

Creative Education in Upper Elementary School Class to Improve Attitudes Toward the Use of Concepts in Idea Generation

Tomonori OZAWA¹ and Takaya YUIZONO²

Abstract—This study aims to help 10 to 12-year-olds understand that the quality of their ideas can be improved using concepts, which is clearly shown when they generate ideas and develop their attitude toward using the concepts in the future. Here, concepts are words that are more abstract than the final ideas and that have a function to direct new ideas. As a method to improve students' attitudes toward the use of concepts, the authors showed the concepts in the idea generation process. To improve the attitude toward the use of concepts, the author developed a Look-Like Chart, which is a tool that incorporates the use of concepts in the idea generation process. To evaluate whether the students were able to develop an attitude toward their use, The authors compared the differences between the two groups: the "Shown Concepts" group and the "Not-Shown Concepts" group. A Mind Map was used for the tool that did not show concepts. The results revealed that their attitude toward using concepts was improved.

Index Terms—Creative Education, Concepts, Motivation, Idea generation, Look-Like Chart

I. INTRODUCTION

Currently, the importance of developing ideas to solve problems is being emphasized in society [1]. In addition, educational content is often influenced by the social context of the times [2]. From this viewpoint, creativity education that encourages idea generation should be systematically provided during the compulsory education stage. However, there is not enough education for this [3].

With regard to supporting idea generation, Amabile states that it is important to "find relationships between information" [4]. Finke et al. present the idea of "Conceptual Combination" [5]. In addition, Ishii et al. propose the "Value Graph" [6], which extracts other ways from an abstract word (higher purpose) after raising the level of abstraction from a lower concrete word (original ways). Furthermore, Erickson proposes a way to utilize "Concepts" [3], which are universal and abstract words derived from multiple facts. They all capture the relationship between the target information and utilize the concepts for that purpose. However, Finke takes some concepts of the features of the subject and combines them, and the value graph raises and lowers the level of abstraction in the relationship between purposes and ways. Furthermore, Erickson aims to transfer existing knowledge in subject learning and does not mention its use as a tool for idea generation.

Therefore, this study seeks to help elementary school students understand that when creating new ideas, the quality of the ideas can be improved by using "Shown Concepts" that are more abstract than the final ideas and also understand that these direct new ideas. Students develop their attitude toward using concepts in the future. For this purpose, the authors developed and used a Look-Like Chart, which is a tool that visualizes concepts and has the function of creating new concrete words from concepts. To compare

the "Shown Concepts" method with the "Not-Shown Concepts" method, the authors used a Mind Map, which is widely used [7]. The authors modified the Mind Map to ensure it was appropriate to the age of the students. The Mind Map which the authors refer to in this study means modified Mind Map.

In this way, the authors prepared opportunities for idea generation by "Shown" and "Not-Shown" concepts and investigated the influence of concepts.

The rest of this paper is organized as follows. Related Knowledge including the components of creativity are discussed in section 2. The proposed method is outlined in section 3. Our experiment and results are discussed in sections 4 and 5, respectively. The authors provide a discussion in section 6. Finally, concluding remarks are provided in section 7.

II. RELATED KNOWLEDGE

A. Components of creativity

Regarding the process of idea creation, Amabile states that it is important to "find relationships between information" [4]. However, they do not mention these specific measures. The author also argues that "motivation is the key element," with particular emphasis on "intrinsic motivation" [8-9]. This practice also focuses on the intrinsic motivation for the use of concepts.

B. Concepts and abstraction

To create new ideas, Finke refers to "Conceptual Combination" [5], in which the object is first broken down into its elements, then some are extracted and combined with other parts. However, the author does not discuss idea generation by synthesizing the whole of the objects. In addition, Ishii proposes the "Value Graph" [6], which is a tool for clarifying objectives by abstracting ways, and then creating new concrete ways from the objectives. But the object of raising and lowering the level of abstraction is about purpose and ways, and other uses are not mentioned.

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Furthermore, Erickson states that “Concepts” [3], which is an abstraction of “Facts,” can be made explicit and used to transfer to another context. But the author did not mention the use of the idea generation. “Concept is a polysemous word” [10]. For example, “an abstraction of the common characteristics of things and events included in a category” [11]. In this study, concepts are considered “highly abstract words that lead to concrete ideas.”

