<center>論 文 の 内 容 の 要 旨</center>

論文題目　　　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ィザインへの活用）

氏　　名　　金　恩英

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 1st – 4th 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 appropriate ideas.

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.