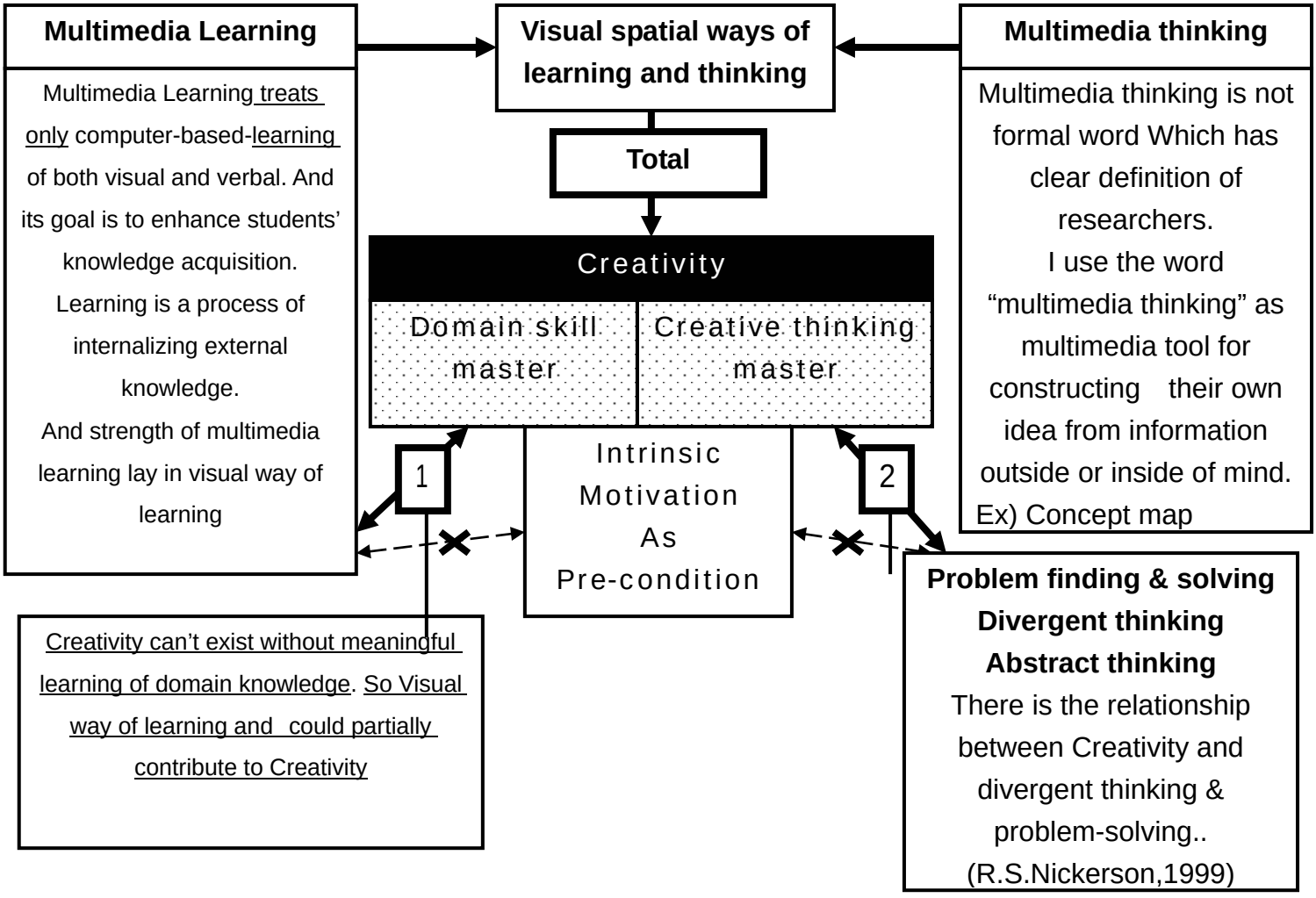
RQ.4 Quality Analysis of Relationship Between Visual learning /thinking and Creativity

1 Preparation;Overview of hypothesis

I made a hypothesis that there is a relationship between to enhance "divergent-thinking" and "problem-solving", and visual/spatial ways of learning and thinking tool which enable students to visually express their relationship of ideas and how it relates to each other. That is, Multimedia learning might contribute to Creativity in indirect way.

