

# Creativity and design method in idea generation: the comparison between intuitive approach vs structured approach

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In order to come up with creative ideas, designers have adopted several design methods in the process of idea generation. However, few studies have been conducted about which design method is more efficient for increasing creativity. Therefore, we selected two design methods, Brain Writing and S.C.A.M.P.E.R that are opposite to each other in terms of approach. An experiment was designed in a way that given the same design brief three groups of designers came up with design ideas: one group used brain writing, another S.C.A.M.P.E.R, and the other no particular design method. The design ideas generated from the experiment were assessed by three design experts to judge the ideas in terms of creativity. The results indicate that there is no significant difference in ideas between three groups in terms of creativity while a radical way is more efficient in terms of the quantity of ideas. The limitations and further study are discussed in the end.

**Keywords:** Creativity; Design method; ideation; Intuitive method; Structuring method; Brain writing; S.C.A.M.P.E.R

## 1 Introduction

Psychologists have found that creativity is one of the most energetic activities in the brain, along with logical thinking and will (Gailliot et al., 2007). The definition of the creativity in the Oxford dictionary said that it is 'The use of imagination or original ideas to create something; inventiveness.' it tried to create something new and it often occurs in unconscious thinking (Csikszentmihalyi, 1997). When people think about an idea, they come up with a new idea by combining various ideas or information that are unconsciously latent. People instinctively hate change and hope to remain intact. But without change, there is no development. Therefore, to develop into a better society, creativity that can make a change becomes essential. Creativity is a phenomenon whereby something new and somehow valuable is formed (Bennett & Bennett, 1975). Without creativity, humanity would not progress (Csikszentmihalyi, 1997). People make creative ideas a little easier when limiting thoughts. (Bhushan, 2017).

Especially, creativity is a core of design activity because design is meant to solve complex problems of our society considering all the pros and cons. So how can we help designers in coming up with these ideas? Many creativity techniques have been created to help generate

an idea for a designer. The most representative generation method would be brainstorming that people knew well. This method appeared in the book called Applied Imagination (Author, 1953) and began to become famous, and it became the most popular method among many idea generation methods. The reason for being established most popularly is that this method can be widely used and can be easily applied. However, brainstorming method cannot be creative in every environment and generate creative ideas for every single session. That would be one of the reasons why people try to extract ideas from far more diverse ways than one method (Mackay & Fayard, 1997). Thus, brainstorming, cultural probe, focus group interview and so on was create and tested from the various environments.

### 1.1 Changing perspective method of idea generation

In addition to design, the method of changing perspective is a method used to solve problems by looking at the problem from a different point of view, exploration from a completely different perspective can provide a completely different solution than what designer or other people have seen so far. By changing perspectives, people instinctively can figure out the solution to the problem. Sub categories are many in the changing perspective method of idea generation, such as transformational, SCAMPER (Eberle, 1996), and etc. S.C.A.M.P.E.R are really focus on the problem analysis and idea generation

### 1.2 Insight experience methods of idea generation

In the case of the insight experience design method, it is a way of instantly telling people the ideas they come up with, or mapping ideas while writing, exploring the thoughts that are inside people. Examples include such as brain writing, brainstorming, and 5whys. In the case of design methods, it is a way to explore their own experiences and thoughts instinctively.

### 1.3 Measuring Creativity

To find out which design method is more effective in increasing creativity, a measurement of creativity is needed. There would be various aspects of measurement that quality of ideas and feasibility that needs to define for the measurement of creativity are the example. The categories of creativity used in the research of Christiaan (1992) who has been studies about creatives has developed 5 measurement of creatives which is explain in the table 1. The categories are goodness of example, idea quality, technical quality, attractiveness, and integrating capacity.

Table 1. Measurement of creativity (Christiaans, 1992)

Goodness of example	The extent to which the product is prototypical for its class of products. To exclude the influence of other criteria assessed, it was preferable always to begin with the prototypically criterion.
Idea quality	Quality of idea that comes with method
Technical quality	The extent to which a product meets the necessary technical requirements
Attractiveness	Preference for the outward form.
Integrating capacity	The extent to which the product integrates the underlying aspects of form, function, and construction.

