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# Domain-Specificity of Creativity and School Education

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## [Abstract]

In this article, the concept of “domain-specific /domain-general” in creativity and its proof data of them are introduced. Baer found the facts that creativity is "domain-specific", rather than “domain-general”, and sometime it is "task-specific". During these 30 years, he conducted a series of studies for examining the nature of creativity. Yumino propose and argue a unique way of creativity education in several school subjects, basing on the concept of “domain-specific/ task specific”.

Learning is consisted of two phases, “Acquisition: *Manabi* in Japanese” and “Creation: *Tsukuri*”. Yumino differentiates the two strictly, and concludes “creativity” belong to “*Tsukuri*”. The characteristics of *Manabi* and *Tsukuri* are summarized. In order to realize *Tsukuri* in a certain subject, it is necessary to make clear the key points for realizing *Tsukuri*. Here, the key points of *Tsukuri* in 4-kinds of subjects are proposed.

**Key words:** domain-specific, task-specific, creativity, Tsukuri(Creation), Manabi( Acquisition), fostering creativity in Math, Science, Social Studies, Japanese Language

## 1. Who evaluates creativity?

People create many products in a variety of domains. Who evaluates creativity of these products? And then, who assesses the creative potential of man who shows some creative performance? In a certain case, it is an expert who works in a specific domain. In other cases, it is creativity measuring tests.

### (1) Evaluation of creativity in real world

By making the Nobel Prize into the peak, there are a lot of prizes for the creatures in engineering, invention, construction, physics, computer science, mathematics, biology, life science, music, fine arts, literature, and other various domains.

These prizes are given to outstanding products in certain fields or domains. The specialists in the fields and domains judge the quality of the products. It is ordinal that creativity of the high level in real society is accessed by a small number of "specialists". Not a very first rank, but superior products appear in science, researches, arts, life, activities, and jobs, etc are accessed by academic circle members, teachers, people near him, and the fellow workers.

In that case, a judgment to the product of an evaluator who is well acquainted with the domain may probably be quite exact. On the contrary, an ordinary person's judgment may be greatly influenced by the liking and impression to the product. That means the reliability of such evaluation is low.

## **(2) Evaluation by creativity test**

Torrance Test of Creative Thinking (TTCT) is often used for evaluating creativity. It remained a doubt whether this kind of test that based on measurement of divergent thinking can measure "genuine creativity". That is, whether the creativity evaluated by this kind of paper-pencil test can predict the creativity of the actual scene which exists everywhere in many domains. Furthermore, does any general creativity or creative skills that are applicable to all domains exist? Unfortunately there are few data in supporting of this prediction.

## **(3) Evaluation by "Consensual Assessment Technique: CAT"**

Amabile (1996, p.33) who is a proposer of CAT, defined creativity as follows: "A product or response is creative to the extent that appropriate observers independently agree it is creative. Appropriate observers are those familiar with the domain in which the product was created or the response articulated. Thus, creativity can be regarded as the quality of products or responses judged to be creative by appropriate observers, and it can be regarded as the process by which something so judged is produced."

In CAT, creativity is evaluated by several experts and semi-experts. The experimenter does not show any standard about creativity to raters. And asks them merely to rate "creativity of the work" subjectively. Therefore, creativity measured by CAT does not evaluate a creation process, but evaluates an outcome of a creation.

## **2. Why does it need researches concerning domain-specific and its argument to creativity?**

### **(1) What does it mean domain-specific/domain-general of creativity?**

The "domain-general" of creativity means that a person having high creativity can produce superior products in all domains. Furthermore, it also means that there

are special knowledge and cognitive skills that are applicable to the production of all domains.

The “domain-specific” of creativity means that high creativity of a certain person is limited to a particular domain. That is, a person who can show a high creativity in a domain is not always shows high quality of creativity in other domains. In other words, there is no knowledge and cognitive skills that are applicable commonly to all domains or many domains.

## **(2)The abuse of the social belief that creativity is domain-general**

When we say “a person with high *intelligence*”, we imagine a person who can behave not only a domain but also many domains smartly. Concerning *creativity*, we have same kind of image.

People often refer to a certain person as “creative” without specifying particular area, domain or limitations to one’s creativity. The implicit assumption is that a creative person has some kinds of skills, aptitudes, traits, propensities, and motivations that lead themselves to creative performance in whatever activities one undertakes (Baer, 2010, p.322).