Aim of RQ.4 is to prove whether this hypothesis works or not by literature review.



Creativity is consist of Domain knowledge, Intrinsic motivation and Creativity skill(Amabie,1996). Creativity is in synthesized activity of learning, imagination, thinking and applying.

Among these elements, the range of multimedia learning/thinking is Domain skill mater and Creative thinking master. It can't contribute to intrinsic motivation. Although this is fundamental Source(pre-condition) for Creativity. So Visual way of learning/ thinking can contribute to Creativity under condition that learners already have intrinsic motivation in their mind.

And there is another pre-conditon. In this paper, I don't aim long-term effects on creativity but short-term-effect on creativity during the task. So it is OK that divergent thinking is not such strong measure as to influence longitudinal effects on one's true creativity as long as divergent thinking Increase the potential of Creative thinking(Runco and Sakamoto,1999)

The definition of the word "Visual thinking"

Origin of visual thinking is the research topic which survey the perception of shape marks the beginning of concept formation. The term "visual thinking" is derived from it. (Rudolf Arnheim ,1969).

Visual thinking is high order critical thinking conducted by imaginative means alone by seeking to discover visual forms that fit his/her underlying human experience.(Definition from NAB on the web)

Total Relationship between visualization and Creativity

Visual Learning/ thinking ⇔ Creativity

Pro-position ; There is relationship between visual Learning and Creativity

Pro-combined Evidence 1

- **Overview of this combined analogy**

	Outcome	Input	Casual path
Visual Learning/ thinking	Visual memory is stored in long term memory.	**A) Dual coding theory (Paivio,1972)**	**Pre-condition** A → B → **Under this condition association can exist** C **Visual⇔Right brain** → D **Right brain** ⇔ **Creativiy** ⇔ **Left Brain** → . **Final analogy** **Visual ways of Learning/thinking** ⇕ **Contribution To Creativity As an aid for Right brain function** → E
Creativity	Regarding all creating is merely the continual redesign of information till solutions or novelties	**B) Information design model Of Creativity (Tabor,2002)**	
	Visual-spatial learning and Thinking might be based mainly on Right brain function.	**C) Visual-spatial learner's characteristic Similar to Right brain function (Linda, from web page)**	
	.Figural creativity is base mainly right brain. And verbal creativity is consist of both brain functions.	**D) Verbal creativity require both left and right brain function.(Ruth et al,1999)**	
	.**Detail of information model of Creativity**	**E) How visual information should be To cause creative thinking?**	

Pre-condition A); visual memory is stored in long term memory

Visual memory is stored in long term memory.

Pre-condition B); Creativity is information design aiming novelty

"Creativity".could be defined as that all creating is merely the continual redesign of information till solutions or novelties appear. (Richard Tabor Greene, The information Design Model of Creativity).

Evidence of information Design Model of Creativity

This model is come from Greene's analogy come from historical review of creators.

C) Visual-spatial learner's characteristic similar to right brain function

According to Linda Silverman(on the web site), visual-spatial one's characteristics is corresponded to functions of right brain, like dealing with image, intuition, pattern and spatial cognition, system, synthesis thinker while audio-sequential one is corresponded to left brain function.

Evidence of the site

Why Linda Silverman categorize learner into these visual-spatial and audio-sequential? Analyzing IQ score, she noticed that ability of solving a problem visually is in correspondence with ability of spatial rotation task. So is audio task and sequential task.

And two kinds of talented children exist, one is who excels both visual-spatial task and auditory-sequential task. The other is who excels in only one dimension and weak in the other.

Visual components ⇔ Function of Right Hemisphere

Topologies or configural pattern of information like network, Hierarchy and distribution is processed in visual pictorial channel and stored in long term memory. Then one of major right brain function, Synthesis or highly abstract reasoning use the visual components stored in long term memory.

Thus, visual information influence the function of right brain.

D) Function of Right Hemisphere ⇔ Creativity

1. Figural Creativity requires right brain function. (Torrance)
   Verbal Creativity requires both left and right brain function. (Ruth ea al,1999)
   That is, right brain function is needed for both figural and verbal creativity.

2. Creativity requires right brain function to design and arrange information based on configuration.(Information design model of Creativity)
3. Visual ways of learning and thinking contributes to expressing the configuration.

