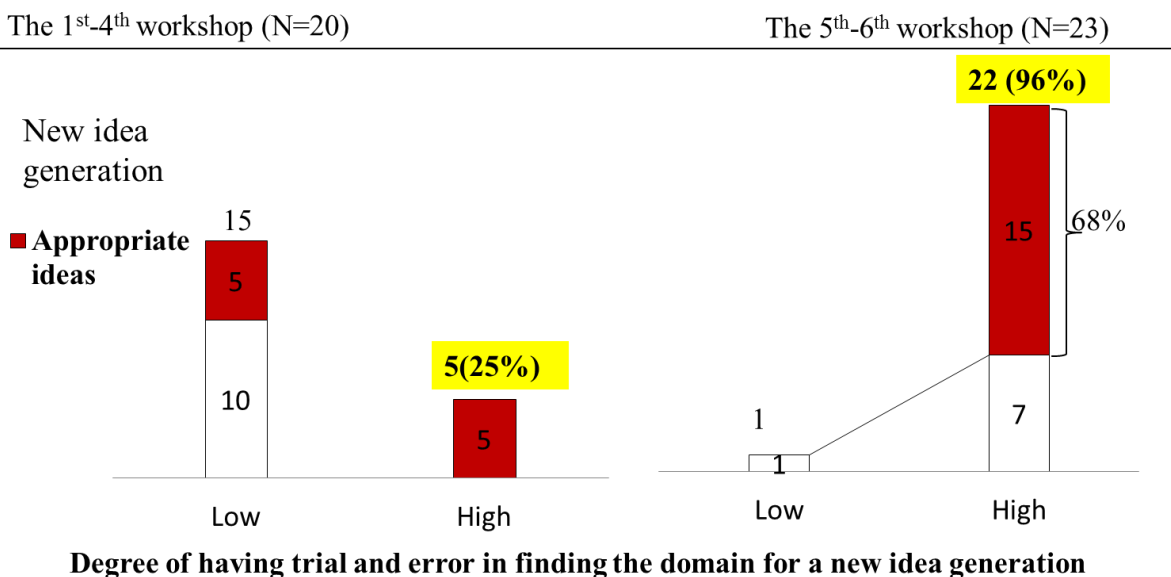
In addition, the proposed workshop design enhanced participants' level of having trial and error in finding a domain for generating a new idea. 96% of participants had high degree of trial and error in finding a domain for new idea under the new workshop design, while only 25% of participants appeared to have high degree of trial and error in the previous workshops (see the table 21 and figure 35).

Table 21. The degree of trial and error in finding the domain for a new idea: the 5th-6th workshops

Subject	New idea	No. of domains considered	Degree of trial and error	Appropriateness of new idea
5A	Job training by expertise	5	High	Low
5B	House finder for professionals/students	5	High	High
6-1A	What is he/she like?	5	High	Low
6-1B	No garbage life	4	High	Low
6-1C	Remote Chef	6	High	High
6-1D	Res X: Cross-collaboration in specific fields	4	High	High
6-2A	Group travel planning	5	High	Low
6-2B	artSpace	5	High	High
6-2C	Everyone's PARTY	6	High	Low
6-2D	Dog sharing	6	High	High
6-3A	Machine Learning Charity Impact Analysis	6	High	High
6-3B	Service platform for new mothers	16	High	Low
6-3C	Japanese Hospital Rating System	7	High	High
6-3D	Crowdsourced Refugee Housing	5	High	High
6-3E	Custom, handmade tailor goods by craftsmen	1	Low	Low

6-4A	Matching old people's house to international students	11	High	High
6-4B	Starting business	4	High	High
6-4C	collaborative diagnosis	7	High	High
6-4D	studying abroad	5	High	High
6-5A	Renting room for artists	4	High	High
6-5B	Psychologist Tournament	6	High	High
6-5C	Crowdsourcing divorce settlement	4	High	High
6-5D	Blood matching	4	High	High

Figure 35. Comparison of the degree of having trial and error between before (the 1<sup>st</sup>-4<sup>th</sup> workshops) and after (the 5<sup>th</sup>-6<sup>th</sup> workshops) application of new method



Participants' interview commentaries provided specific evidence of positive contribution of the proposed workshop design, presenting the exemplary domains for a new idea to have diverse

ideas first, then generating a new ideas using analogical thinking. The interview quotes from the participants who generated appropriate ideas are as follows:

5B *“The white notes were important to me. I wrote about business structure in white notes, and I made new ideas by combing these white notes with each domain card. To create new ideas, I tried to mix a couple of business domains here together, so I mixed ‘Job’ + ‘Housing’ then came to think of my new idea house finder for people who got a job in new place.”*

6-3A *“After having a bunch of ideas revolved around once or twice in a life time decisions, I realized there is value in algorithms to learn from feedback loop and repeated decision making. Therefore it led me to thinking of hard decisions that has repeatability in it and has emotional hard to quantify qualities”*

6-5B *“I came to think of this idea while thinking of other jobs that can be made into a tournament (selected mechanism)”*

6-1B *“I reached my idea through thinking about the category label I selected "contributing with~".”*

6-1D *“I came to think of it by the combination of artisanal methods and advanced manufacturing techniques”*

6-3C *“I felt Eureka, when I think about the searching a hospital (domain of the new idea)”*

6-4C *“I scanned through the categories and trying to find a provider with a customer”*

On the other hand, participants who did not stress out the importance of the proposed design workshop while the interview, could not generated an appropriate idea. The interview quotes from the participants who did not generated appropriate ideas are as follows:

6-1A *“I selected the category label “real voice”. People know reality, and people want to know reality. On the case of love, people want to know what he is like.”*

6-3B *“In the beginning, matching supply and demand, in the middle, similar idea came up about mothers don't feel alone.”*

6-3E *“I tag the expected consumer exactly to the items.”*

The results indicates that the proposed workshop design have significant effects on thinking process in the idea generation task. To test its effect on enhancing the appropriateness of generated ideas, it is important to examine the comparison of results of uncontrolled factor, which is the categorization skill of participants. In the 5<sup>th</sup>-6<sup>th</sup> workshop, there were six groups in total, and each group created 5.6 labels on average, overall, 73% of cases were categorized correctly. To assess a participant's categorization skill, the same standard was adopted from the previous workshop evaluation. Thus, if a subject categorized cases in a label he or she created with more than 79% of correctness, his or her categorization skill was assessed as “high” (see the table 22).

Table 22. Performance in categorization task and idea generation task in the 5<sup>th</sup> – 6<sup>th</sup> workshops

Initiator	Created label	No. of Cases		(B)/ (A)	Categorization skill	Appropriateness of new idea
		All (A)	Fit (B)			
5A	Matching service	5	3	50%	Low	Low
	Community contribution	5	2			
5B	User generated contents	4	3	53%	Low	High
	Collective solution finding	4	1			
	Personalized recommendation	2	2			
	Online marketplace	5	2			
Group 5		25	13	52%	Low	
6-1A	people trust people onsite, real voice	8	4	50%	Low	Low
6-1B		0	0	0%	Low	High
6-1C	help to make choices, Rating System	6	4	82%	High	Low
	connecting with specialists	5	5			
6-1D	Participatory Approach, contribute with their skills	4	3	83%	High	High
	Activity tracking	2	2			
Group 6-1		15	12	80%	High	

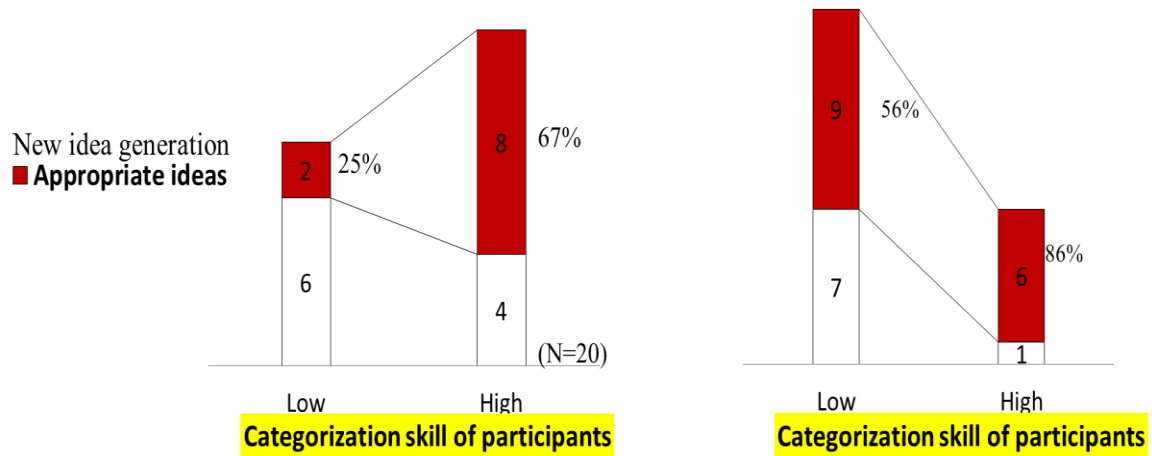


6-2A		0	0	0%	Low	Low
6-2B	Algorithm suggestions (B2C)	7	4	72%	Low	High
	connecting people (matchmaking)	2	2			
	Crowdsourcing	3	3			
	Open collaboration platform: creation	3	2			
	Open collaboration platform: information	2	1			
	Social media advocacy	8	6			
6-2C		0	0	0%	Low	High
6-2D		0	0	0%	Low	High
Group 6-2		25	18	72%	Low	
6-3A	One entity tailoring info to consumers (algorithmic)	9	3	33%	Low	High
6-3B		0	0	0%	Low	Low
6-3C		0	0	0%	Low	High
6-3D	Crowdsourcing information	7	7	100%	High	High
	Match specific skills with specific needs	7	7			
6-3E		0	0	0%	Low	Low
Group 6-3		23	17	74%	Low	
6-4A	matching service	7	6	91%	High	High
	prediction	4	4			
6-4B		0	0	0%	Low	Low
6-4C		0	0	0%	Low	High
6-4D	crowd creating contents	6	5	79%	Low	Low
	get advice from others	8	6			
Group 6-4		25	21	84%	High	
6-5A	Big Data Utilisation	1	1	50%	Low	High
	Ranking system	3	1			