## 2 Method

From these two categories of ideas generation and changing perspective categories, brain writing and S.C.A.M.P.E.R design method were selected respectively. The brain writing is a more advanced method than the brainstorming method (Litcanu, Prosteian, Oros, & Mnerie, 2015). S.C.A.M.P.E.R has various method to gathered to stimulate the idea-prompting checklist which stands for Substitute-Combine-Adapt Modify-Put to other Uses-Eliminate-Rearrange (Vehar, Firestien, & Miller, 1999). The experiment was conducted with three groups of designers: a brain-writing group, a S.C.A.M.P.E.R group and a control group that has no design method to use and generate the idea freely.

### 2.1 Experiment

The experiment is divided into three teams. The two teams applied different design methods, and the last group is control-groups that do not offer any design method so that it can show and compare the creativity of the ideas of the two team. The control-group's creativity would show the average creativity of the idea that can be generated in general occasion. For this research, the design methods for this experiment are used to Brain-writing and S.C.A.M.P.E.R. This method could be explained in the below.

#### 2.1.1 Brain writing

Brain writing is a way to effectively engage everyone and not everyone else has the same influence, but at the same time, there is no stimulating synergy among the participants (Figure 1). It is particularly helpful with a crowd of people who are somewhat hesitant and would be extraordinary to offer many opinions in an open group session. Brain writing method provides equal time to think and write without other people's disruption and conflict. Each of which has 6 to 8 comments on a single sheet, and distributes them, and draws his or her own ideas on the theme on the first three to five minutes on each paper. After 3 ~ 5 minutes, let's pass the sheet to the participant on the left side, and write the other blank space in consideration of the idea that developed the idea written on the sheet. Continue to use the same method until all fields are filled. For the brain writing method, the session with six students may generate 108 ideas can be produced in about 30 minutes (Csikszentmihalyi, 1996). Compared to brainstorming, brain writing tends to result in somewhat fewer, but more fully developed, ideas (Roco, 2004). The benefit of brain writing method would be:

- Less communication opportunity and think deeply by themselves
- Quick and easy to generate the ideas
- Construction of "idea on idea" to generate creativity
- Combination of teamwork and individual works.
- Provide teamwork

#### 2.1.2 S.C.A.M.P.E.R method

S.C.A.M.P.E.R uses seven rules that can be intentionally tested to get ideas: [S = Substitute], [C = Combine], [A = Adapt], [M = modify, minify or magnify], [P = Put to other uses], [E = Eliminate], [R = Reverse, Rearrange], etc., and People have to create ideas

within the space set by the S.C.A.M.P.E.R. This method can increase the flexibility of thinking from various perspectives. In the S.C.A.M.P.E.R design method, it is necessary to move each method freely, and no matter how strange idea it is necessary to think less and write down. The goal of the method is by looking at problems from various perspectives, we discover the problems and differences that people have not thought about wildly, and as much as possible, users are looking for new solutions from other perspectives. The S.C.A.M.P.E.R would be explained in Table 2.

Table 2. S.C.A.M.P.E.R method

Method explanation	Description
Substitute	focuses on what would be the part that can be replaceable or substitute.
Combine	combining the ideas, process or product into one more efficient output.
Adapt	adapting an existing idea that might not have worked before to solve a problem.
Modify	modifying an aspect of situation or problem, for example by magnifying or minifying them and see whether it gives a new insight or whether it adds any value.
Put another use	put current processes or products that were intended for a specific purpose to another use to solve the problem.
Eliminate	elimination or simplify a process or idea to get to improve it, but also to identify its most important aspect.
The reverse	reverser the orientation or direction of a process or products do things the other way around, entirely against its original purpose.