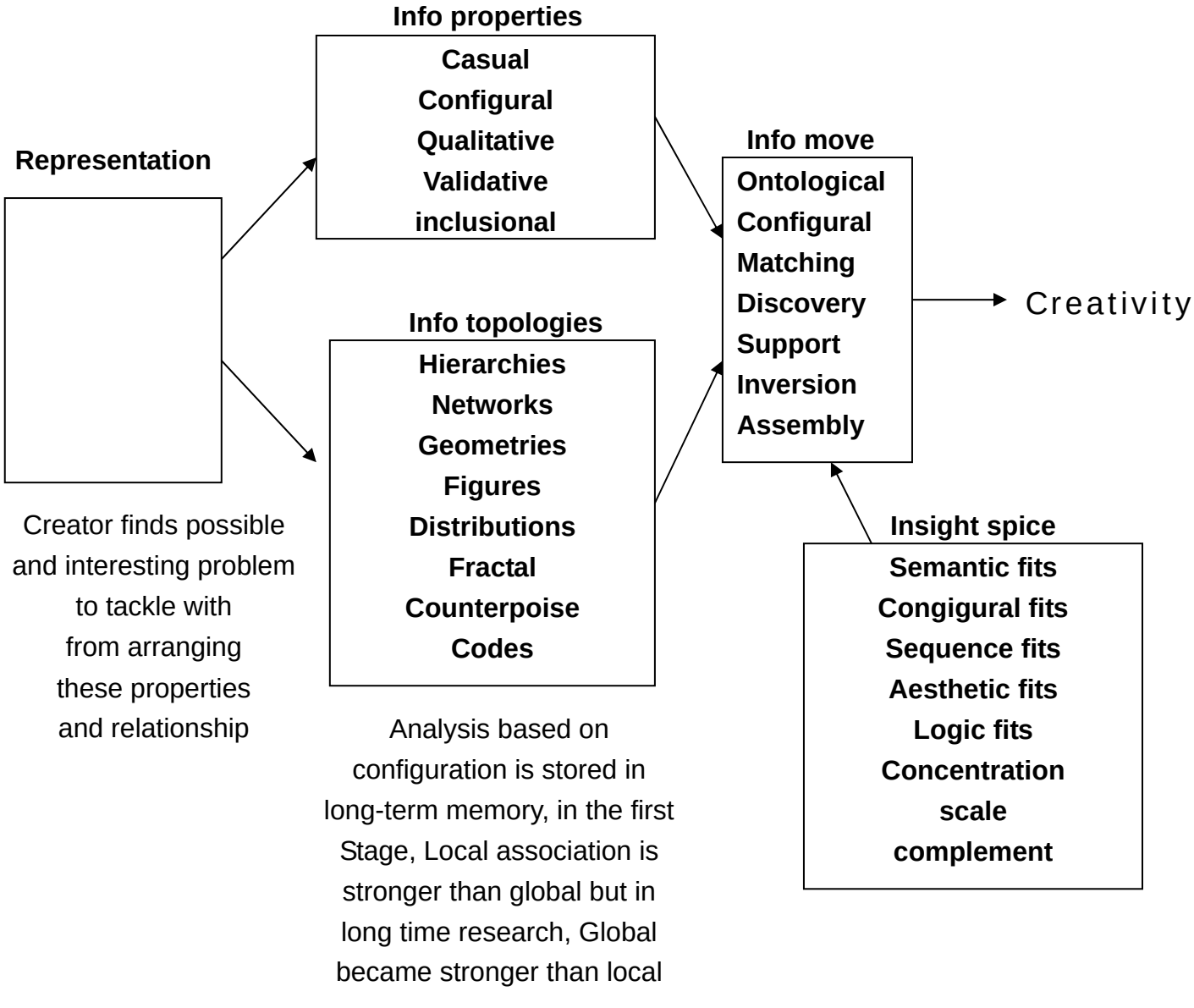
E) How visual information should be to cause creative thinking?

I deducted the principle of visual information design to cause creative thinking from the information design of Creativity.

This model's point of view aimed finding method for Creativity emergence in configuration possibilities.