Feist added more: “It is a very appealing, and ultimately firmly American, notion that a creative person could be creative in any domain he or she chose. All the person would have to do would be to decide where to apply her or his talents and efforts, practice or train a lot, and voila, you have creative achievement. On the view, talent trumps domain and it really is somewhat arbitrary in which domain the creative achievement is expressed. Indeed, we often refer to people as “creative” not as “a creative artist” or “creative biologist” (Feist, 2004, p57).

In the area of education, science, arts, and business world of Japan, the word “creativity” is used frequently. The indication of Feist fits completely Japanese people who have little opportunity to learn strictly what creativity means. Whenever we discuss creativity education and talent development, it is necessary for us to recall indication of Feist.

## **(3) What kinds of domains or what kinds of fields are involved in creativity?**

In order to push forward an argument of the domain-specific or domain-general, it is necessary to know what kinds of domains or what kinds of fields are involved in creativity beforehand. So far, concerning this points, there are a few investigations to prove it.

Recently, Kaufman (2012) conducted a study that aimed at deciding main domains in creativity. Standing on past studies, he performed a factor analysis of data that was obtained“94 self report questions”. He proposed the following domains:” 1.self / daily

"," 2.academic "," 3.results (include composition and music) ","4.mechanical/scientific "," 5.artistic". Unfortunately, a new concept of the domain proposed by Kaufman does not get the agreement of many researchers.

### **3. The studies that insist domain-specificity of creativity**

John Baer performed many studies to examine domain specialty of creativity so far (Baer, 1991, 1994, 1996, 1998, 2010). Baer's research (1991) is summarized as follows.

#### **(1)Abstract of Baer's research (1991)**

The existence of general creative-thinking skills was investigated. In the first study, 50 eighth grade students wrote poems, stories, mathematical equations, and mathematical word problems, all of which were rated for creativity by experts. When the effects of IQ, reading achievement, and math achievement were controlled through multiple regression analyses; creativity score on the four tasks were not correlated. This suggests that general creative-thinking skills did not contribute to creative performance in these different tasks. Subjects also responded to a brief verbal fluency test. Scores on this test correlated significantly with story-writing creativity( $r=.34$ ) but not with the other three tasks. Three follow-up studies were conducted with second-, fourth-, and fifth-grade students, and adults. These studies also produced no significant correlations among creativity rating of various products.

#### **(2)Is creativity domain-specific or domain-general?**

As stated above, Baer (1991) measured creativity of the children about a. poems, b. stories, c. mathematical equations, d. mathematical word problems. He found that no meaningful partial correlations were observed among four tests. Basing on these results, he concluded that creative thinking skills contributing to the performance of one domain were not domain-general but domain-specific. Furthermore, he found that the creative thinking skills was not function in the same way even if two problems belong to the same domain because of the correlations between two tests in each domain were both low. The creative thinking skills, even if the plural tasks in the same domain, was not generally function effectively.

Baer found out a fact that creative thinking skills worked as "task-specific".

**The discovery by Baer includes an important suggestion that teachers and trainers who are designing creativity education and creativity development program cannot overlook it.**

#### **4. Is divergent-thinking training domain-specific or domain-general?**

### **(1) Abstract of Baer's research (1994)**

Twenty-one second-grade subjects received divergent-thinking training and 20 matched subjects received training in solving mathematical word problems. All subjects were then given five tasks: 1. telling stories, 2. writing stories, 3. writing poems, 4. writing mathematical word problems, and 5. making collages. Experts evaluated the creativity of each product. The divergent-thinking groups scored significantly higher than controls on the story-telling, story-writing, and poetry-writing tasks. The lack of correlations among scores on the five tasks, however, suggests that several task-specific factors, rather than one general factor, led to observed group differences. This is consistent with previous research using subjects untrained in divergent thinking in showing that divergent thinking is not a general trait.

### **(2) Divergent-thinking training acts as domain-specific**

In above research, the training group got high scores in creativity for 1. telling-stories, 2. writing-stories, 3. writing poems than that of the control group. On the other hand, there were no differences in 4. writing mathematical word problems, and 5. making collages. These results show that the divergent thinking training acts as domain-specific.

These results seem to prove that the divergent-thinking training used here was only factor that improve the three performances in language domain. However, it remains a doubt whether the divergent-thinking training is an only factor of the increase of creativity in language domain. In order to make sure this point, it needs to calculate the partial correlations among five factors.