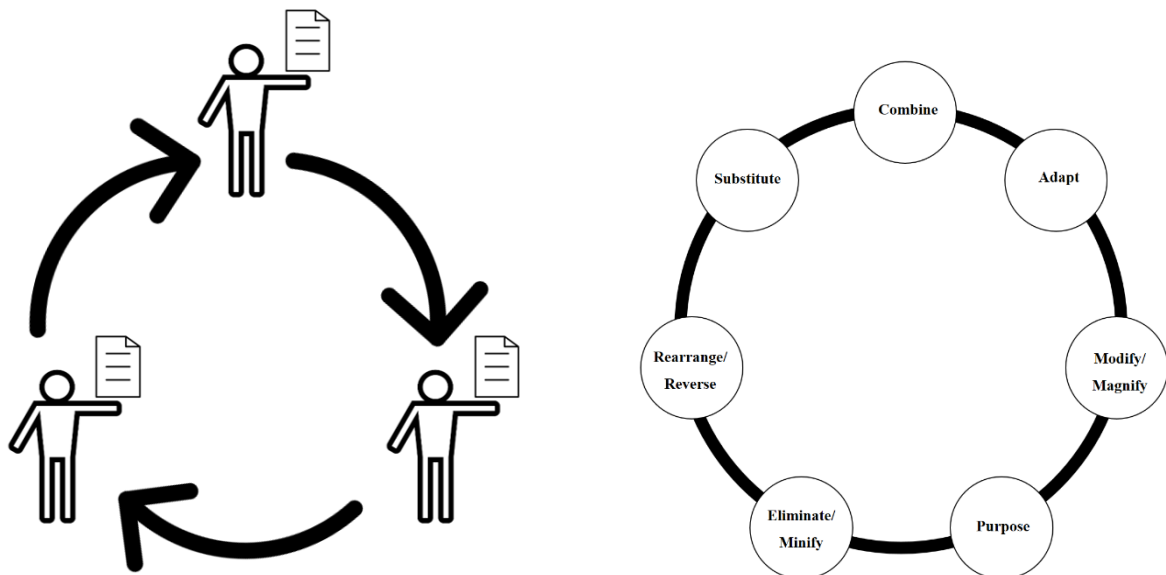


Figure 1. The working mechanisms of Brain writing method (left) and S.C.A.M.P.E.R method (right)

## 2.2 Participants

In order to confirm the difference in the design method, more than two years' design experienced students chosen to experiment design methods. They studied at the same school for one year, and their experience in design had more than two years and less than six years of experience in common. Nine participants recruited whose age ranged from twenty to thirty years old and consisted of six males and three females. Three groups

created as randomly as possible while creating a group including one female and two males in each group to minimize the influence of gender difference. For judging the creativity of ideas generated from the experiment, three professional designers who had more than 10 years of experience in design practice were recruited. They were all male and their age ranged between 40 and 50 years old.

### **2.3 Materials**

To facilitate creativity with ideas a particular design assignment was made. The medical industry has steadily grown and continuously growing field (Aghion, Jones, & Jones, 2017). As life expectancy increases, health-related products developed day by day, and their usage gets diversifying. In addition, the medical field has large studies about weak A.I. development in a medical product. (Negnevitsky, n.d.) There are many various products that designers can think about for future. Creativity may come better when there is freedom to do for the topic. Fusion of this future technology and the medical area is a field where designers can demonstrate a wide range of creativity. Therefore, it became the assignment for the experiment to generate ideas for medical equipment with artificial intelligence aiming at 2030. Based on the theme, three examples for the assignment were made to help participant better understand the concept of AI and applicable solutions to medical equipment:

- Device that helps with cancer detection (Gulshan et al., 2016)  
Usage - Estimation of cancer cells by cancer tissue sample review  
Required data – patient CT or MRI  
How data is used - comparative analysis with thousands of data classified by professional doctors.  
Development Direction - How to advise and supplement doctor's opinions
- Skin cancer diagnosis products (Esteva et al., 2017)  
Usage - 5.4 million new cases of skin cancer created every year in U.S.A, it tests to detect skin cancer early stage.  
Required data recent skin photos (hospital shot) - Image based classification  
How Data is Used-By: contrasting thousands of photographs selected by 21 certified dermatologists,  
Development direction - Provide physicians with data on whether the skin disease is malignant or benign
- Diabetic retinopathy test (Andre E., Brett K., Roberto A. N., Justin K., Susan M. Swetter, 2017)  
Usage - Examination of the retina, examination of the patient's condition  
Data Needed - Patient Retinal Photographs  
How data is used - Contrast with the data that the professional retina physicians have categorized to analyse the current patient condition.  
Development Direction - To see the status of the patient quickly and accurately to doctors.

### **2.4 Procedure**

The S.C.A.M.P.E.R method group was first invited to Home Lab and then the brain writing method group while the third group was the control group (Figure 3). And the purpose of the experiment was introduced. All three groups were given the same assignment that 'if the weak AI included healthcare product enters the home, what kind of product would it be?' An explanation of weak AI and related examples were given before they started to come up with

ideas. An hour for each team was given for generating ideas and no other resources such as internet and books were not provided except the creativity technique. There was no considerable difference in using a different place to experiment with each test from each group (Liikkanen, Hämäläinen, & Häggman, 2015). Nevertheless, trying to provide fairness to each group, with equal time and experimenting with the same space with providing the same information were provided to the participants. After the participants finished generating ideas, they individually gave full explanations of their ideas. In order to prevent experts at the phase of the evaluation of the ideas from influenced by the participant's drawing skill, a professional sketcher was invited and redrew all the ideas while idea explanation was given. Merging similar idea into one in each group, each idea sketch done by the sketcher was added in a creativity evaluation form (Figure 2) and the forms were randomly rearranged to avoid possible order effect. Then, A set of sketches was provided to the three professional designers for rating the ideas in terms of creativity. They marked on the five Likert scale for each idea.



Figure 2. Experiment scenes of each design method group: S.C.A.M.P.E.R group (left), Brain writing group (middle), and Control group (right)

### 3. Evaluation of creativity

#### 3.1. Experts

In order to evaluate creativity, three professional designers who chosen based on the design career with at least eight years of professional design experience selected, among which have experienced projects related to medical care., . The selected professional designer were designer professors hired at the university, and it considered appropriate to receive the design evaluation. In addition, chosen professors had experience of teaching creativity and had enough knowledge about it; it could give a more objective evaluation of creativity.

#### 3.2. Materials

In this study used creativity evaluation criteria provided by Christiaan (1992) to evaluate creativity by design experts. Five categories of explanatory provided with five categories were given to the three experts (Figure 3). Also, since the evaluation of the experiment may vary depending on the sketch ability, all the sketches have been resketched by hired sketch specialist. Also, providing A2 paper and tools for drawing for the experiment. From three group, the control group provided a basic white page, and printed form of S.C.A.M.P.E.R and brainstorming method provided to the experiment participants. In addition, before experimenting, they gave them three examples of weak A.I. future medical product that was actually under development, along with a definition of weak A.I.

Expert name : \_\_\_\_\_

Degree

<p><b>Idea quality</b></p> <p>Quality of idea that comes with method</p>	<input type="radio"/> — <input type="radio"/> — <input type="radio"/> — <input type="radio"/> — <input type="radio"/>
<p><b>Technical quality</b></p> <p>The extent to which a product meets the necessary technical requirements</p>	<input type="radio"/> — <input type="radio"/> — <input type="radio"/> — <input type="radio"/> — <input type="radio"/>
<p><b>attractiveness</b></p> <p>Preference for the outward form.</p>	<input type="radio"/> — <input type="radio"/> — <input type="radio"/> — <input type="radio"/> — <input type="radio"/>
<p><b>Integrating capacity</b></p> <p>The extent to which the product integrates the underlying aspects of form, function, and construction.</p>	<input type="radio"/> — <input type="radio"/> — <input type="radio"/> — <input type="radio"/> — <input type="radio"/>
<p><b>Goodness of example</b></p> <p>The extent to which the product is prototypical for its class of products. To exclude the influence of other criteria assessed, it was preferable always to begin with the prototypically criterion.</p>	<input type="radio"/> — <input type="radio"/> — <input type="radio"/> — <input type="radio"/> — <input type="radio"/>