C. Creativity education in elementary schools

In school education in the United States, “brainstorming is often used in elementary schools” [12] as a creative educational activity and in Finland, “creativity education is demonstrated in entrepreneurship education, which includes the ability to generate ideas” [13]. However, these studies do not focus on methods of thinking for creating ideas. Furthermore, the International Baccalaureate (IB), a global learning program, uses the “Concepts” proposed by Erickson to utilize previously learned knowledge [14-16]. However, they are not always used for idea generation.

III. PROPOSED METHOD: LOOK-LIKE CHART

The authors created the Look-Like Chart (Fig. 1) as an educational tool based on the method used by Mizuno as a cue for idea generation in the actual business context. According to Mizuno [17], “Look-Like categorization is a method of getting closer to the essence of a target product or service by considering what it is like to have it existing.” Specifically, it is a method of extracting the characteristics of an object by associating it with “what color it is, what animal it is, what country it is, where it is, who it is, and when it is. There are infinite variations of the Look-Like classification” [17]. Based on this, the Look-Like Chart created in this study is a tool which has the process to generate ideas step by step from Question (A) to New ideas (D) in Fig. 1. And then, this chart is designed to make the concepts conscious by placing and making explicit the concepts word at stage (C), one step before the new ideas (D).

Fig. 2. Look-Like Chart

IV. EXPERIMENT

A. Objectives

The purpose of this study is to investigate whether there will be a change in the attitude of students toward using concepts in idea generation by showing and making conscious the concepts.

B. Methods

To confirm objectives, students generate ideas using both “Shown Concepts” in the Look-Like Chart and “Not-Shown Concepts” in the Mind Map.

Along with brainstorming, a Mind Map is a well-known free-association method that is used in a wide range of settings [7]. Essentially, a Mind Map is created visually using not only words but also colors and diagrams. However, considering the technical limitations of expression due to the developmental stage of the children, a simplified version of the Mind Map is created using only lines of one color and associated letters to encourage ideas. In the following, the authors refer to the modified version as a Mind Map.

The participants are two classes of 5th graders (10–11 years old) and two classes of 6th graders (11–12 years old) from one public elementary school in Yokohama, Japan. The authors implemented this practice with permission from the principal and parents. It is assumed that there is no difference in academic achievement between classes within the same grade. The reason is that teachers take care to ensure equal academic performance between classes when they organize new classes. Among the students, those who participate in all the sessions are considered for the evaluation. The authors also assume that there is a difference in thinking ability between 5th and 6th graders because the authors consider them based on their learning experience.

Regarding Look-Like Chart, this is the first time for students to use it. In addition, the authors prepare two types of questions (A and B). The authors consider that the level in Types A and B should be mostly equal. The reason for these conditions is to avoid any learning effects in the second