### **(3) The divergent thinking training is not almighty**

In fostering and developing program of creativity, divergent thinking training is a most important tool. When performances are improved using this tool, we liable to conclude that the divergent thinking training was effective. Scarcely consider other factors that leading to the improvement of performances. Concerning above 1-, 2- and 3-task, the performances were improved. Are the improvements of these performances common to all students? If it is true, the correlations among three tasks must become higher.

In order to confirm this point, Baer calculated partial-correlations among three tasks. As results, all coefficients scattered near zero. These results mean that the increase of three scores in the same language domain were not common to most of students. In other words, the increase of three scores cannot be explained by only a divergent thinking training factor. As Baer guessed, other factors may explain the

increase of these scores.

**Standing on the viewpoint of task-specific, the teachers and trainers who are designing creativity education and creativity development program are should to search a variety of effective contents and training methods to run.**

## **5. Domain-specificity and task-specificity of creativity and school education**

School education has many subjects. What kind of relation exists between a subject and a domain? It may be meaningless to ask the relation of the subject and the domain until the domains in creativity are confirmed. A certain thing is that a subject has several content areas. For example, mathematics has geometry, algebra, statics, etc.; science has physics, chemistry, biology, earth and astronomy, etc. Through learning in each subject, students acquire new knowledge in every lesson. In addition, they develop many skills to conduct an experiment, inspection, and expression.

If we admitted the thinking skills in creativity are domain-specific and task-specific, how could we develop creativity in school education? **The author want to propose an effective plan for fostering creativity in school while reconfirming the conclusion obtained from a series of Baer's study.**

## **6. How could we develop creativity of each subject?**

Each subject is comprised of "unit contents". A bunch of unit contents can be regarded as "a task" that Baer is saying. We can select carefully the suitable unit contents for advancing creation (**Tsukuri** in Japanese). After selected suitable **Tsukuri** that are attainable through the unit contents, several lessons aimed at creativity development are conducted, by using some creativity improvement techniques that are particular to each subject and the divergent thinking training. By increasing opportunities of **Tsukuri**, we can expect to develop the students' creativity.

## **7. Learning, Acquisition (Manabi) and Creation (Tsukuri) in creativity education**

When we plan creativity education in a Japanese school, it's necessary to make a sharp distinction between acquisition (Manabi) and creation (Tsukuri) in learning. As long as Manabi and Tsukuri are being vague, creativity education does not succeed at all. Here, let the differences between Manabi and Tsukuri make clear.

## (1) Manabi and Tsukuri in Learning

The students learn a lot of things in the school, home, local area, books, the TV, Internet, etc. This kind of “learning” has 2 phases, “acquisition of knowledge” and “creation of knowledge”. Most of Asian countries, for example China, Korea, Japan, weigh on the former. On the contrary, advanced American and European countries weigh on both phases.

“Creation (Tsukuri)” is a new concept that the author advocates recently. Creation (Tsukuri) is a consecutive process to make/produce something new and valuable. In such reason, it can be executed not only art, music and craft, but also most of subjects, including extra-curricular activity and comprehensive learning.

## (2) The characteristics of Manabi and Tsukuri

"Manabi" is emphasized in the education of Japan. The etymology of Manabi is “I imitate it”. So, Manabi needs models and examples to imitate for. These are usually contents of textbooks, theories, skills, behaviors and values of the teachers.

Standing on the premise that knowledge, skills, and behaviors are completely “right”, the student learn them earnestly. On the surface, while the students’ attitude of Manabi is seems to very modest, but the learned contents have serious defects actually. The responsibility whether the acquired knowledge, skills, behaviors through lessons are right or not, are not belong to the student side but to the model or teacher side. In such reason, the students can avoid responsibility of acquired contents.

The students are enough just to understand and memorize exactly the model and example, and recall it when it needed. This is a reason why an active interaction and responsibility of "the self" to acquisition are low. The author wants to draw a sharp line between Manabi and Tsukuri in learning. Distinguished them strictly, the characteristics of the two are summarized in Table 9.1. Let's explain the contents of the list sequentially.

