

DEVELOPING THE ATTITUDE AND CREATIVITY IN MATHEMATICS EDUCATION

Paper to be Presented at
The International and The Fourth National
Conference on Mathematics Education 21-22
July 2011, FMIPA UNY

By

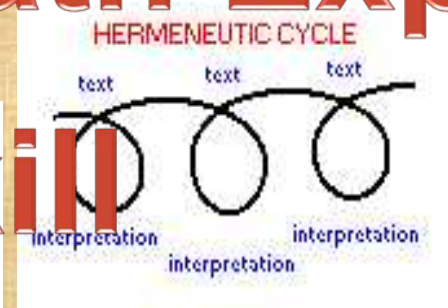
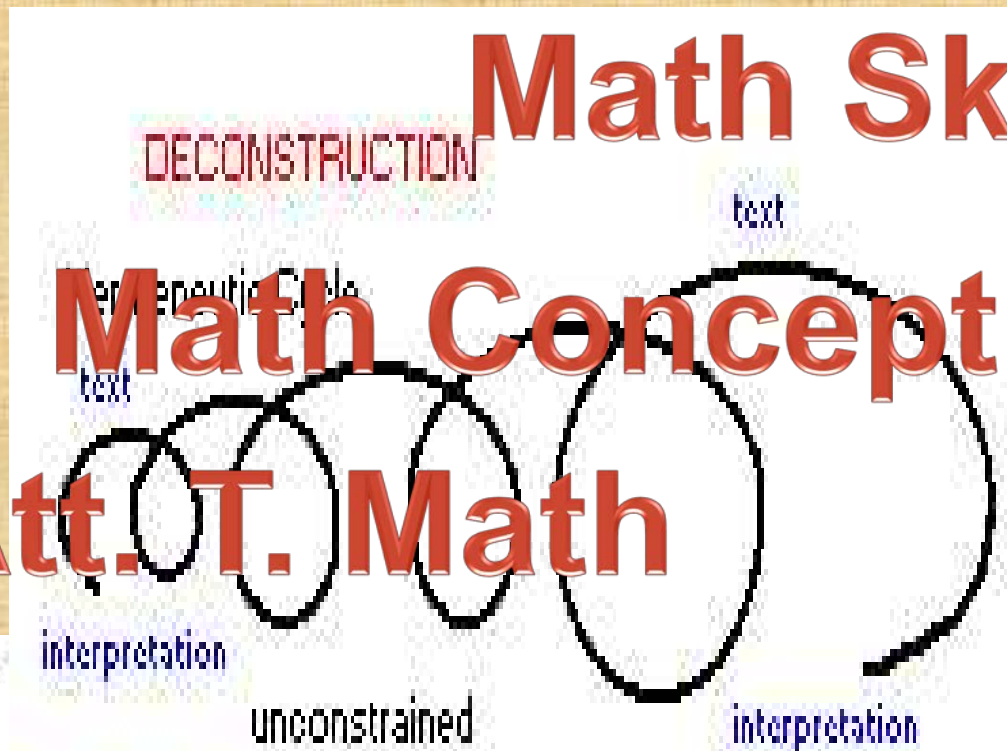
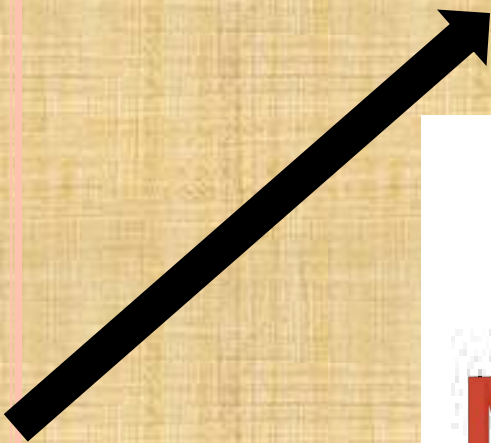
Marsigit