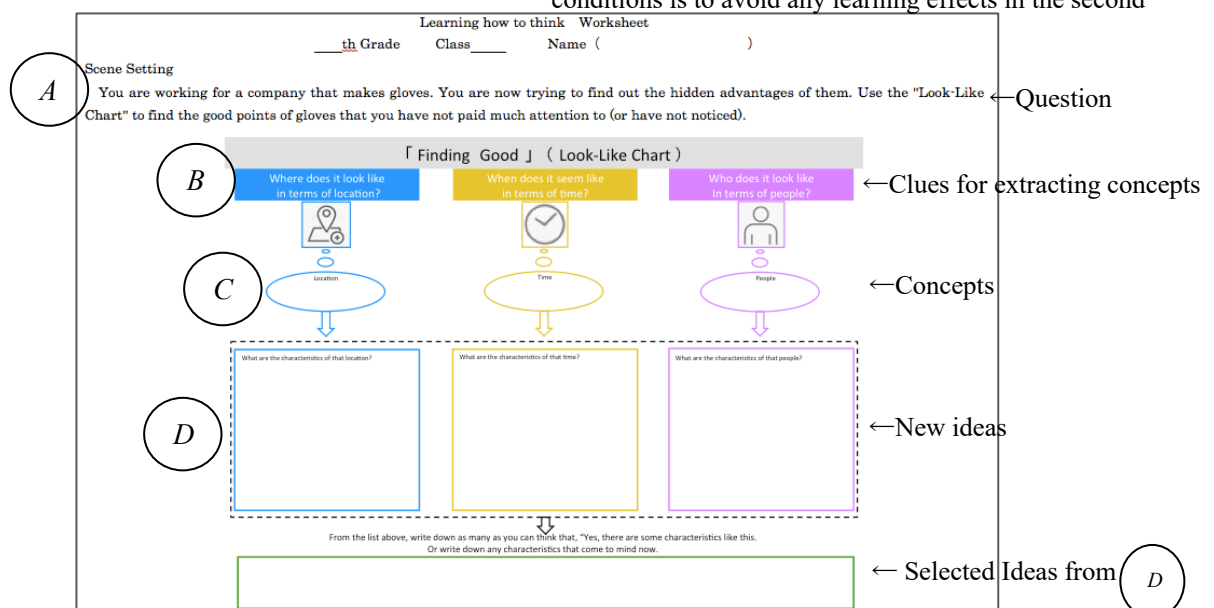


TABLE I
PRACTICE SCHEDULE

Grade, Class	1st class	2nd class	Post-event
Questionnaire	45 min.	45 min.	15 min.
6th Grade, Class 1 n=27	Shown Question A 3/8	Not-Shown Question B 3/11	3/11
6th Grade, Class 2 n=25	Not-Shown Question B 3/8	Shown Question A 3/9	3/11
5th Grade, Class 1 n=30	Shown Question B 3/9	Not-Shown Question A 3/11	3/11
5th Grade, Class 2 n=25	Not-Shown Question A 3/9	Shown Question B 3/10	3/16

Note: 3/8 = 2021 March 8th

Fig. 3. How to use the Mind Map

experiment. To compare the “Shown” and “Not-Shown,” the authors consider the counterbalance of the following factors: 1) Difference of the order between “Shown” and “Not-Shown.” 2) Difference between difficulty of the question. 3) Difference in grades. The authors therefore consider these effects to be counterbalanced and compared the overall results between the “Shown” and “Not-Shown” groups.

The flow of an idea generation class (1 unit class: 45 min) is as follows.

Look-Like Chart: (Fig. 2)

1st : Students listened to the teacher’s explanation and confirmed the procedure.

2nd: 1 minute for each part (a).

3rd: 3 minutes for each part (b).

4th: 7 minutes for the part (c).

Learning how to think Worksheet

____th Grade Class ____ Name (____)

Scene Setting
You are working for a company that makes gloves. You are now trying to find out the hidden advantages of them. Use the “Look-Like Chart” to find the good points of gloves that you have not paid much attention to (or have not noticed).

「Finding Good」 (Look-Like Chart)

Where does it look like in terms of location? (a) Location

When does it seem like in terms of time? (b) Time

Who does it look like in terms of people? (c) People

What are the characteristics of that location? (b)

What are the characteristics of that time? (b)

What are the characteristics of that people? (b)

From the list above, write down as many as you can think that, “Yes, there are some characteristics like this. Or write down any characteristics that come to mind now.” (c)

Fig. 2. How to use the Look-Like Chart

Learning how to think Worksheet

____th Grade Class ____ Name (____)

Scene Setting
You are working for a company that makes hand gloves. You are now trying to find out the hidden advantages of them. Use the “Mind Map” to find the good points of gloves that you have not paid much attention to (or have not noticed).

「Finding good」 (Mind Map modified version)

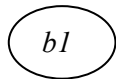
First, let's list some of the characteristics of “_____”.

Electronic Dictionaries

(b1)

(c1)

From the list above, write down as many as you can think that, “Yes, there are some characteristics like this. Or write down any characteristics that come to mind now.”



Mind Map: (Fig. 3)

- 1st: 9 minutes for part (b1), which is the total time for the three parts of (b) in the Look-Like Chart.
- 2nd: 7 minutes for (c1).

In addition, the space on the worksheet for parts (c) and (c1) were the same size. This was to prevent the quality of ideas from being affected by the size of the space. Furthermore, to eliminate the influence of others, the class was conducted individually.