6-5B	Crowdsourcing	2	2	100%	High	High
6-5C	crowd funding	1	1	83%	High	High
	Matchmaking	4	3			
	Screwing Somebody Over	1	1			
6-5D	Collective input	3	2	85%	High	High
	Recommendation + customers just choose	4	3			
	review (experience)	3	3			
	review (product)	3	3			
Group 6-5		25	20	80%	High	
Total		143	104	73%	Low	

As shown in the figure 36, the proposed workshop design enhances the appropriateness of new idea especially those who showed low categorization skill. Before applying the new workshop design, 67% of participants with high categorization skill generated an appropriate idea, and this ratio increased to 86% under the proposed workshop design. Moreover, the effect is drastic among the participants with low categorization skill. In the previous workshops, only 25% of them could generate an appropriate idea, while 56% of them who didn't present high categorization skill appeared to generate an appropriate idea after applying the proposed workshop design.

Figure 36. Comparison of the categorization performances between before (the 1<sup>st</sup>-4<sup>th</sup> workshops) and after (the 5<sup>th</sup>-6<sup>th</sup> workshops) the application of new workshop design



From the results, we conclude that the proposed workshop design effectively enhanced the appropriateness in idea generation using analogical thinking. When the participants were required to have 15 minutes for increasing the span of considered domains with the cue of example domains as external stimulus before using analogical thinking to generate an idea, people generate an idea that is, on average, more appropriate.

## **7. Conclusion and discussion**

### **7.1 Implications of findings from the results**

Though we are all aware of the importance of generating new ideas for innovation, and there exist many workshop programs which are facilitating new idea generation for innovation, still, there is the lack of structured theory on new idea generation.

As an educational program designer, the research goal should direct to how we can enhance the thinking skill of participants by facilitation which encourages them to create more appropriate ideas through the instruction of innovation workshop. In this regard, this study proposes a novel definition on appropriateness of the new idea generated by analogical thinking to overcome the limitations in existing definitions on related terms such as creativity, and novelty. In addition, it also proposes an effective evaluation method for the appropriateness of new ideas generated using analogical thinking. The results from the implementation of the proposed evaluation method provide insights, especially for those who study on the development of educational programs for promoting innovation. Based on the detailed description of the evaluation method in this thesis, researchers can replicate assessment in further studies.

The objective of this study is not only to develop an evaluation method on new ideas, but also to identify factors which are influencing on the performance in an idea generation. In respect to this, this research investigated the relationship between performances in categorization and an idea generation, also, the relationship between the thinking process in ideation and the appropriateness of a generated idea. In regard to an appropriate idea generation, meaningful relationships were founded with participant performance in categorization, deliberation before reaching the creative leap moment, and having trial and error in finding the domain for an new idea generation. Furthermore, this study is distinctive from other existing studies, while almost all of past research evaluated the outcomes, which are the new ideas itself, our proposed method allows us to trace the source of ideas, including personal thinking process.

For education program designers, it is important to develop a workshop design method, which enhances the appropriateness in idea generation. The results of this study found that high degree of deliberation to reach the creative leap moment and having trial and error in finding the domain

for a new idea generation enhances the appropriateness in idea generation during the workshop. In terms of educational practice, effective facilitation is needed to influence on the appropriate idea generation using analogical thinking. The results from the proposed workshop design supported that facilitation interventions are required for ideation.

Pedagogical actions during the workshop are useful for participants in order to show them how to use analogical thinking for an appropriate idea generation by understanding the superficial similarity and structural similarity. Notably, a specific guidance should lead them to explore various domains with the given samples as cues, as well as to connect these domains with the structure of mechanism for a solution. Such thinking process allows more knowledge to be involved in combinations for the generation task, therefore more appropriate ideas to be generated.

## **7.2 Limitations in this study and proposals for further research**

There are some limitations in this study and they should be improved in further studies as follows:

The first limitation is that we used only 43 sample ideas to be tested. There were several restrictions in recruiting participants: they should be interested in the innovation workshop for participating voluntarily, but who had never experienced the same topic of workshop before, and participants should be able to speak English. Data collection by recruiting participants from many different nationalities increases the generalizability of findings, however, the number of subjects was relatively small and the demographic characteristic of samples were limited to English speakers as a second language or mother tongue, undergraduate or graduate school students in their twenties or thirties. In further study, more workshops need to be conducted to increase a number of samples to give more robust statistical supports on the findings. In addition, learning effect also should be examined with the experienced participants.

The second limitation is related to the ideation tool we used for workshop, which is the APISNOTE. We used data from single mode in idea generation, which is a text format idea by a computer-aided mode using the APISNOTE. Therefore, the verbalised ideas but not produced in

a text format, and non-verbal ideas, such as sketching were not included in the scope of analysis. Furthermore, participants showed different level of usability of the APISNOTE. Some participants actively used the APISNOTE for their idea generation, while some of them merely used it only to fulfil the instruction. In average, participant generated 27.8 notes during the generation task, in minimum 10 notes and maximum 61 notes, standard deviation is 12.5. In further study, usability of the APISNOTE should be improved, also, the scope of data should be expanded not only confines to the text data, but also includes the sketches or other non-verbal data.

The third limitation is the topic of the idea generating task in this study was given to the participants, confined to the collective intelligence service. During the workshop, subjects were free to select the domain of problem to be solved after attaining knowledge of the business mechanisms by reading the booklet of the 25 case studies and group discussion, however, in our real lives, there are many cases that the problem to be solved is given in unknown domain and a range of knowledge is limited. In further studies, the topic of idea generation tasks should expand to diverse fields such as new products development, social services, and personal behaviours based on the needs of participants.

The fourth limitation is related the issues in validation of the proposed evaluation method. In further studies, we should validate the proposed evaluation method by having trained raters who test the proposed evaluation method. In addition, comparison of the results of the proposed evaluation method and the evaluation of novelty and impact by experts and novice people should be examined. However, in spite of this limitation, our approach is important not only because it allows us to overcome weaknesses in current assessment methods which depend on subjective judgement, but also it enables further studies of how people generates appropriate ideas by observing all the ideation process. The proposed method in this study makes us possible not to be biased in favor of any particular rater's subjectiveness.

Lastly, appropriate idea generation can be encouraged in many ways in various setting. However, this study presents a workshop design method that promotes the deliberation by increase the number domain of new ideas in the early stage of the idea generation task. In further study, more methods which enhance the performance of new idea generation task should be developed and

tested. For example, participants may improve their categorization skill by applying some techniques: such as focusing on the outstanding structural features for the title of a category rather than comparing a pair of cases each other, which was usually observed pattern in the categorization task.

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# APPENDICES

## APPENDIX A: Transcription sample of the categorization task

### 1) The first workshop

Date: February 15th (Saturday), 2014

Time: 13:00-17:00

Place: 3F, Engineering Building No. 11, Hongo Campus

No.	Subject	Dialogue	Video time		Duration (sec.)
			Min	Sec	
1	1C	Amazon and Tabelog are similar	4	41	5
2	1A	Yeah, it's like the same system	4	46	2
3	1C	book... recommended and food also.	4	48	4
4	1A	Yeah...I agree	4	52	9
5	1C	Kura sushi...	5	1	8
6	1A	Yeah, Kura sushi	5	9	2
7	1C	Kura sushi is also maybe...	5	11	3
8	1A	Yeah, I know, amazon like...	5	14	1
9	1E	Number ?	5	15	10
10	1C	okay, that is also recommending....	5	25	3
11	1D	Do we want to divide groups into the kind of product they are working with, the kind of things they are providing. Is it like food, travel, or...	5	28	11
12	1C	Nonono...it's gonna be similarity...	5	39	0
13	F*	Nonono...similarity	5	39	0
14	1D	Similarity.	5	39	4
15	F	we are going to use analogical thinking	5	43	2
16	1D	in terms of how they ... and provide service.	5	45	1
17	F	Yeah yeah.	5	46	32
18	1D	why have we categorized these two, three together?	6	18	7
19	1A	I think it's reviewing, its common and, nono, reviewing is common with amazon and tabelog.	6	25	6
20	1D	because there are a lot of reviews. Because the ... is review based,	6	31	16

		rakuten travel is review based, ...everything is probably review based.			
21	1A	um, no. but for example, like Google, like the Google input is not review based. But its kind similar to amazon in a sense that people who type this based on frequency of association. What you buy at amazon and what you type in Google...	6	47	10
22	1D	ok ok.	6	57	1
23	1A	um, yeah.	6	58	3
24	1D	it's like interconnected.	7	1	1
25	1A	yeah...	7	2	17
26	1A	yeah, there's a strong case to classify with review based, like amazon and tabelog. The cosmetic one (@cosme) is also review based, I think... its also review based. I think it's close to tabelog.	7	19	20
27	1E	...a bit.	7	39	4
28	1C	this no. 5 POS system is also this thing about mostly bought things.	7	43	22
29	1E	so you suggest this with this group?	8	5	1
30	1C	I think is. Because it also recommends the...	8	6	6
31	1E	based on the frequency?	8	12	2
32	1C	based on frequency. But it doesn't categorize as the amazon, it only recommends based on frequency. Let us skip for now, we can sense later.	8	14	24
33	1D	um, we can probably create a group where people explain and they have reviews for a thing. It's not a product that is been said, because they are being recommended, because you bought these things. But reviews where people go and search for something, they get reviews for that. That can be a group? Like we can have a	8	38	20
34	1A	review based?	8	58	4
35	1D	these are like products which you search on line and products are based on what you are searching for. But these are something you go and search for.	9	2	8
36	1A	it is like frequency based, and it has two different concepts. But I think amazon has both. It's like there are reviews, but recommendation based on what people bought.	9	10	10
37	1D	so you just have a commend like probably...	9	20	13
38	1D	I think frequency based is (pointing to the screen)	9	33	2
39	1E	this one? (moving the pic)	9	35	0
40	1D	yeah.	9	35	5
41	1E	then this one (POS) suggesting frequency.	9	40	0