*Figure 3. An evaluation sheet for ideas in terms of creativity*

## 4. RESULTS

### 4.1. GENERATED IDEAS

#### 4.1.1 Brain writing method group

The brain writing team created eighteen ideas. From the eighteen ideas, three for sleeping, two for toilet, one for exercise, three for beauty, three for health check, two for food, one for tooth, two for posture ideas for health care were generated (see examples in Figure 4). There were many ideas and as an example, there is an anal treatment for the bidet. It installed in a toilet like a bidet, and when people sit down, it can check their body condition automatically and perform the appropriate treatment. In addition, post-treatment records also automatically transmitted to the doctor. Other many be, Child health check stroller, exercise check wearable, etc.

In the brain writing method, the three-combined idea that may use was the health care shower booth. It helps people to be healthy while taking a shower by providing perfect shampoo and treatment to the user to have a better experience and health care at the same time.

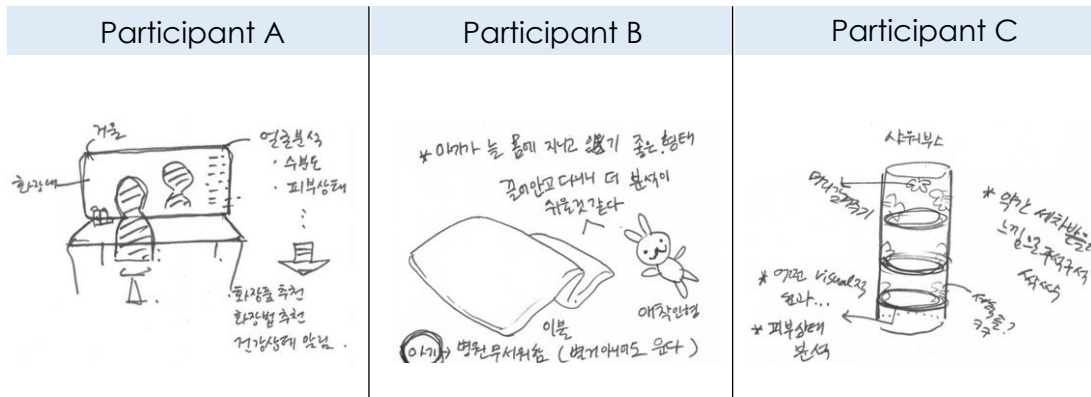


Figure 4. Ideas generated from the brain writing method group

#### 4.1.2 S.C.A.M.P.E.R. method group

Using S.C.A.M.P.E.R. team was able to create twenty-seven ideas. Of the twenty-seven ideas, two for toilet-related, two for sleep-related, twelve for health-check, two for beauty related, three for exercise-related, one for air cleaning described, three for food-related, two for posture-related ideas were created. Examples include a sofa that is detecting people's emotion and changes shape by people who is sitting on the sofa and, a robot that makes a mess to make people to moves, a product that checks the color of toilet stools and checks health (Figure 5). This group had the time to gather ideas for each task they have given. An individual method provided about eight minutes to think and proceed to the next practice. Some of the unique idea from S.C.A.M.P.E.R method can be reverse the ideas that the machine creates a mess to make people exercise. The device is not helping people. It provides a mess to develop people to the works would be one of the unique ideas that come up.