Since this is an action research project conducted by the first author as a primary school teacher in the class, the following considerations are taken into account.

- During the practice period, the authors do not evaluate the ideas or other aspects of this practice, either inside or outside the class.
- The authors ensure that the wording of the teacher's explanation, the procedure and time allocation, the materials, and the worksheets are the same for all classes.

C. Evaluation method

A questionnaire survey is used to evaluate the experimental objective. The item is self-assessment in a single-response format using a 4-point scale and a free-text section. The wording of all questionnaire items is designed to be understandable to the students. The reason for the self-assessment is that the idea generation practice is based on the "mini-c," which is "making new interpretations of experiences, activities, and events that are personally meaningful" [18]. In addition, all post-questionnaires are completed within a week of the second class. This was done to prevent the memory of the feeling of use from becoming vague. Moreover, to make it easier to compare the results of the first and second practices, the students keep two worksheets at hand for comparison.

First, the authors confirm whether the students understand and can use the Look-Like Chart and the Mind Map.

Understandability:

Understandability is evaluated on a 4-point scale according to whether the students understand how to use the tools.

Usability:

Usability is evaluated on a 4-point scale based on whether the students are able to use the tools.

Next, the quality of the ideas is compared to see if there is a difference in the ideas generated by the different tools, Look-Like Chart and Mind Map. To measure the quality of ideas, the authors use "Fluency, Flexibility, and Originality," which are common factors in Guilford's results [19].

Fluency:

Fluency is assessed by evaluating the ease with which the

ideas were conceived.

Flexibility:

Flexibility is assessed by evaluating whether participants were able to generate ideas from multiple perspectives.

Originality:

Originality is assessed by evaluating whether the participants are able to generate ideas that are not duplicated. In particular, the judgment of each is used to determine the degree of non-duplication (non-similarity).

After confirming these, the authors check for changes in the students' attitudes toward the use of concepts.

Use-Orientation of Concepts:

Use-Orientation is assessed by evaluating whether the participants are thinking about the use of the concepts in their idea generation in the future.

All evaluation method is based on a 4-point scale, and the results are used as the evaluation values. "The four-point scale of the questionnaire was regarded as an interval scale," with four points for a high evaluation and one point for a low evaluation.

V. RESULTS

First, the authors checked whether the children understood and were able to use the Look-Like Chart and the Mind Map, and the results are shown in Table II.

From Table II, it can be seen that more than 90% of the respondents gave rating values of 4 and 3 for both understandability and usability. This indicates that the students were able to understand and use both educational tools. Therefore, the authors confirm the effectiveness of "Shown" and "Not-Shown" concepts.

TABLE II
RESULTS OF UNDERSTANDABILITY AND USABILITY
[NUMBER (PERCENTAGE)]

N=107	4	3	2	1
<i>Look-LikeChart</i>				
Understandability	70 (65%)	33 (31%)	4 (4%)	0 (0%)
Usability	54 (50%)	44 (41%)	9 (8%)	0 (0%)
<i>Mind Map</i>				
Understandability	71 (66%)	35 (33%)	1 (1%)	0 (0%)
Usability	61 (57%)	35 (33%)	10 (9%)	1 (1%)

TABLE III
EVALUATION OF FLUENCY, FLEXIBILITY, AND ORIGINALITY
[NUMBER (PERCENTAGE)]

N=107	4	3	2	1
<i>Look-Like Chart (Shown)</i>				
Fluency	47 (44%)	47 (44%)	13 (12%)	0 (0%)
Flexibility	39 (36%)	45 (42%)	23 (21%)	0 (0%)
Originality	43 (40%)	43 (40%)	20 (19%)	1 (1%)

<i>Mind Map (Not-Shown)</i>				
Fluency	45 (42%)	40 (37%)	17 (16%)	5 (5%)
Flexibility	44 (41%)	48 (45%)	13 (12%)	2 (2%)
Originality	32 (30%)	57 (53%)	16 (15%)	2 (2%)

TABLE IV
EVALUATION OF FLUENCY, FLEXIBILITY, AND ORIGINALITY

N=107	<i>Look-Like Chart (Shown)</i>		<i>Mind Map (Not-Shown)</i>		p-value	effect size
	M	S.D.	M	S.D.		
Fluency	3.31	0.678	3.16	0.859	0.127	0.19
Flexibility	3.25	0.746	3.14	0.737	0.255	0.15
Originality	3.19	0.766	3.11	0.714	0.258	0.11

$p<.01$ (Paired t-test) effect size $d=0.2$ (small effect)

Next, the authors compared the quality of the ideas between the Look-Like Chart and the Mind Map in order to confirm the effect of the different tools on idea generation.