It is good for creativity to visually arrange information, caring these features of information

- **Model summary; Information design model of Creativity(Tabor, 2002)**



Pro-Evidence 2 Visualization ⇔ Creativity

Definition of Visualization

It is defined as representations of information consisting of spatial, nonabitary(i.e,"picture-like" qualities resembling actual objects or events), and and continuopous(i.e, an "all-in-oneness" quality) characteristics.(Paivio,1990, Lloyd,1995)

Visualization ⇔ Creativity

The study connect both visualization and Creativity by showing how many famous creative scientists owe their discoveries to mental visualization, introducing case studies from Einstein to Kekule. (Lloyd P.Rieber,1990)

Role of visual knowledge with forms of the highest quality, it contributes to conceptual thinking ,Creativity and Problem-solving.(Arnheim,1969,Paivio,1979)

Its result was also supported by History review of relationship between creativity and visual thinking(Thomus G.West,1994,"Mind eye")

Con-position; Visual thinking does not contribute to Creativity

Con-Evidence 1; Against Pro-Evidence 1

There is a pitfall in Pro-Evidence1. it said that Visual information like configuration and topology of information is processed in right brain and right brain contributes to Creativity. So visual infromation contributes to creativity.

But two evidence show that right brain function for processing visual information is not so important.

One evidence provides it for the reason that for highly intellectual people, visual topologies, color is not needed because they can make analogy from the similarity of visual/spatial structure. In the process of analogy, left brain and frontal cortices is actively working.

(Charles M. Wharton, Jordan Grafman, Stephen S. Flitman, Eric K. Hansen, Jason Brauner, Allison Marks, Manabu Honda ,1999)

Another evidence provides the reason that right brain functions are minimized during logical task with in simple cognition of shape and color.

To work on logical problem solving, the complexity of visual information should be minimized.(Matthias Mölle[*], Inge Schwank[†<>], Lisa Marshall[*], Anke Klöhn[*], Jan Born,2000)

So for creative tasks which require logical thinking and for highly logical person, Visualization is not so important elements but logical, left brain function.

Weighing Pro and Con evidence; Pro won

Pro-position won because pro-position does not try to full right brain with visual information and solve a problem only by right brain function and visual thinking.
Because of relationship between visualization and creativity, and creativity and right brain function.
The true aim is to eliminate unnecessary visual information and only provide visual information which has meaning and structure.
so using well designed visual information result in both full potential of right brain and minimized unnecessary right brain function.

Relationship between visual thinking and creativity

Visual spatial ways of learning and thinking multimedia tool	⟷	**Divergent thinking Abstract thinking Association fluency**

☆To prove the relationship, I apply concept map and fractal model as one of major visual thinking tool

2 Pro-position; Visual-thinking tool contribute to creative thinking

Pro-Evidence1 Concept map contributes to association fluency

Visual Thinking Network(concept map) encourages students to integrate multiple ways of thinking about scientific events and objects by utilizing color, form, and spatial information. (Longo,Palma.J,2001)

Lloyd said that highly visual and interactive computer-based tools may allow the user to take on an unprecedented role in the design process because of discovery of unexpected association. (Lloyd P.Rieber,1995)

Author suggests giving people opportunities to use the design tools for their own creative visualization to solve problems.

Pro-Evidence 2 Fractal model contributes to categorization which is cotributes to useful knowledge stored in long-term memory

Then the stored knowledge in long term memory later contributes to creative analogy

Fractal concept model enable people to organize idea into categories and synthesizing and building large scale concept. (Tabor,1999,2002) This visual

tool has the potential to contributes to creativity because it is self-organizing tool for divergent ideas. (Sub-creation model of Creativity)
So unexpected emergence might occur to mind during this similarity-based categorization. Or after these similarity-based information is stored in long term memory(Gentner,1989;Holyoak and Koh,1987; Keane,1988;Ross,1989;Seifert et a,1986), But similarity-based role of categorization has been challenged, so the category membership judgement should be theory-based rather than similarity-based(Keil,1989;Murphy and Medin,1985)
Then the categorization would be used for inspiration later.(the information design model of creativity)
Because how a property is represented will affect the way it is processed.(Assumption by Gentner and Markman,1998)

Pro-Evidence 3

CoRT 4 program(1973) help one generate ideas. Empirical evidence show thatCoRT training for a year did better than controls. These who received three years training showed the abstractness and elaborateness of the ideas they generated.(Sanchez & Astorga,1983)

Con-position;there is no relationship between Creativity and visual thinking

Con-evidence 1

There is no longitudinal evidence here, so it can't generalize these relationship.