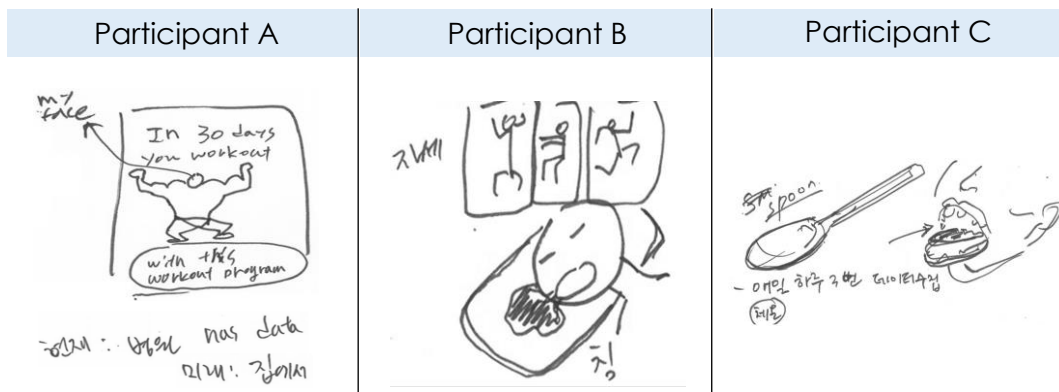


Figure 5. Ideas generated from the S.C.A.M.P.E.R method group

#### 4.1.3 Control group (no particular design method)

The last team is the center group that there are no method or rule to be followed by participants. This team has unlimited freedom to use any method or way to create. However, participants hesitate to lose the track and only thinking so much, which they could create seven ideas, total. Of the seven ideas, two for food-related, one for beauty-related, three for health check-related, one for toilet-related ideas were generated. Example of control group's idea was the food selection refrigerator (Figure 6). It uses the bid data of the location of the user, their preference, hospital data, current health state, weather, and circumstance to



define the best healthy food to the user. Participant's idea was trying to connect everything to provide the best food to the user. From this result, analysis of the data and defining the result can be possible. As a result, there was a distinctive difference from each outcome, and there would be some difference can be observed.

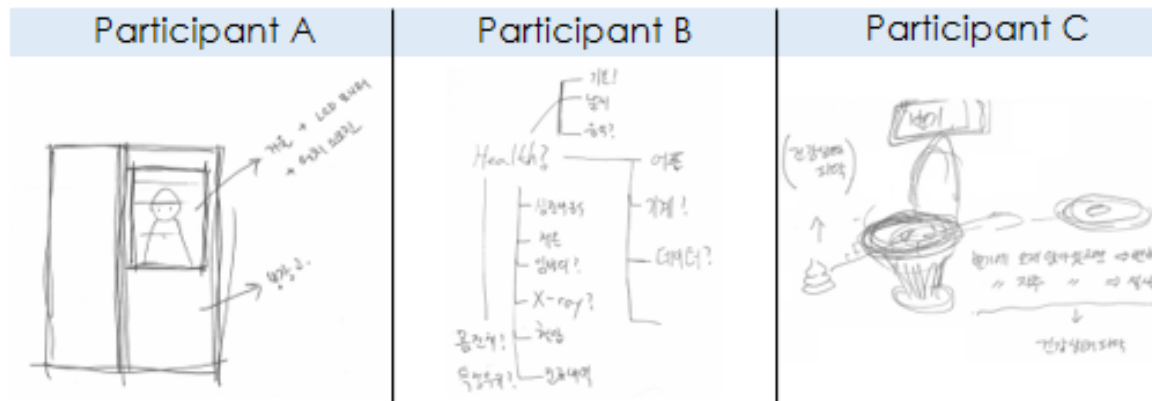


Figure 6. Ideas generated from the control method group

#### 4.2. Creativity evaluation of the ideas

After the results of the experiment, hired a professional drawer to come to the work and draw all the ideas (Figure 7). By letting one-person sketch, this sketch could rule out an evaluation based on painting ability. After that, all the sketches entrusted to the design experts and evaluated for creativity.