According to Table III, the sum of the evaluation values of 4 and 3 for all items in both the Look-Like Chart and the Mind Map is about 80%. In addition, a corresponding paired t-test (two-sided test) was conducted to compare how much the effectiveness of the former differed from that of the latter. The authors also measured the effect size, which is less affected by the sample size. The effect size is calculated using the following formula [20].

$$d = \frac{\text{Mean of the experimental group} - \text{Mean of control group}}{\sqrt{\frac{\text{Standard deviation of experimental group}^2 + \text{Standard deviation of control group}^2}{2}}}$$

According to Table IV, Fluency was $p=.127$ ($d=.19$), Flexibility was $p=.255$ ($r=.15$), and Originality was $p=.258$ ($d=.11$) ($p<.01$ (two-sided) Effect size $d=0.2$ small effect). This result indicates that there is no significant difference in the effectiveness between “Look-Like Chart (Shown)” and “the Mind Map (Not-Shown).” In other words, This can indicate that and have almost the same quality in idea generation.

With these results, the authors will continue to examine the effects without considering the effects of the tools.

Next, the authors examine the use-orientation of the concepts. A paired t-test (two-sided) was conducted to compare whether the participants were aware of using concepts as a way to find features that they were not previously aware of, and whether they intended to use the tools in the future.

From Table V, we can see the results, $p=.000$ ($d=1.31$). ($p<.01$ (two-sided) Effect size $d=0.5$ large effect) This indicates that the Look-Like Chart have changed the students’ attitudes toward using concepts.

TABLE V
“SHOWN” AND “NOT-SHOWN” FOR USE-ORIENTATION

N=107	M	S.D.	d.f.	p-value	effect size
<i>Shown</i>	3.54	0.618	106	0.00	1.31
<i>Not-Shown</i>	2.52	0.914			

$p<.01$ (Paired t-test) effect size $r=0.5$ (large effect)

VI. DISCUSSION

A. Changes in students’ attitudes toward the use of concepts

First, to determine whether there was a change in the students’ attitude toward the use of concepts in the idea generation scene, the description in the free-text section indicated “I have not been conscious of using concepts, but from now on, I will use concepts. The reason for this was that the students were able to recognize the effectiveness of concepts in their idea generation.

B. Students’ perceptions of effectiveness regarding the use of concepts

When concepts were used in idea generation, about 80% of the students gave a high rating of 4 or 3 in fluency, flexibility, and originality. Regarding fluency, the description in the free-text section said that “By using concepts, I can narrow down the range and find the characteristics of the subject.” The reason for this is the concepts played a role in determining the direction of divergence. Regarding flexibility, the description in the free-text section said that “I realized that there are connections even where there seems to be no connection at all.” This indicates that the participants were able to identify a wide range of features of the subject that they had not noticed before. Regarding originality, the description in the free-text section said that “I was able to relate to something else.” “I noticed features that I could not find by myself.” This indicates that the participants were able to connect the subject that was presented firstly with something beyond what they had previously noticed by increasing the conceptual distance.

VII. CONCLUSION

The authors confirmed whether 10 to 12-year-olds understand that the quality of their ideas can be improved when they use concepts and whether they develop their attitude toward using these in the future. Results indicated the students were aware of the usefulness of using concepts to generate ideas about features that they were not aware of before. In addition, the students were motivated to use these concepts in the future.

The authors will research which triggers teachers should present for students to find the concepts. If the conceptual distance is too close or too far, it is difficult to generate new ideas. By solving these problems, the use of concepts by students will be promoted in the future.

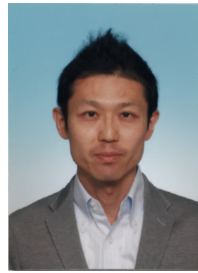
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