Weighing Pro and Con; Con-position win

It is true that con-position pointed out. I can't generalize these relationship from those 3 evidences. But these three are strong showing the relationships between short-term creative thinking and visual thinking.
And again, my intended effect is short-term effect of creativity.

Relationship between visual thinking and creativity

☆To prove the relationship, I apply concept map and fractal model as one of major visual thinking tool

Pro-position ; Visual learning contributes to domain knowledge master

Pro-Evidence1

Concept maps which clearly express hierarchy of key words, contributes to retention.(Morita, Nakayama Shimizu,1999)

Pro-Evidence 2 Visualization of what they learned contributes to responsibility for own learning process

People have natural tendency to use visualization as the ways in which people can manage their own learning, especially during problem solving.(Weinstein & mayer,1986)

Pro-evidence 3 Multimedia learning affects personal creativity

The results suggest that integration of multimedia learning program positively affects the personal creativity characteristics of student (year6&7) .

(Proctor, Romina M. J.(2001)) this is based on longitudinal study that is Investigation for 520 students from seven schools.

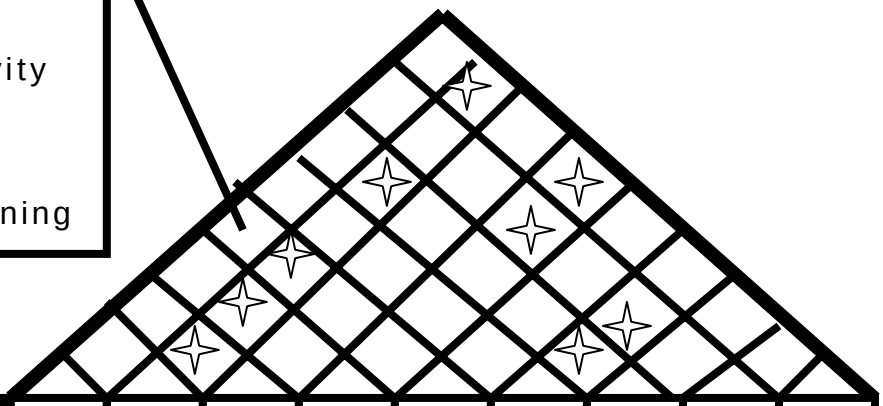
Con-position; There is little relationship between domain knowledge master and visual learning

Weighing these two, Pro-position won

Visual learning contributes to self-directed learning and self-directed learning contributes to domain knowledge master.

Summary of relationship between Creativity and Multimedia

Interactive relationship Among creativity Component Related to Multimedia learning



Multimedia Learning \ Creativity	Personal Creativity	Information Design	Originality	Problem Solving	Good question finding	Intrinsic motivation	Creative thinking	Domain knowledge	Right and Left Brain	Importance For Creativity 1 2 3 4 5
Cause-and-Effect chain								●		✦
Computer Aided Learning	●	●								✦
Instructional Help					●	●				✦
Discovery Learning			●	●	●	●	●	●		✦
Abstract & Logical map		●	●	●	●			●	●	✦
Minimum Visual Design			✦	●			●	●	●	✦
Complex Information			●		●		●		✦	✦
Logical Visualization		●		●	●		●		●	✦

Evidence to prove the relationship

Additional Source journal

- **Computer assisted learning ⇔ Personal Cerativity**

The results of investigation to 520 students suggest that integration of multimedia learning program positively affects the personal creativity characteristics of student (year6&7)

Proctor, Romina M. J. "Enhancing Elementary Students' Creative Problem Solving through Project-Based Education" (2001)

- **Discovery learning ⇔ Creativity**

Allowing students one hour of classroom time daily to explore their interests complements the curriculum and creates lifelong learners, though benefits may not show up on test scores. Discovery learning nurtures creativity and love for learning, creates a community of learners, develops self-esteem, teaches skills, and uses real-world resources.(Wolk, Steven(2001), Educational Leadership v59 n2 p56-59 Oct 2001)

☆ **The most of source needed for other association is already presented in this paper**