Yogyakarta State University
Indonesia

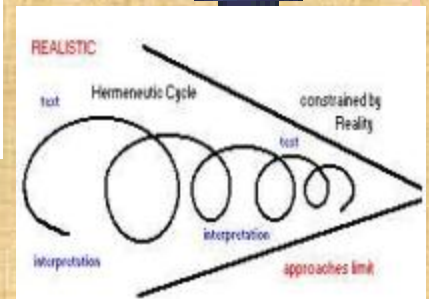
7/20/2011 Marsigit, Indonesia

HERMENEUTICS OF LEARNING MATH

Theories Math Expo



Practical/Implement





HERMENEUTICS OF LEARNING MATH

Theories

Math Exper

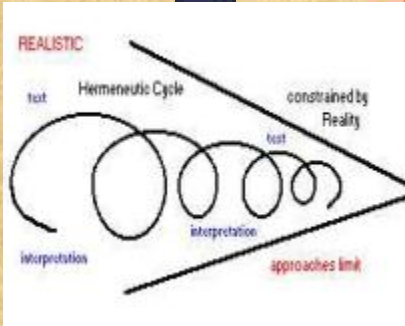
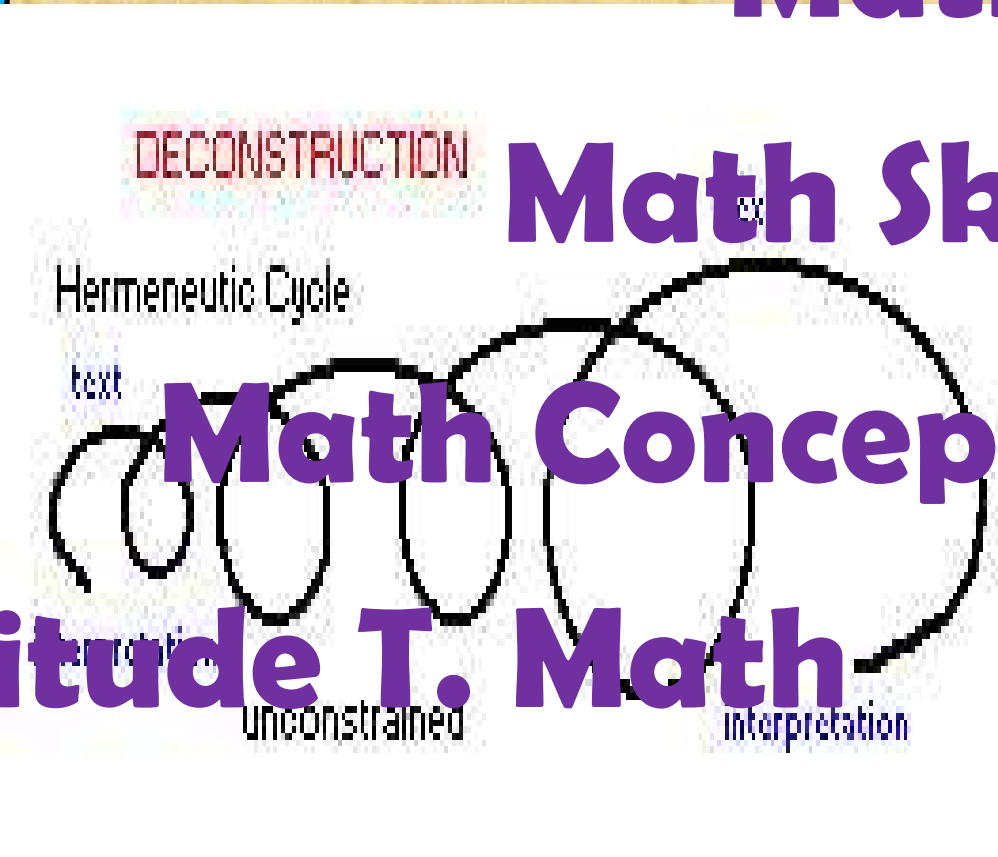
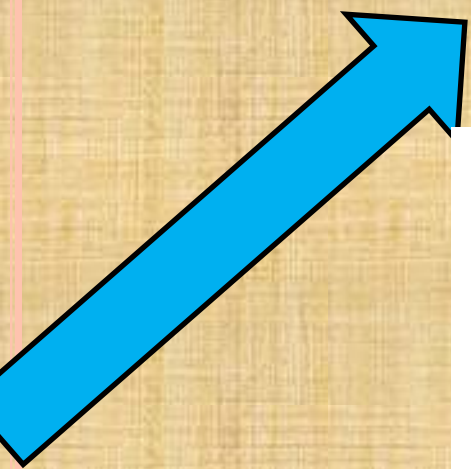
Math Skill

Math Concept

Attitude T. Math

Will

Practical/Implement

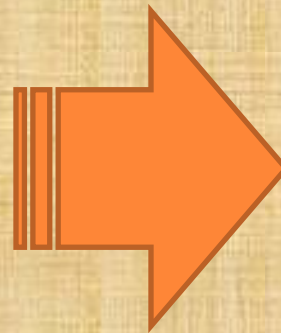


ATTITUDE TOWARDMATHEMATICS

West

Indonesia

ICEBERG



VOLCANO

ATTITUDE OF....MATHEMATICS
(MATHEMATICAL THINKING)



TSUNAMI'S ATTITUDE

A photograph of a volcano erupting. A large, dark plume of smoke and ash rises from the peak of the volcano, spreading out in the sky. The volcano itself is a dark, conical shape. The foreground shows some dark, silhouetted vegetation. The sky is a pale, hazy blue.