**Table 7.1.** The characteristics of Acquisition (Manabi) and Creation (Tsukuri).  
(Yumino, K., 2012)

	Learning	
	Acquisition (Manabi)	Creation (Tsukuri)
1. Creation of new study and new technology	not Contain	Contain
2. Efficiency of the learning	High	Low
3. The true/false of the		



teaching materials	Always true	judgment is necessary
4. Scope of knowledge	Narrow	Wide
5. Forget the knowledge	Easy	Hard
6. Responsibility for the learning	Low	Moderate High
7. Confidence for the knowledge	Low	High
8. Self involvement	Low	High
9. Need of the argument	Nothing	Needed
10. Knowledge for the argument	Little	Plenty
11. Expanding creativity	Little expected	Fully expected
12. Range of the thought	Narrow	Wide
13. Setting of the hypothesis	Sometime needed	Often needed
14. Verifying hypothesis	Old type	New type
15. Level of the reasoning	Low	High
16. Atmosphere of the meeting	Serious	Free and relaxed

### **(3)The relationship between Creation (Tsukuri) and Creativity**

Learning includes Acquisition (Manabi) and Creation (Tsukuri). Creativity is expected to develop in the process during the learners are enthusiastic to produce a new, advanced product, or in searching for the expression just fitted to “the self”. Creativity is realized while we push Tsukuri forward for asking a better thing. So, creativity is included in Tsukuri, not in Manabi.

### **(4)Fostering creativity by increasing opportunities to create (Tsukuri)**

As stated in detail so far, creativity exists in Tsukuri, far beyond Manabi. In such reason, we could develop creativity by increasing opportunities to Tsukuri, not aimed at directly fostering creativity. It is very difficult to use a special program to expand creativity in the ordinary Japanese schools, which have uniformed- and whole-class-lesson mainly. Because, the contents and each grade curriculum are restricted by “**the curriculum guidelines**” that is presented by the authority. Furthermore, the teachers have little chance to use teaching materials freely.

In acquiring the contents of a textbook in each subject, the students can have many opportunities to create (Tsukuri), and can complete many products. In all of the products of each student, most superior one is “the creative product” for the student. In this way, it seems like to realize creativity education suitable for the Japanese schools, by carrying out continually the teachings that aiming at creation (Tsukuri).

## **8. Fostering creativity in realizing the creation (Tsukuri)**

In order to realize the creation (Tsukuri) using a certain content of the textbook, it is necessary to make clear the important points for realizing the creation. Shizuoka Creativity Research Group has been asking for the suitable teaching methods and procedures to achieve the creation (Tsukuri) for several subjects more than one year. Here, the author summarizes the key points of 4 subjects below, **and shows lesson plans for Social Studies and Science.**

### **(1) Key points of creation (Tsukuri) in Japanese Language**

1. The teacher gives many chances to imagine a certain meaningful thing to each student, and to make each student's imagination abundant, and to link a lot of images to creations (Tsukuri).
2. The teacher increases the opportunities of creative writing.
3. The teacher asks the students to avoid a simple sentence of impression to the topics or stories, and to make it in a logical sentence.

### **(2) Key points of creation (Tsukuri) in Math**

1. Each student thinks out a lot of own ideas.
2. Each student communicates own thought to a third party person exactly.
3. The teacher inquires each student to have many questions to the issues.
4. The teacher pushes forward a lesson which is helping the creative problem solving in real world.
5. The teacher makes many opportunities that the students do a creative problem solving as a team.
6. In order to recommend creation (Tsukuri) in a class, the teacher set a bulletin board that a student can express freely a question and thought to other students on it.

### **(3) Key points of creation (Tsukuri) in Social Studies**

1. The teacher asks the students to link the contents of textbook to the ones in real society.
2. The teacher asks the students to forecast the course and result of society and the thing, supposing it happened.
3. The teacher asks the students to think many questions that begin "why".

## **<A Lesson Plan for Tsukuri in Social Studies (5th grader)>**

**Unit: People who producing foods**

## **Tsukuri in the lesson: Open a Sustainable Fish Shop (2-hours)**

**Aims of the Lesson:** Pupils reason several key sustainable factors that a Fish Shop has to equip with; including balance sheet of money.

**Pupils are given following opportunities:** Pupils think out many reasons and factors. They narrow them down some possible reasons in light of reality. They express the reasons in the class.

**A learning form:** Small group of 5-6 pupils.

**Background of the Tsukuri:** A pupil's full name, ISODA Sakana( means "Beach Fish"), is a fifth grader of a city with a population of 100,000 people. He wants to become a Fish Manager in the future.

**Tsukuri Question 1:** Infer several reasons why Isoda Sakana want to become a Fish Manager?

**[Praise Tsukuri]:** "Your idea includes a reason to be able to nod. A lot of various thoughts appeared. There are the words that I(the teacher) does not think out of. It is very good that you thought many different kinds of ideas].