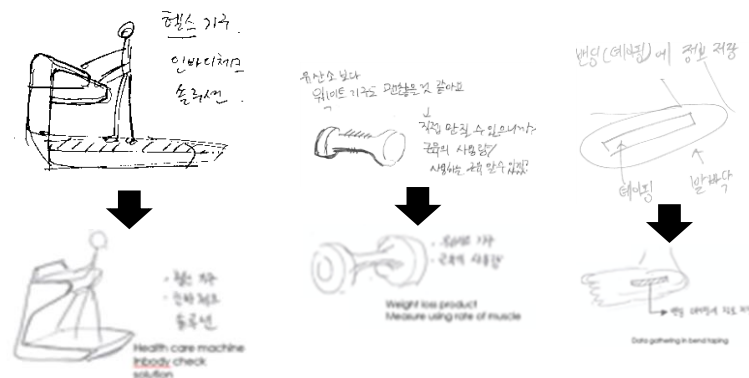


Figure 7. Examples of resketched ideas for the expert evaluation

Fifty-two ideas were created in terms of the five criteria measuring creativity. After the expert's judgement was done, the quantity of all the ideas between groups was identified and the mean value of each group was given to compare which design method has more creative ideas. In addition, the mean value of each criterion of creativity measurement within a group was given to identify what differences there are in terms of the criteria between groups. Although there is a difference in terms of the number of ideas generated from each method (18 ideas from brain writing group, 27 ideas from S.C.A.M.P.E.R group and 7 ideas from the control group, no significant difference in the creativity between groups has been discovered (Figure 8). In addition, there shows no difference between groups in terms of creativity measurement criteria (Figure 9).

In this research, compare and analyse the three designs method to discover what kind of design method has more potential to generate creative ideas. Among three-design method, S.C.A.M.P.E.R method received slightly higher figures than other methods in Technical quality. However, figure seven and eight shows that there is no huge significant difference in creativity. The grade was not able to find such a big creativity difference in the way of each design. When viewed from a qualitative point of view, the average value that appeared in the experts' evaluation shows a similar score that does not have a huge difference in each design method's creativity score.

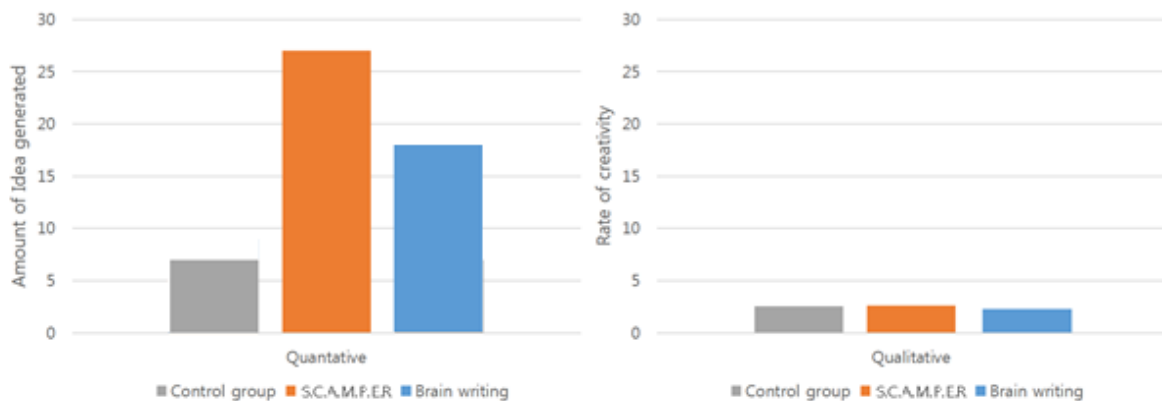


Figure 8. Comparison groups in terms of quantity (left) and creativity (right)