42	1C	this one is frequency based, yeah.	9	40	1
43	1D	that is frequency based,	9	41	0
44	1D	tabelog is review based actually.	9	41	17
45	1E	here this trouble others ...	9	58	3
46	1D	um, probably one group will problem shooting where people go and they say what is the problem they are having and they try to find solution for it.	10	1	11
47	1E	trouble shooting.	10	12	1
48	1D	trouble shooting, for trouble like.	10	13	2
49	1A	no, for trouble it's just a bit like rakuten travel.	10	15	5
50	1D	like trouble shooting, there was a thing like a, where people, Innocentive, you know this one, like if you go search for the problems, they try to solve the problems.	10	20	13
51	1E	um, like a...	10	33	1
52	1D	like you ask questions and you reply, like a forum, like a forum.	10	34	4
53	1C	consulting...	10	38	0
54	1D	like a consulting!	10	38	5
55	1A	yeah, it's like yahoo answer. Except that...	10	43	1
56	1D	yeah, yeah, yeah.	10	44	1
57	1A	except that people in ... don't joke around.	10	45	29
58	1D	this should come to there. (No 10 is moved by D)	11	14	3
59	1E	this one?	11	17	1
60	1D	nonono, this one (No 11 Innocentive is moved under tag Forum)	11	18	3
61	1E	oh yeah yeah. Sorry. so this one is, um... (hesitate a little)	11	21	10
62	1D	(pointing to No 7), consulting with senior members for career choices, what is this one?	11	31	7
63	1C	that is meeting at a particular place.	11	38	2
64	1D	no, this is, ...where you can contact your seniors, alumni. And they suggest some career options.	11	40	7
65	1E	also forum	11	47	1
66	1D	So forum/consulting.	11	48	34
67	1E	here it is, interests share... (moving No50 interests share under Forum). Do you think this match this?	12	22	12
68	1D	yeah, it's here.	12	34	1

69	1A	yeah, that's good.	12	35	8
70	1A	I think we can move the Google suggestion (No. 24) and this one, I think we can move it to frequency based.	12	43	10
71	1D	hum, hum. You are right there.	12	53	3
72	1E	this one also frequency based? no. (No.1 kura sushi)	12	56	2
73	1D	yeah yeah.	12	58	1
74	1A	yeah yeah, the kura sushi is frequency based, like recommending sushi... based on the pattern of consumption.	12	59	11
75	1D	Cookpad (No.19), easy to find a favored recipe	13	10	6
76	1D	is it forum or?	13	16	1
77	1B	I think the 23 is more like a consulting, forum.	13	17	3
78	1A	which one are you talking? 23... yeah, it is.	13	20	8
79	1D	...one more thing, one more group, where the public create information. Like the weather of days(No. 4)...	13	28	9
80	1C	the weather of days, bike's map (No. 8).	13	37	3
81	1D	and bikes, so it's like intelligence through public participation. I don't know how to... it's like you all give some information and this one big thing, this information created through the public participation.	13	40	
82	1E	public participation? (typing the new group nam			
83	1D	ok, public participation			
84	1B	collective intelligence is...	13	57	1
85	1D	collective intelligence, yes!	13	58	1
86	1E	collective intelligence, yes!	13	59	2
87	1C	proper word.	14	1	11
88	1D	so the bike one, the weather one, they all come to there. That one, also (No. 4, No8 and No 13 are moved to CI by D)	14	12	15
89	1C	number 13 also about weather.	14	27	14
90	1A	oh, number 20 is like forum/consulting. You know like translation. You know it's like you ask, is it that, you ask people to translate.	14	41	7
91	1B	I think it is in forum...	14	48	0
92	1E	like duolingo? (shake head)	14	48	2
93	1A	no... it's like you need something translated. Then somebody will translate for fee.	14	50	4
94	1B	translate it...	14	54	2
95	1E	(nod) um, yeah! like kind of for, um...	14	56	6

96	1E	share document on Internet (No.26 happy campus)?	15	2	4
97	1C	information, information sharing?	15	6	6
98	1C	let us create a group, like information..	15	12	2
99	1E	information sharing.	15	14	0
100	1C	yeah.	15	14	24
101	1E	here, (No. 27) data express stories..., so it's consulting. Agree?	15	38	22
102	1B	I think it's more like the, hum, the category	16	0	5
103	1E	the category	16	5	0
104	1B	yeah.	16	5	2
105	1E	should we make another one?	16	7	3
106	1B	nonono, I mean just like the, hum.. 16;	16	10	10
107	1D	I think this optimization of mechanizing (No. 51), I think should go to the frequency based.	16	20	6
108	1E	number?	16	26	1
109	1D	there, 51.	16	27	6
110	1D	(No28) comparing... I think it's review based.	16	33	3
111	1A	yeah.	16	36	1
112	1C	there is one, another, hum, kind of like innovative ideas... there is number 50 and, um.	16	37	20
113	1E	innovative ideas?	16	57	1
114	1C	yeah, innovative ideas	16	58	10
115	1A	I think number 16 is CI. It's learning languages with the help of native speakers. You collaborate. You learn a language and you teach your native language.	17	8	11
116	1D	your own language. So it's collective...	17	19	1
117	1A	collective intelligence. I would say. I don't know. What do you think?	17	20	4
118	1E	you were saying (to B) ?	17	24	1
119	1C	um, number 23 and number 50 are similar. Um, innovative ideas.	17	25	5
120	1D	you can put it (No.27 )here, forum and consulting.	17	30	0
121	1A	and it's a bit like forum and consulting at the same time.	17	30	3
122	1B	yeah (agree with E), it's kind of like in the middle of two topics (groups)	17	33	6
123	1A	yeah, actually, number 16 might be forum/consulting rather.	17	39	3
124	1E	which one? 16?	17	42	1

125	1A	16, yeah. It's not quite CI, it's more like based on actual question you have.	17	43	7
126	1B	I think the dating one (No. 27) is more like amazon. Because it's based on some real experience.	17	50	10
127	1A	yeah.	18	0	1
128	1B	just like review that..	18	1	1
129	1A	it's like rakuten travel or amazon.	18	2	1
130	1B	yeah, yeah.	18	3	2
131	1E	review base?	18	5	1
132	1B	yeah!	18	6	3
133	1D	it's like they share their date experience and then review what they ... is this, haha	18	9	4
134	1A	no, I mean I don't review the person, yeah..	18	13	3
135	1D	is this somebody says the problem and they	18	16	2
136	1C	nono. About the place, the dating place.	18	18	2
137	1D	oh, dating place. Then it is review based here.	18	20	30
138	1D	I think wedding park is also review based.	18	50	6
139	1E	which, number?	18	56	2
140	1D	14. Find a type of wedding for the users. So you just go the	18	58	3
141	1A	it's review base.	19	1	1
142	1D	yeah. The review based.	19	2	16
143	1B	I think we should have an information distribution kind of thing for the cookpad and wikileaks..	19	18	9
144	1D	which one?	19	27	1
145	1B	that information distribution.	19	28	2
146	1D	information distribution, ah.. that's it!	19	30	1
147	1B	you know, for the cookpad and wikileaks.	19	31	0
148	1C	title, oh, yes.	19	31	2
149	1D	ok, it's included.	19	33	3
150	1A	but...	19	36	1
151	1C	so wikileaks	19	37	1
152	1D	wikileaks	19	38	8
153	1A	I think cookpad is more like CI. It's like you post your recipe and you can look at other people's recipe.	19	46	5

154	1E	yes!	19	51	3
155	1A	it's like you just create information you wanna share, and	19	54	3
156	1D	what about the ewoman ?	19	57	3
157	1C	that seems, similar to consulting?	20	0	2
158	1E	number 8. Do you agree?	20	2	3
159	1D	ewoman round table...( description of No.8 ).	20	5	5
160	1E	consulting?	20	10	1
161	1D	I think yeah, consulting.	20	11	2
162	1E	CI?	20	13	1
163	1D	nono, consulting.	20	14	0
164	1E	consulting.	20	14	6
165	1E	happy campus ...(description of Happy Campus! ). CI, no, information distribution.	20	20	6
166	1D	information, yeah!	20	26	6
167	1E	this one (No. 50), what do you think. CI or information distribution?	20	32	5
168	1C	information distribution.	20	37	2
169	1A	I would say CI.	20	39	1
170	1A	cause it's	20	40	1
171	1E	or maybe both?	20	41	1
172	1A	yeah, it's like everybody contributes their ideas and look at other people's idea.	20	42	9
173	1D	there's another one. Innovative ideas topic (group).	20	51	3
174	1E	what? Oh!	20	54	4
175	1C	oh, innovative ideas. That seems similar to innovative ideas, because, um, innovative ideas by (description of No. 50)...	20	58	15
176	1B	I think the, 23 is more like CI.	21	13	6
177	1E	23?	21	19	1
178	1B	we don't need another one for innovative ideas.	21	20	5
179	1E	so you mean just remove this?	21	25	1
180	1B	yeah.	21	26	1
181	1E	ok.	21	27	3
182	1D	business microscope	21	30	5