**Tsukuri Question 2:** What are important points which Mr. Sakana continue to his Fish Shop long periods? Think out many ideas in group?

[Let pupils think for several minutes and write them on the blackboard and explain them with reasons]

**[Praise Tsukuri]:** "You thought various reasons, goods; you noticed an important point; it is very much of you that you thought ideas from different viewpoints."

**[Write down the following concepts or words on a blackboard]:**

{Place to open a fish shop; the number of visitors; design of the shop; putting in and out of the money; kinds (high-quality fish - popular fish)}

**Tsukuri Question 3:** What are sustainable factors that Mr. Sakana will continue to maintain his Fish shop?

**[Incoming and Outgoing of Money:]** a) Selling money; b)buying money; maintaining and administrative cost ; tax ;e) living cost of family.

**Tsukuri Question 4:** In order to maintain his Shop for long period, how the inclusion relations of above five factors should be kept?

**[Conclusion] :** Let each group express a conclusion , and summarize conclusions of all groups on a blackboard.

#### **(4) Key points of creation (Tsukuri) in Science**

1. The teacher asks the students to stand the viewpoints of a scientist.
2. The teacher asks the students to think out a lot of methods to confirm the expectation for the experimental contents.
3. The teacher encourages the students make hypothesis.
4. The teacher assists the students to link a generated question to a hypothesis.
5. The teacher should not always give an answer to a question of each student. It is important that the student continues to have the question.

#### **<A Lesson Plan for Tsukuri in Science (4th grader)>**

**Unit: Temperature and volume of the things (4<sup>th</sup> grader, 1-hour)**

**Tsukuri in the lesson:** " a)Pupils think out some methods to identify existence of the Air; b)infer a role of Air; and c)confirm through an experiment that air swelling by heat changes to the power; and d)illustrate the inside state of the table tennis ball before and after adding the heat"

**Aims of the Lesson:** "Pupils infer the existence and a role of the air from everyday experience, and understand by an experiment that it swells out and shrink by the heat"

**Pupils are given following opportunities:** "Pupils take out knowledge of the daily life; confirm by an experiment the air swells out and shrink by the heat; c)draw an illustration with the color pen that the swelling power pushing the part of the dent to outside.

**Learning form:** Small group of 5-6 pupils.

**Background of the Tsukuri:**

When an animal and a plant live, the air is needed. It cannot see and smell. In the lesson, pupils are experienced a part of discovery as a scientist by finding about a method to identify the existence and role of the air.

**Tsukuri Question 1:** What kind of method do you use to check existing air? Please think about many methods to check it as many as possible.

**Confirmation methods:** a)Close a mouth and nose ;b) shave a fan (something touches your skin ) ;c) blow off water in the glass using a straw; d)observe a movement of a leaf)

**[Praise Tsukuri]:** “ a)You found an excellent method to confirm existing air; isn't it? b)It is a splendid reasoning that puts excellent detectives to shame; c)The point that several kinds thought of is very good.”

**Tsukuri Question 2:** Human cannot live without the air. Do plants need the air to live? {They of course need the air}

**Tsukuri Question 3:** Where will the air come from?

{**Inference:** a) It exists primarily around us, b)it comes from a mountains, fields and farms, c) from gardens; parks and green trees; d)from flowers in gardens; e)from sea }

**[Praise Tsukuri]:** “Does the air come from such strange place, isn't it? You noticed a lot of possible places and things well! “

**Tsukuri Question 4-1:** A table tennis ball became dented. How could you put it back in original form?

**[Things to set up]** A dented table tennis ball, an alcohol lamp]

{**Inference:** a)Suck dented place with vacuum cleaner; b) absorbing it in hot water; c)push strongly around a dented place}

**Tsukuri Question 4-2:** Why would the table tennis ball be restored when it soaked in hot water?

{**Inference:** a)The power of the air was added to the dented place; b) the air was swollen}

**Instruction:** Let's draw two inner states of table tennis ball with color pens, before and after the heat adds.

**Tsukuri Question 4-3:** What is a cause, and what is a result?

**[Praise Tsukuri]:** a) You infer a cause and effect correctly; b) your inference is good like a real scientist.

**A purpose to learn science:** One of objectives one learn science is to obtain certain methods to infer the relationship between the cause and result through an experiment and a research.

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