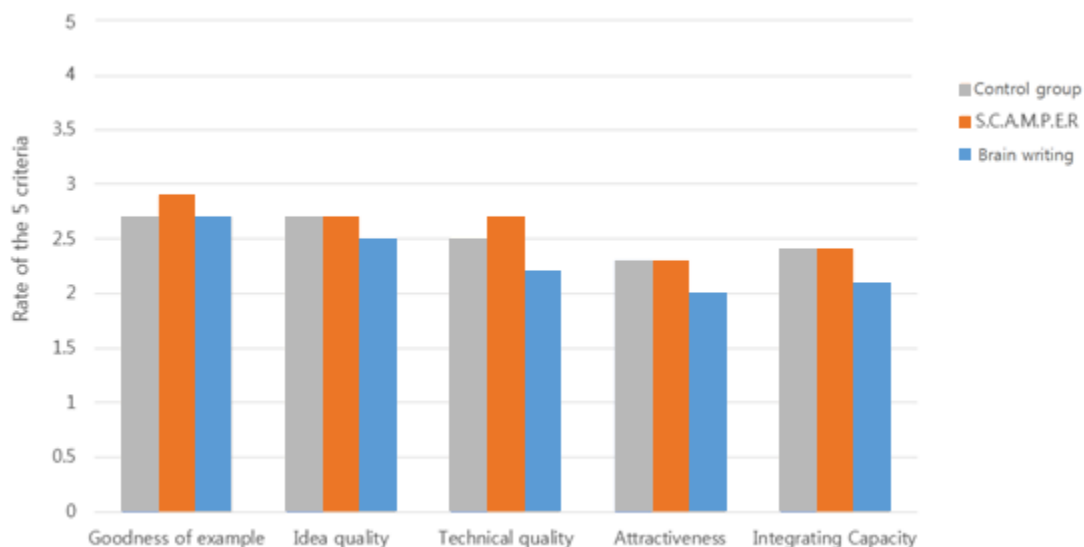


Figure 9. Comparison between groups per creativity measurement criterion

## 5. Discussion

The reason for the difference in the quantity of idea shows that each design method's limitation of how many ideas can generate can be seen. For example, in the case of 6-3-5 brain writing design method, the number of ideas with a definite number of 108 ideas generated in 30 minutes was informed. From this result, there are two key finding, which is:

First, there were similar ideas that appealed from the individual method that was the toilet. All three groups had the idea of defining their health by researching user's dung. No example nor data provided to the participants and there was common sense to each other and created a similar idea. It can point out; there would be commons knowledge that people know in a particular field would be similar.

Second, there was a different method to generate ideas. However, depending on the participant's attitude, there was a different amount of idea generated even with the format provided. Therefore, there would be some different quantitative idea may create from each different idea generation.

From this finding, extracting ideas in limited time and cost will not make a huge difference in creating creative ideas using the design method. Thus, in this study, even if various design methods extracted ideas, participants with similar experiences could extract ideas with similar creativity.

## 6. Conclusions

The purpose of this study was to discover which of the design methods could be more creative in future-oriented design. For this purpose, two design method, which is Brain writing, and S.C.A.M.P.E.R. picked and tested. The creativity of the two design methods evaluated through Christiaans(1992)'s creativity evaluation. As a result, there is not much difference in the qualitative aspect that done by the expert's judgment. In the quantitative difference, but the quantity difference in generated ideas could be different according to the method's maximum limitation of generating ideas. From the results, the creativity of different design method is similar with a single major of the designer who lives in one country. Therefore, for a company or a school to gather various people in various fields to create a creative idea would be valid.

In conclusion, though quantitatively it can be a big difference, creativity in terms of quality did not make such a big difference. This research had fundamentally based on research on future-oriented design products, and the result of a small amount of qualitative research, which is the result created by the masters and the doctor between the ages of the 20s and 30s who have the design experience for more than one years. In addition, participants studied together for more than a year in the same area and experimented with Koreans only has been selected. That is why the creativity they create can be similar. Even if their experiences have the difference, experiences in similar places may cause them to draw inspiration from a similar aspect. Further research needs to gather people from various backgrounds, and conduct research would provide different results. Also, result from the professional designers who know the did future medical design and other different major would be different. For a more reliable research result, it is necessary to experiment with other design methods or different professional design judger to get the more reliable result to find a way of increasing the quality of creativity. Further studies are need.

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