183	1C	these are, sort of, there are two different kinds of, there are some of, um, day to day activity, day to day, um, living?	21	35	10
184	1D	Lancers (No. 46)..	21	45	0
185	1B	you means, um, the daily..	21	45	1
186	1C	yeah, and some are about the CI. Um, yeah, about 23 and 15. Some are about, um.	21	46	7
187	1B	23, yeah.	21	53	5
188	1E	23.	21	58	1
189	1C	for example, the bike lover's map is for day to day	21	59	4
190	1B	um (nodding )..	22	3	1
191	1C	and the, about number 23, the recruiting ideas and solutions. Social issues, they are not day to day, but, it is quite broad,	22	4	16
192	F	you don't have to categorize everything. If you have nice group, that's fine. You can have 5, 4 groups. Some of the cards, if you don't use, that's fine. No problem.	22	20	20
193	1B	or do you think it's better to include 23 into the Forum/ consulting?	22	40	7
194	1C	um, not the forum, ok, it is CI.	22	47	9
195	1A	I think 23 should be forum/consulting.	22	56	3
196	1B	yeah, maybe, it's very..	22	59	1
197	1A	it's really like you have an issue and you try to find solution with people.	23	0	4
198	1B	yeah, yeah.	23	4	3
199	1D	or we just create a new group for 23, 50 and the other one. This one. (point to the screen)	23	7	13
200	1E	which one?	23	20	1
201	1D	number 21.	23	21	3
202	1B	21.	23	24	1
203	1D	it's all like you share ideas.	23	25	2
204	1E	creative agency (description of 21)..	23	27	1
205	1D	all like sharing ideas. Number 21, 50 and number 23.	23	28	6
206	1E	sharing ideas. (typing the title, new group created)	23	34	0
207	1D	yeah, but do we need a new group or we just..	23	34	8
208	1D	I don't know. I guess, I think it's clear to group. It's easier to like just..	23	42	20
209	1A	I think 21 is more like forum/consulting. It's like you need to create, to get some work done.	24	2	6

210	1E	I think these two groups are very close to each other.	24	8	7
211	1D	this ( the new group, sharing ideas) is like a, um, you think of an idea, you create it, and people starts to review it.	24	15	7
212	1A	no, I think IDEO is finding solution to problems. So it's close to innocentive, anyway. But I think that 21 it's more like you need some aid made, so you look for a person to do it.	24	22	19
213	1D	okay, like..	24	41	4
214	1A	so it's like the translation job. I think they both belong to forum/consulting. And it seems that your looking for somebody to do some work, are you looking for an answer to a problem. So I think they are kind of similar anyway.	24	45	14
215	1D	so, these two are here (pointing to group f/c) and you can delete the group (of sharing ideas or innovative ideas)..	24	59	10
216	1E	this one, travel other's real (No. 10), this might be consulting (f/c)?	25	9	7
217	1D	yeah, yeah, yeah, consulting.	25	16	4
218	1E	you, you all agree?	25	20	3
219	1C	it may be similar to amazon, because it is based on experience?	25	23	5
220	1E	find a solution/ got a job done.	25	28	1
221	1A	I think, I think that's (what D just said) like explanation for what I think this group would be. It's like what it does is to find a solution to a problem, or get a job done.	25	29	10
222	1C	travel,...(description of No. 10) oh, that is similar to rakuten travel.	25	39	10
223	1E	where is rakuten travel?	25	49	1
224	1C	there, there, that is amazon, similar to amazon. Review based. because it is based on the experiences of travelers.	25	50	14
225	1A	I think for travel, ... description is more like people they share their experience from specific travel.	26	4	5
226	1E	yeah, like forum.	26	9	1
227	1A	yeah, it's more like forum. It's like you share your experience and you can ask people about their experience. But it's not like commercial.	26	10	2
228	1D	um, it's forum, sure.	26	12	3
229	1D	users can see ...(description of No. 53), I think this one, number 53, I think it's CI, where you have a topic and everybody just drop in what their interest is.	26	15	22
230	1E	yeah.	26	37	2
231	1E	business micro...(description of No. 82), no. This one, No.15, information distribution maybe.	26	39	

232	1D	Ekiten, search for...(description of No.15			
233	1C	ah, it is.	26	50	2
234	1C	search nearby restaurant (description of No.15)... similar to	26	52	0
235	1E	or it should be consulting.	26	52	5
236	1D	I think it's...	26	57	4
237	1E	it could be like distribute	27	1	0
238	1D	it's not like consulting, it doesn't help you. Just, information distribution ( saying at the same time with B )	27	1	2
239	1C	it's similar to collective (CI)	27	3	2
240	1E	here, ok. (dragging No. 15 under ID )	27	5	1
241	1D	you just know what is there, there's no need...	27	6	14
242	1B	I think the 58 should go to consulting.	27	20	4
243	1E	this one?	27	24	0
244	1B	yeah.	27	24	4
245	1D	ideas from different person...(description of No58)	27	28	1
246	1C	what is this about, user...(description of No58). It is also similar to another weather. The weather, weather reports created by users.	27	29	19
247	1E	this one? (No.4)	27	48	1
248	1C	CI, yeah.	27	49	2
249	1D	user creating?	27	51	1
250	1C	user creating. Weather news project(No.4). ideas from different perspective, of different living streets.	27	52	9
251	1D	ask questions, find...	28	1	1
252	1A	I think that's what they have in common. Like for example, um, innocente and IDEO is, it's like about finding someone or some solution	28	2	17
253	1A	But some is, for example, the career café, is more about just asking a question to users. Um, like 4 travel (No. 10) is the same. Like you ask a question is very open and in that sense.	28	19	14
254	1E	oh, this one (No. 82 Biz Microscope) is interesting... business...(description of No. 82)	28	33	7
255	1D	...business...(description of No. 82)	28	40	8
256	1C	I couldn't understand.	28	48	2
257	1D	what do they do. (laugh) make the employees speak better?	28	50	7
258	F	as I said, you don't have to use everything.	28	57	3



259	1D	well just put others. (laugh)	29	0	2
260	1B	others. (laugh)	29	2	1
261	1D	mysterious. (laugh)	29	3	5
262	F	but if that is interesting, you can create title and only single service exists.	29	8	7
263	1E	yeah, it's very interesting.	29	15	2
264	1C	I could not understand (what) it was.	29	17	2
265	1E	for example, you..	29	19	
266	F	Facilitator explained what the Biz microscope is.			
267	1B	this is more like information sharing.	29	26	4
268	1C	(listening to instructor's explanation) it is a kind of monitoring.	29	30	3
269	1D	it's office spy. (laugh)	29	33	5
270	1C	monitoring, yeah, it's spy. (laugh)	29	38	5
271	1C	monitoring, create another one, monitoring.	29	43	0
272	1B	yeah, yeah.	29	43	2
273	1D	I don't.. their work..	29	45	6
274	1E	slash other, no, there's no (other)	29	51	14
275	1E	...(description of 62) BOP	30	5	3
276	1D	what is BOP?	30	8	4
277	F	bottom of the pyramid is..(explain..).	30	12	2
278	1D	bottom of the pyramid. Oh, okay, ok.	30	14	17
279	1D	Lancers...(description of No.46)	30	31	12
280	1C	number 59...(description of No.59 )	30	43	2
281	1D	these two are similar actually, this one (No.59) and this one(No.46). Actually you have something, you just give it all to the public to design. And they have to create a create of designer or etc. and you pay them. It's like a business.	30	45	15
282	1C	occupation?	31	0	1
283	1E	this one?	31	1	1
284	1D	number 59 and number 46.	31	2	2
285	1A	I would say like the 59 is close to 21. It's like you need some creative job done and you find people to do this.	31	4	8
286	1D	um hum. (nodding) like I want this (with one hand), and I have this (with another hand) and you just connect them. That it.	31	12	5

287	1A	yeah. It's like I need somebody to create this logo or this ad, and users are like ...	31	17	7
288	1D	(finishing E's sentence) I can do that for you.	31	24	0
289	1A	I can do the logos and ads. So they have contest or something.	31	24	3
290	1E	so these two (21 and 59)?	31	27	3
291	1D	and 46 also. It's like, um, you know, kind of like mediate between the	31	30	2
292	1C	innovation by competition?	31	32	5
293	1A	you know, like freelancers and clients.	31	37	0
294	1D	freelancers and clients.	31	37	2
295	1A	it's like intermediation.	31	39	2
296	1D	yeah.	31	41	3
297	1C	innovation by competition? Maybe?	31	44	4
298	1D	maybe, I don't know. Both?	31	48	1
299	1C	open, from open competition? The innovation is.	31	49	5
300	1D	it likes..	31	54	1
301	1C	creativity.	31	55	0
302	1A	I think the intermediation is..	31	55	1
303	1C	OK.	31	56	3
304	1A	I don't know. I like my title.	31	59	1
305	1D	what is KAYAC, what is this?	32	0	2
306	1C	(read KAYAC's description) that, I couldn't. I misunderstood this.	32	2	
307	F	FAcilitator explained KAYAC			
308	1A	in that case...	32	40	2
309	1C	(asking instructor) oh, the Kopernik and KAYAC seems similar?	32	42	5
310	F	the K is more like create some fund. Like they want to develop some product for developing countries, and when scientist and technician they make a concept or design on website, and they post it on website and they can collect some fund from the company and they can make it. They can distribute it to poor countries.	32	47	31
311	1C	innovation for science.	33	18	2
312	1D	we just group these two like saying promoting start of.. I mean when you start a company?	33	20	5
313	1E	startup?	33	25	0
314	1C	nono.	33	25	2

315	1D	yeah, startups.	33	27	1
316	1C	innovation for..	33	28	1
317	1B	no, I think the Kopernik is more like intermediation. Like between the fund and projects.	33	29	1
318	1E	this one(62)?	33	30	1
319	1B	yes. For example, you can see it says that on the Internet, there are tech so they can attract some fund to develop those tech.	33	31	23
320	1D	oh, ok.	33	54	9
321	1B	I think the KAYAC still goes to the consulting.	34	3	4
322	1E	consulting?	34	7	1
323	1B	yes, because says in the material, if you want to have ideas from different perspective of different industries, ... free to ask what choice you want.	34	8	11
324	1D	ok.	34	19	1
325	1B	so it's more like ask question and somebody answers.	34	20	1
326	1D	asking the industry.	34	21	
327	F	Instruction			
328	F	amazon should be linked to this? (pointing to frequency based)	38	53	3
329	1C	no.	38	56	1
330	1A	I think it should, it should be linked to frequency based as well.	38	57	4
331	1E	yeah, yeah, yeah. Amazon.	39	1	2
332	1B	en hum.	39	3	5
333	1E	oh, yeah, it's frequency based.	39	8	5
334	1C	can you keep with both topics?	39	13	

\*F: Facilitator

2) The second workshop

Date: December 26th (Friday), 2014

Time: 13:30-18:00

Place: i.school studio, 4F, Engineering Building No. 11, Hongo Campus

No	video time	Duration (sec.)	Subject*	Dialogue
1	00:24:43		F*	Before you start, I'll give you information.
2	00:24:57	14	F	If you compare the Amazon, and the Sushi bar , they have no superficial similarity.
3	00:25:07	10	F	When I say superficial similarity, Amazon is web service and Sushi is real service.
4	00:25:15	8	F	And food - bookstore, so they are different.
5	00:25:18	3	F	That means, superficial similarity is low.
6	00:25:27	9	F	But, structural similarity, that means a service mechanism is same.
7	00:25:34	7	F	They have the history of purchase and recommendation,
8	00:25:45	11	F	In a sense, they have structural similarity.
9	00:25:47	2	F	We believe that we can create innovative service or ideas with high structural similarity and low superficial similarity.
10	00:26:01	14	F	So you are going to create the group of services based on structural similarity.
11	00:26:11	10	F	Not superficial similarity, do you understand?
12	00:26:14	3	2B	e.g., amazon and this sushi is in the same group
13	00:26:20	6	F	Yes, that's right.
14	00:26:25	5	F	Then, I think when you read material, you must have found that some of the services are similar.
15	00:26:34	9	F	Based on your sense, you create services, a group of services, and then you create title note to each group like amazon and dushi bar to tailor-made proposal.
16	00:26:52	18	F	ok?
17	00:26:54	2	F	You're going to give a title with a gray note.
18	00:27:00	6	F	This is what you're going to do.
19	00:27:05	5	F	It's a group work, so you discuss.
20	00:27:10	5	F	If somebody moves (the note) then it moves on the all the displays.
21	00:27:15	5	2C	We have to create this, like for the more? Or for just to 25 different
22	00:27:20	5	F	For 25 cases
23	00:27:22	2	2C	Then we have to connect that for like structural similarity to small one?
24	00:27:28	6	F	more?
25	00:27:29	1	2C	shopping mall
26	00:27:30	1	F	Nonono. That's just introduction.
27	00:27:33	3	F	Forget about the shopping mall
28	00:27:37	4	F	So, today we create new service, but the new service can be anything.
29	00:27:44	7	2C	Ok!
30	00:27:47	3	F	Ok? Are you ready? Ok. Why don't you start?

31	00:28:13	26	2A	Do you have any initial idea?
32	00:28:15	2	2C	Not particularly
33	00:28:24	9	2B	I wonder how much we can create.
34	00:28:52	28	2B	So how about start with cooking from the service that make some match, matching
35	00:29:02	10	2A	matching?
36	00:29:04	2	2A	which one?
37	00:29:07	3	2B	for example, No.16. match
38	00:29:25	18	2B	And there's another one..
39	00:29:41	16	2A	I think I, when I read this, I recognized 3 types of structures.
40	00:29:54	13	2A	So, one is e.g. the one you have in the left, those services ,
41	00:30:04	10	2A	They are, they connect one person.
42	00:30:07	3	2A	Should we?... for another person?
43	00:30:11	4	2A	But then, the other one, their structure is based more on
44	00:30:22	11	2A	collecting the from the large group
45	00:30:30	8	2A	And then passing that information to a single person
46	00:30:37	7	2A	What's your think?
47	00:30:39	2	2C	This is from the , maybe, consumer's point of view.
48	00:30:43	4	2C	from the business point of view, which is like No.59, what they do is like, they create a competition, and the one who wins, he will be using that service
49	00:30:54	11	2C	instead of giving the content to someone.
50	00:30:57	3	2C	for more something to do more particular one
51	00:31:05	8	2C	They create like an open competition, and they get a better result, so this is from the point of view of business
52	00:31:12	7	2C	some of them are from the consumer's point of view, the you get a better result or something.
53	00:31:19	7	2A	I think one difference certainly that, in some services, you are passing on just general knowledge or opinions,
54	00:31:31	12	2A	and other services, they are, your actually doing actual services, design your website, design the logo..
55	00:31:42	11	2B	So on the left, they all match one that provides some matching.
56	00:31:50	8	2B	ok, I'll try to group another one that you mention that they gather the information.
57	00:31:59	9	2B	So I move this ...
58	00:32:02	3	2B	and this
59	00:32:03	1	2C	Which one is the No.53?
60	00:32:04	1	2B	This one is bulletin board
61	00:32:05	1	2C	Oh yeah
62	00:32:07	2	2B	And what else?
63	00:32:09	2	2A	That, the one of eating.. No.03
64	00:32:14	5	2B	Ah, yeah, No.3
65	00:32:16	2	2A	And, there's also the one about the riding the bicycle.

66	00:32:24	8	2A	It's in the top row
67	00:32:47	23	2A	So, which one still we have?
68	00:32:53	6	2B	It is matching, but it's based on like, competition, something like,
69	00:32:58	5	2A	Yeah, so it's certainly not,
70	00:33:01	3	2B	Not the direct matching like this but, I put it right side
71	00:33:10	9	2B	No.59, it's also create something that based on the ranking system, so I think it could be here. It's brainstorming too.
72	00:33:24	14	2C	But, about the ranking of the person like No.21, is it you rank by yourself? Or they'll rank what you design.
73	00:33:37	13	2B	I think the rank is by ....
74	00:33:43	6	2C	So there's a two things, right?
75	00:33:44	1	2C	One, we go to the website we do some rating and the other is, we create something and the business man or the company, they rate us.
76	00:33:56	12	2C	On the basis of the level of the idea.
77	00:33:59	3	2C	So No.59, they rate us, and No.8, and No.03 we rate those things
78	00:34:12	13	2B	try to gather.. The website that provide into many...
79	00:34:20	8	2B	This one...
80	00:34:28	8	2B	This and also No.17
81	00:34:46	18	2C	I'm not sure, maybe this one, which is connecting the social issues, No.23
82	00:34:54	8	2C	Creating ideas...
83	00:35:05	11	2B	I think,..
84	00:35:12	7	2A	I think some of the
85	00:35:16	4	2B	You can move around (the notes), please
86	00:35:26	10	2A	Of course, all of them satisfying somebody's needs.
87	00:35:31	5	2A	either some person, who wants to looking for finding the good restaurants
88	00:35:36	5	2A	like a recommendation
89	00:35:39	3	2A	or you have the other ones, are people who are looking for specific service.
90	00:35:46	7	2A	I don't think the structure changes dramatically.
91	00:35:51	5	2A	I think they all have in common, you're trying to facilitate you solution for some kind of need.
92	00:36:04	13	2C	Normally, how many categories do you think there would be, on the basis of structure.
93	00:36:11	7	2A	I think one structure, of course, we have to ambiguous, everybody have a different structure,
94	00:36:23	12	2A	But I think one common trait is, e.g. the one in the left, where you're providing using the service at the platform to provide in specific service from one person to one person.
95	00:36:43	20	2B	I think obviously, group the other one
96	00:36:56	13	2B	Some of these, they not sell the products by themselves
97	00:37:05	9	2B	Apart from this one(No.1&2)
98	00:37:11	6	2B	This is all selling the products.
99	00:37:29	18	2A	If you try to go deeper, in the once, in the left, that group
100	00:37:39	10	2A	you have a like a pool of the resources, which is people are talented:

				developers or artists.
101	00:37:51	12	2C	Expert?, opinion professional
102	00:37:54	3	2A	So, here in the one in the left, have some kind of professional as resources,
103	00:38:04	10	2A	And you're trying to
104	00:38:07	3	2B	I'll move No.21 to left side to
105	00:38:10	3	2C	Yeah, maybe yes.
106	00:38:11	1	2B	It's not directly match,
107	00:38:13	2	2C	No.21's the direct one.
108	00:38:16	3	2C	And that in the competition they came up
109	00:38:18	2	2A	The other, such as No.16, the resource are not professional, just people in general.
110	00:38:29	11	2A	So, layman, but still, I need
111	00:38:31	2	2A	If you collect, you know, opinions from layman,
112	00:38:34	3	2A	it's your turn to some kind of having useful information.
113	00:38:40	6	2C	yeah.
114	00:38:43	3	2C	So, in general, this one is from kind of professional, we don't need to re-doing, they all professional,
115	00:38:47	4	2C	this one is like raw data, and
116	00:38:52	5	2C	they should be I think, rated. Right?
117	00:38:56	4	2C	everyone is like No.08, and this one, they rated and .. Information..
118	00:39:02	6	2A	I think in this one you have just normal people, they give their opinion, once you have collected opinions,
119	00:39:14	12	2A	obiously, you have noticed, No.03, whatever becomes more popular,
120	00:39:23	9	2C	No.62
121	00:39:28	5	2A	This is the one who develop, I think solutions for developing countries,
122	00:39:36	8	2B	So what do you think?
123	00:39:38	2	2A	I think it's also some kind of
124	00:39:41	3	2C	profieessionals?
125	00:39:42	1	2A	Yes. Definitely. Professional.
126	00:39:48	6	2C	This one also will be a,
127	00:39:50	2	2C	Is this like a google one? Is this from the professionals or
128	00:39:56	6	2C	from like, the , using the doing the reviews of gathering these things and then.
129	00:40:02	6	2A	I think
130	00:40:04	2	2B	It should be on the top because they provide the service bu themselves, not
131	00:40:09	5	2B	e.g. from the left side,
132	00:40:13	4	2C	Professionals ...
133	00:40:15	2	2B	But the provider, they're not providing the service by themselves.
134	00:40:22	7	2B	like, try to match, try to find the best for the users.
135	00:40:29	7	2C	No.24 provide by themselves, they don't do the...
136	00:40:31	2	2B	Yeah

137	00:40:33	2	2A	Does it make a difference?
138	00:40:40	7	2A	I think , e.g.,
139	00:40:47	7	2A	eventhough No.24, e.g. , there's no person ,no other 3rd party which is providing the service,
140	00:41:00	13	2A	It's just a piece of software.
141	00:41:04	4	2B	It is a piece of software.
142	00:41:07	3	2B	I think No.5 & No.24 is quite similar.
143	00:41:10	3	2A	So you have
144	00:41:13	3	2B	Some kind of hardware you use to collect the data
145	00:41:16	3	2A	You could use that as a category so you services which require at least like two human, or whatever it takes place
146	00:41:29	13	2A	in the other one which requires only software
147	00:41:32	3	2A	So I think, e.g. the ones in the right, you're not deaking with a person directly,
148	00:41:38	6	2A	you're just dealing with, kind of ratings in the smartphone app.
149	00:41:45	7	2C	So, in general, we can say that this one comes from the credible source, professionals, right?
150	00:41:53	8	2C	So, they must be like more reliable, in some ways.
151	00:41:58	5	2C	Then, like this .. Things
152	00:42:01	3	2A	Well, I think,
153	00:42:05	4	2C	In a normalized .., I mean, not like the
154	00:42:09	4	2A	I thinkg normalized, like, in this, in the ones in the right,
155	00:42:16	7	2A	You're still going to ..
156	00:42:19	3	2A	e.g. if you follow the recommendation, you'll probably end up with good restaurant.
157	00:42:23	4	2A	So I think, you know, the quality of the recommendation is not bad, it's just ones in the right
158	00:42:33	10	2A	They are using normal peopla as the resource,
159	00:42:37	4	2C	Yeah, their experience and this one is from..
160	00:42:39	2	2A	This, they're not using normal people, they just have resource they're actively looking at the group of profesisonals
161	00:42:50	11	2C	So, a professional base and experience .. Practical
162	00:42:53	3	2A	Yeah
163	00:43:03	10	2B	In that case,
164	00:43:14	11	2C	No.14 should be here, right?
165	00:43:23	9	2B	on the left?
166	00:43:26	3	2C	I think the right
167	00:43:37	11	2B	they provide
168	00:43:46	9	2B	information about the place so..
169	00:43:55	9	2B	they provide, but it's not gathered by the other users , no.14
170	00:44:09	14	2B	that information on this website is gathered by a the website itself.
171	00:44:22	13	2B	Not shared
172	00:44:25	3	2C	Ah, from the users?



173	00:44:27	2	2B	So I think it should go on the left
174	00:44:32	5	2B	The group, as Daniel said,
175	00:44:36	4	2B	Ok. And what about No.11?
176	00:44:38	2	2B	matching, matching
177	00:44:42	4	2A	No.11 is definitely profesisonal
178	00:44:46	4	2B	what about No.10?
179	00:44:51	5	2C	No.62?
180	00:45:14	23	2A	I think the one, No.7 is also in the left because,
181	00:45:22	8	2B	here?
182	00:45:23	1	2A	uhm, because it's using actual university student as the source
183	00:45:32	9	2C	TheNo.62 could be on the left, because it's actually getting a social issues
184	00:45:39	7	2C	from a NGO, something like going for the funding for developing countries
185	00:45:48	9	2B	I think it's same... because their information
186	00:45:52	4	2C	which one?
187	00:45:57	5	2B	No.7
188	00:46:02	5	2C	I think , maybe they're like local people , professional compare to but,
189	00:46:11	9	2C	in other sense, they're also users on their experience
190	00:46:17	6	2C	but the user in this case, it's getting from professional people.
191	00:46:21	4	2C	So, we can say that , maybe the senior members are kind of profissional or in...
192	00:46:29	8	2B	So it's kind of matching other..
193	00:46:33	4	2C	Yeah.
194	00:46:35	2	2A	I think maybe.. Try to focus on another structure
195	00:46:44	9	2A	because I think now we agree at least that we can identify the type of resources which they're using.
196	00:46:56	12	2A	But, I think we can still , maybe, make a final category.
197	00:47:05	9	2A	I think 2 is a little bit, not a....
198	00:47:16	11	F	After you create categories, you're going to put title.
199	00:47:21	5	F	And title is quite important. This should summarize service mechanism, or structural similarity. Or provided values of those services
200	00:47:34	13	F	This should be in a short sentence, it should explain.
201	00:47:40	6	F	And you can do a grouping, categorization, at the same time you can create title.
202	00:47:49	9	F	And, so if you put title of the group, then your discussion become more deeper
203	00:48:04	15	2C	we put the titles..so...
204	00:48:12	8	2C	I'm still not sure about the google.
205	00:48:22	10	2B	Because I think there's more than one structures.
206	00:48:27	5	2B	It's quite different from.....
207	00:48:29	2	2C	Yeah
208	00:48:30	1	2A	But in regards to what is different,

209	00:48:35	5	2C	Because it's getting, doing the slangs, like local languages of people, and google itself is using that provider as input.
210	00:48:51	16	2C	on the internet or something, I don't know...
211	00:48:54	3	2B	I think it's like, when you type Japanese,
212	00:49:00	6	2C	Yeah, so new vocabulary or something.. Yeah, that kind of..
213	00:49:05	5	2C	But in other ones, like Amazon and sushi.
214	00:49:11	6	2C	It's kind of more, as technical, QR or something, they use technology.
215	00:49:21	10	2C	This is kind of, it's not survey, like a new trend of a vocabulary.
216	00:49:27	6	2A	So, I think you could say some services are made to give to provide additional convenience.
217	00:49:43	16	2A	Others could say, they are clearly made to help you to save money.
218	00:49:50	7	2C	Yeah.
219	00:49:51	1	2A	e.g. the ones on the left, you have a this matching between translator , service provider and service seekers
220	00:50:01	10	2A	I think they are there to minimize your cost because you're..
221	00:50:07	6	2A	You have to many, to make a proposal many many , while you have contract.
222	00:50:15	8	2A	Then you contract which one you want. That's...
223	00:50:19	4	2B	the one from the customers, so it should be on the left,
224	00:50:30	11	2A	No. no. that one is for the right.
225	00:50:33	3	2A	Because, that one is using just the, I think, just input from many many people, and they compiling it into some kind of slang dictionary.
226	00:50:44	11	2B	They provide themselves, not ..., these, they provide others' idea then you have to decide by yourself
227	00:50:58	14	2A	Hah...
228	00:51:06	8	2C	But, How do they know about the vocabulary, form the internet? Or they do some survey? Like..
229	00:51:13	7	2A	I think they use for that one people use google to search they use the input for that. To build the database
230	00:51:30	17	2C	Ah.
231	00:51:35	5	2A	So, I think , uh, if you look at each service provider and you look at the idea from there how are they profiting this service.
232	00:51:57	22	2A	So, I think that could give use some insight to some other type of...
233	00:52:03	6	2C	Yeah, that's right, because the No.2 and No.1 they're like doing efficient time management and improving the efficiency..like for customer.. Right?
234	00:52:15	12	2C	Something which user wants for..
235	00:52:20	5	2C	and the from a point of view, like the left one, especially, the No.24, they're kind of making for more users, maybe, that, you write something and som vocabulary comes up.
236	00:52:34	14	2C	And the.. And also, the left one is more
237	00:52:41	7	2C	solving, more like a , in a way, not technical...
238	00:52:51	10	2C	Because this is just making a database giving something , this is kind of more social... how to say..
239	00:53:04	13	2C	advice..
240	00:53:07	3	2A	So, I think, e.g. the one No.2 and No.24, they are actively using this scheme to improve their
241	00:53:18	11	2C	user-friendly

242	00:53:19	1	2A	user-friendliness, or efficiency
243	00:53:23	4	2B	You guys're right.
244	00:53:25	2	2A	But as for the other ones, they're I don't think they maybe care a lot of their user-friendliness, they more like looks making profits
245	00:53:37	12	2C	Hmm.
246	00:53:40	3	2B	You mean, this No.5, because I think if you, from a view point, this is provider, I think this on the right.
247	00:53:55	15	2B	Maybe their income gather from the advertisement, they didn't sell anything .
248	00:54:00	5	2A	Yeah, I think in many ones , you don't have to pay anything to use the services.
249	00:54:08	8	2A	So basically the service provider have to find some kind of ideas to integrate the services into the portfolios
250	00:54:17	9	2A	But the ones in the left, they are, I think they actively making money with this.
251	00:54:23	6	2C	Because they're professionals, right? I mean,
252	00:54:26	3	2A	Not because of professional, but e.g., I'm pretty sure that you have to pay money to actually be a member of one of this website.
253	00:54:34	8	2A	Whereas, I see you don't have to pay.. Most likely, you don't have to pay any money to the other services.
254	00:54:52	18	2A	I think maybe we should start writing some categories.
255	00:54:57	5	2B	I'm trying to group the website that they provide the services by themselves or they try to find the professionals to solve a problems
256	00:55:17	20	2A	I would say, the one category's structure is certainly that
257	00:55:25	8	2A	professionals as a resource
258	00:55:41	16	2C	In general, a person going to the internet and he wants information, so
259	00:55:49	8	2C	there're different category, right?
260	00:55:52	3	2C	The professional one, and from user's experience, and then some other perspectives.
261	00:55:59	7	2C	So maybe we start like, to writing this two in that way.
262	00:56:04	5	2C	we can categorize, yeah.
263	00:56:35	31	2C	I think they're, what they're doing in the No.01 and No. 05, they're actually balancing the supply and the demand.
264	00:56:48	13	2C	In an efficient time, doing efficient time management.
265	00:56:52	4	2C	Because No.1 is some sort of .... Right? So number of people... and similarly No.05,
266	00:57:04	12	2C	It just get the historical data selling goods and they're also kind of doing some sort of balancing the supply and demand
267	00:57:18	14	2A	I think, many of this make the efficiency-driven , so you want to increase efficiency of your business and other ones profit-driven
268	00:57:37	19	2A	you don't, so there's maybe ...
269	00:57:46	9	2A	There isn't much of aspect that you want to optimize but e.g.
270	00:57:51	5	2A	These enable to have, the ones in the left , having possibility of somebody is looking for the service
271	00:58:03	12	2A	And then, they being able to basically choose from many many people, professionals they are
272	00:58:11	8	2A	They're just using the fact that people're interested in this offering to just make money.
273	00:58:18	7	2C	But for that, No.24 and No.02, they're kind of user-friendly in that way.

274	00:58:26	8	2C	Right? Because they're trying to make their website or services more user-friendly.
275	00:58:33	7	2C	No.01&05, time management.
276	00:58:37	4	2B	Nono. No24 is not website, it's a ..
277	00:58:43	6	2A	It's for your smartphone, also for computer.
278	00:58:48	5	2C	Ah. Ok
279	00:58:51	3	2C	So, it just for the person who is using not only for ..
280	00:58:54	3	2B	Yeah, not only for ...
281	00:59:11	17	2A	so... one maybe , make profit..
282	00:59:30	19	2B	Anyway, this group can be same to this group, they gather information from the customers
283	00:59:44	14	2B	And they use their some kind of development, to provide better service.
284	00:59:55	11	2C	Maybe then, we can divide into like that professional people, then into profit base and maybe other category.
285	01:00:05	10	2C	reliable something.
286	01:00:13	8	2C	because these two(No.1&5) are mainly time management
287	01:00:19	6	2C	these No.2 and.. Find demand, supply and demand.
288	01:00:33	14	2A	I think the way , the ones in the left. You're jumping this new crowd-sourcing model
289	01:00:45	12	2A	just to make a profit.
290	01:00:50	5	2A	And this could be, e.g. match translators and people who want translation.
291	01:00:57	7	2A	others are trying to increase the efficiency of the existing business
292	01:01:04	7	2A	I think for the ones in the right. E.g.
293	01:01:11	7	2A	No.08 how do they, what's their incentive behind to implementing crowd sourcing
294	01:01:19	8	2A	of course, it's convenient for bicycle riders but nobody does , I don't think they're just doing this out of good will
295	01:01:30	11	2A	There has to be some other incentive, maybe I'm too pessimistic
296	01:01:35	5	2B	As I mention, maybe, it is provide, make some profit by advertisement
297	01:01:46	11	2A	So here, of course, you can provide valuable knowledge
298	01:01:52	6	2A	people use their service and then they can get cash from advertisement , ah, revenue.
299	01:01:59	7	2C	Yeah.
300	01:02:01	2	2A	So.. But I think that also into making profit for novel business model just not collecting
301	01:02:13	12	2A	like the fee from , here you collect the fee directly from the recipient, and here from the maybe advertisement agency
302	01:02:23	10	2B	Maybe some of them mainly, they are not taking any fees
303	01:02:28	5	2A	I think some of them can be think as just out of good will , for the better world, such as
304	01:02:35	7	2B	e.g. No.7, I think they not charge any fees on student.
305	01:02:40	5	2A	yeah.
306	01:02:44	4	2C	career advice, these are like this
307	01:02:48	4	2B	kind of income.. Their website like advertisement.

308	01:02:53	5	2C	Yeah, so their website will become popular or somethink like, they can run advertisement or something..
309	01:03:04	11	2B	Anyway, mentioned in that...
310	01:03:08	4	2A	you could say like that maybe some of them. Their driving factors to starting the service
311	01:03:16	8	2A	is just a noble cause, I want to provide bicycle riders' experience in Japan.
312	01:03:25	9	2A	I want to provide 3rd world countries with that technology
313	01:03:30	5	2A	so, maybe like, even though they might be making revenue, I think the source of the idea is a also some kind of
314	01:03:43	13	2A	It could be also seen in the structures
315	01:03:46	3	2A	structural profit making...
316	01:03:50	4	2C	one is like, from the point of view, business like No.2, No.5 and No.1
317	01:03:57	7	2C	Other one is like giving advice , professional advice to local people,
318	01:04:03	6	2C	this one is like getting something from the local people's ratings or surveys like these things
319	01:04:12	9	2C	And the one, how do you differentiate the left one, and the this one?
320	01:04:19	7	2B	This one and this one.. What I categorize into two groups, maybe as you mention,
321	01:04:27	8	2B	They have kind of similar structure that they provide from professional
322	01:04:33	6	2B	but, professional with I categorized on the left one , they provide information by themselves.
323	01:04:44	11	2B	but these in the middle, the information they provide is from other users. And they're matching it.
324	01:04:54	10	2A	You could say like a service, basically
325	01:05:01	7	2C	They're middleman? The one is middleman?
326	01:05:03	2	2B	Oh yes. The middle is the middlemen
327	01:05:07	4	2A	middlemen and the other is just provider and consumers
328	01:05:11	4	2B	Yeah..
329	01:05:13	2	2A	Ok
330	01:05:14	1	2B	I mention, maybe we can group this together.
331	01:05:21	7	2B	This gathered information, the users to improve their services.
332	01:05:42	21	2B	But this No.27, maybe not.
333	01:05:45	3	2B	because they... paln you date, consulting....
334	01:05:54	9	2C	This is from local one, right?
335	01:05:55	1	2B	I'm not sure about No.27. let me see the information first.
336	01:06:04	9	2B	No.14 find the spot for your wedding, but No.27, I'm not so sure.
337	01:06:24	20	2B	... consulting...
338	01:06:25	1	2C	They consultants
339	01:06:34	9	2C	Maybe we can divide like in that way, consultants and the other one.
340	01:06:40	6	2B	Consulting but, they spot ranking. User ranking. Hmmm..
341	01:06:51	11	2B	just a moment. Let's see ...
342	01:07:23	32	2B	Their website. OH! Sorry. Date2.jp

343	01:07:53	30	2B	It seems like they provide information, just provide information.
344	01:08:01	8	2B	But they don't match
345	01:08:04	3	2A	Yes, there's no like, they're not the middlemen,
346	01:08:11	7	2B	Yeah, they're not the middlemen
347	01:08:12	1	2A	They're provider
348	01:08:14	2	2B	It should be on the right side.
349	01:08:20	6	2C	From the No.14, I think, here they wrote that we can read the experience of the different people,
350	01:08:31	11	2B	Which one?
351	01:08:31	0	2C	No.14 , you can read the reviews of people from their experience, but they provide the coordinating service. Right?
352	01:08:41	10	2B	Yeah, they provide ... information...
353	01:09:02	21	2B	Hmm. They do not provide , No.14
354	01:09:05	3	2C	No. they provide the coordination service for the wedding ceremony.
355	01:09:12	7	2B	Ah! I see...
356	01:09:21	9	2B	The main reason that... to use that service, ok. I see.
357	01:09:45	24	2A	So, I made two, so one post-it has service chain : the provider - consumer, so there's no middle man.
358	01:09:54	9	2A	And the other is service chain it's on the top .
359	01:10:02	8	2A	I think we starts...
360	01:11:15	73	2A	I'm trying to make a post-it, which is a
361	01:11:20	5	2A	Maybe, you can make it as a like No.14, the idea is,
362	01:11:26	6	2A	it would increase the quality of the lifestyle.
363	01:11:31	5	2C	This professional people, should not, shouldn't be here?
364	01:11:37	6	2C	I mean the professional people in No.1, No.5.... Right?
365	01:11:42	5	2C	They're getting the information from the local users.
366	01:11:46	4	2A	Where is No.1?
367	01:11:49	3	2C	I mean this the left on the bottom(No.1)
368	01:11:53	4	2A	I think it should be here.
369	01:11:59	6	2A	actually I think it's same about the
370	01:12:02	3	2C	No.5?
371	01:12:02	0	2A	No.24 .
372	01:12:05	3	2A	Because this actually using the input from all the regular people, not professional
373	01:12:14	9	2C	I think the professional people in this tap for the second line, right? This one...
374	01:12:23	9	2C	The line of No.62, right? So it should be here.
375	01:12:51	28	2B	service chain : provider-consumer
376	01:13:24	33	2C	No.59 could be in this? They're in a way middleman
377	01:13:27	3	2C	Because they're organizing the event, the competition.
378	01:13:34	7	2B	They're middleman.

379	01:13:36	2	2C	They're all. Right? I mean the No.59
380	01:13:41	5	2B	No59, and yeah, No.62. too
381	01:13:43	2	2B	I think they're same like ...
382	01:13:45	2	2C	Providing a platform.
383	01:13:49	4	2B	Yeah.
384	01:13:50	1	2C	How about the business one? The increase the efficiency of the business.
385	01:13:56	6	2C	There should be No.2, No.1 should be there.
386	01:14:05	9	2C	And no.5
387	01:14:13	8	2C	when we say efficiency of business, we're talking about both saving cost and time.
388	01:14:19	6	2C	or and making user friendly? Like three?
389	01:14:23	4	2A	Yeah.
390	01:14:25	2	2C	so, In that case,
391	01:14:27	2	2B	No.1 should be moved, yeah, exactly.
392	01:14:33	6	2C	How about No.24 then?
393	01:14:36	3	2B	No.24, I think it's really hard.
394	01:14:39	3	2C	How about No.24 then?
395	01:14:41	2	2C	Because they're also kind of making user friendly thing, right?
396	01:14:45	4	2A	But I think we can have this in the increase of the efficiency of the business can be ,
397	01:14:59	14	2A	you can say that apply that both to a professional people as resources and use general public as resource
398	01:15:09	10	2C	I think in there, if we can make the big three circles, then, we can like, put something in between two circles as well
399	01:15:18	9	2C	which can be in both. So there're like all the,
400	01:15:23	5	2C	there're some categories that, which can be In all three, two or only one.
401	01:15:30	7	2A	I'll put "Increase efficiency" in the middle, and going to..
402	01:15:39	9	F	Can I interrupt you a moment?
403	01:15:41	2	F	You don't have to use all that notes.
404	01:15:44	3	F	Important thing is create the nice group.
405	01:15:48	4	F	And that is useful for the idea creation for the next step.
406	01:15:52	4	F	so, if some of the notes don't fit, then you can exclude.
407	01:15:58	6	2C	Ah, ok.
408	01:16:00	2	F	If you create three of four, certain numbers of nice group, that would be fine.
409	01:16:19	19	F	How many more minutes you need?
410	01:16:21	2	2A	5 mins, maybe
411	01:16:22	1	F	ok. It's good. 3 o'clock. You finish, and then we take a break.
412	01:16:42	20	2A	we should be able to select that, more ideas....
413	01:16:58	16	2A	It looks, the funny thing is, it looks different in your screen and mine.
414	01:17:01	3	2B	oh, really?

415	01:17:04	3	2A	just a little bit.
416	01:17:13	9	F	You know, when the synchronization is not complete, you reload
417	01:17:20	7	2B	Because you make the change from your computer.
418	01:17:29	9	F	if it looks different, please reload.
419	01:17:32	3	2A	I think it fairly looks similar.
420	01:17:37	5	F	It should be same
421	01:17:47	10	2C	In general, like a, how many categories ..?
422	01:17:55	8	2A	I think we have, this professional, the resource type as a top category,
423	01:18:04	9	2A	and then, sub category as the increase the efficiency of the business.
424	01:18:14	10	2A	like a business incentive, and also the
425	01:18:20	6	2A	maybe the type of services, which is middlemen
426	01:18:34	14	2C	which one is that one?
427	01:18:37	3	2A	I think you should do the updating.
428	01:18:43	6	2A	It looks like lose the synchronization of my computer.
429	01:18:54	11	2B	Can you try to move something in your computer?
430	01:18:58	4	2A	OK, I'm trying to move another thing
431	01:19:07	9	F	I understand it's not so clear. But please make clear group.
432	01:19:13	6	F	And then put the title to the group.
433	01:19:17	4	F	So you have separate group
434	01:19:31	14	2B	General public...
435	01:19:37	6	2C	Can we increase font size?
436	01:19:39	2	2B	Is it too big?
437	01:19:42	3	F	Nono. It's okay
438	01:19:49	7	2C	This one is big one, right? The general public
439	01:19:54	5	2B	Yeah, the general public ..
440	01:19:55	1	2C	How can we increase font size?
441	01:20:04	9	2B	The font size will be optimized according to your number of layers you typed
442	01:20:11	7	2C	I mean, like a, I want increase the font size because it should be
443	01:20:16	5	2B	You cannot do it I think
444	01:20:17	1	2C	OK.
445	01:20:17	0	2B	It is optimized on your letter
446	01:20:26	9	2C	So this is one category, general public as resource
447	01:20:36	10	2B	No.2...
448	01:20:40	4	2A	Hmm.
449	01:20:40	0	2B	And,
450	01:20:44	4	2C	No.14, and..
451	01:20:48	4	2C	middleman
452	01:21:06	18	2B	Sensei, Can we.....



453	01:21:17	11	F	Create again, yeah. Please
454	01:21:51	34	2B	This is middleman
455	01:21:53	2	2C	Middleman and the ...
456	01:21:53	0	2C	This one should also be the middleman, the...
457	01:22:06	13	2B	Daniel, can I move this one? Because.. Maybe this can be any categories
458	01:22:15	9	2B	What do you think? Too many notes here.. I think...
459	01:22:22	7	2C	I think either have making profit .. Increase efficiency.
460	01:22:28	6	2B	I think so, this one...
461	01:22:31	3	2A	But I think it's important things to keep in mind...
462	01:22:33	2	2C	Maybe, ah...
463	01:22:46	13	2B	This, middleman , so, all of them are middleman.
464	01:22:53	7	2B	So, this group and as a middleman too and professional too. Both right?
465	01:22:58	5	2A	I think they go, kind of hand in hand.
466	01:23:03	5	2A	If you want to use professional people as a resources, then you need some kind of to do, yeah some kind of middleman
467	01:23:10	7	2B	ok. There, they stay together.
468	01:23:15	5	F	Great!
469	01:23:20	5	F	This is not used? (General public as resource)
470	01:23:24	4	2C	No. I think not
471	01:23:26	2	2B	Do you mean this and...
472	01:23:30	4	2A	Nonono. We can delete it because that also goes hand in hand, use the general public.
473	01:23:33	3	F	Oh! Good. You create 4 groups, right
474	01:23:38	5	2C	No, three groups, this one is sub. I mean like,
475	01:23:39	1	F	Sub! Ok, 3 groups
476	01:23:43	4	2C	or, I mean, not sub actually..
477	01:23:46	3	F	Understood, just fine, ok. All right, three o'clock. Shall we take a short break?
478	01:23:54	8	2A	10min

\*F: Facilitator

## APPENDIX B: Samples of the new ideas recorded in the APISNOTE

6-

Yong Jang

RELOAD FULL SCREEN CAPTURE HISTORY NETWORK

LINK VOTE LINK PICTURE

Doc of

SELECT

Matching Service

No 011. Large. Large writing style of foreign language. Teach their own language to other by practicing.

No 022. Large. Large writing style of foreign language. Teach their own language to other by practicing.

No 033. Large. Large writing style of foreign language. Teach their own language to other by practicing.

design and technology

A good design is hard to come from without technical support. A technology is hard to be designed to normal person without good product design. Good design is designed up with technical person (not artist).

Education resources match up

Each good school is paired up with a school which has resources. They are paired according to the aspect of the resources (not just).

easier approach to doctors.

life switch

Exchange the list for a period to let them to try different lifestyle so that they can start to appreciate what they have currently.

Studying abroad matching

Students go to different countries to study. They parents make a list of the countries. They parents have different countries to exchange taking care of their list while that is studying there.

Analogy Table

Wedding Park

Wedding ceremony

Studying abroad

Family with kids studying abroad

Providing the information of the busy who willing to take care of the kids who are studying abroad along with up the two families who have kids studying in each other country.

Users can search available families worldwide according to their countries and the country their children studying.

Providing the information service for the wedding ceremony. Users can find a type of wedding for their both.

Users can search their wedding some conditions spontaneously, making some information for the preparation of wedding. Users can search the price of the wedding. Registered member can request schedule and budget in any page.

ADD