VULCANO'S ATTITUDE

Not Ready

Disaster

7/20/



Pheno-
menon

Readiness

Curiosity/
Ammusing



Disaster...for Students

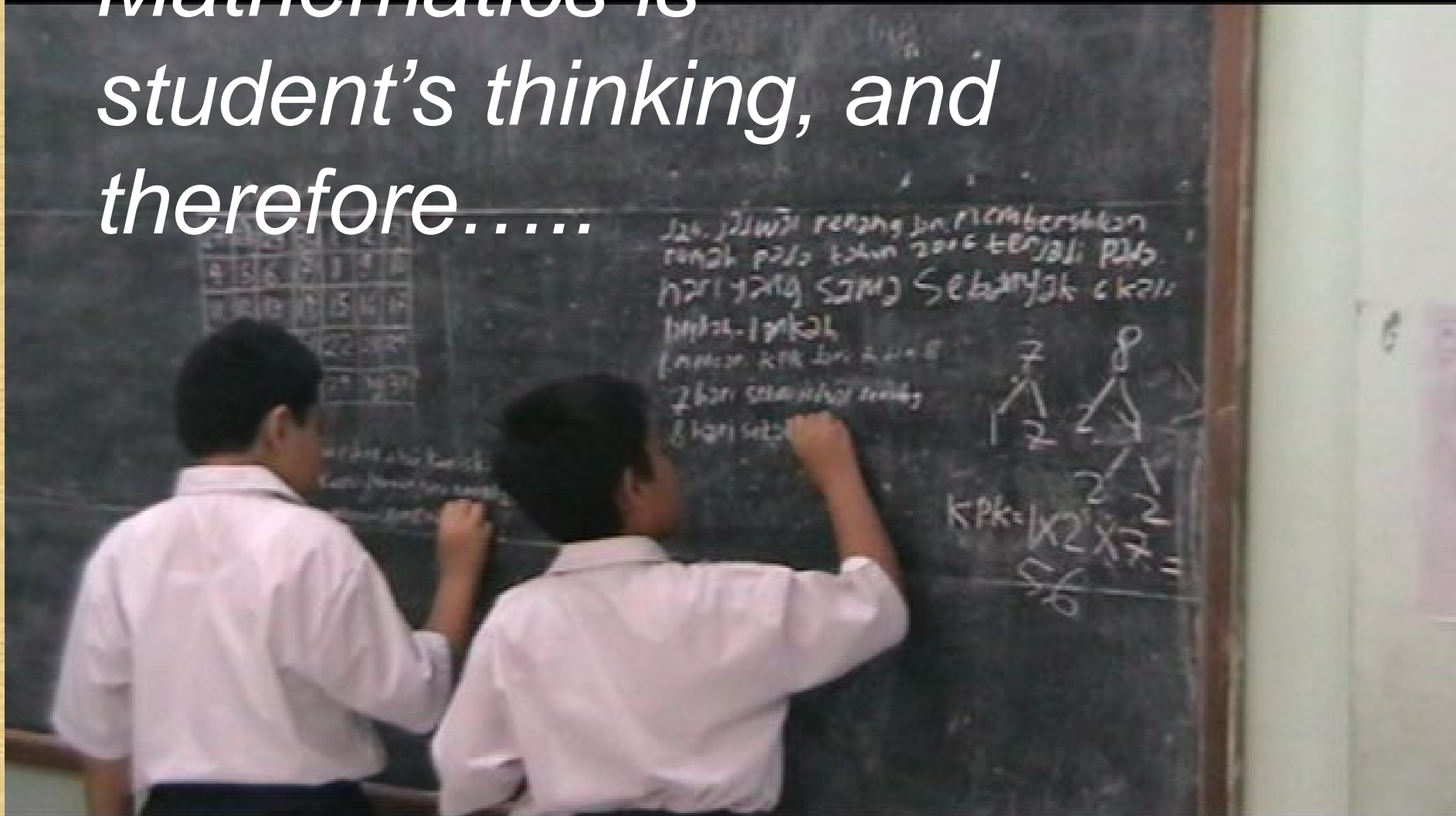


**MATHEMATICAL
PHENOMENA**

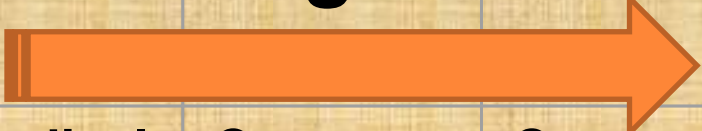


***Curiosity/
Ammusing...for Students***

*Mathematics is
student's thinking, and
therefore.....*

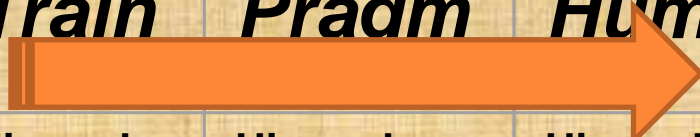


MATHEMATICS is.....The Student himself

	<i>Idst Trnr</i>	<i>Tech Prgm</i>	<i>Old Hum</i>	<i>Prgrs Educ</i>	<i>Pub. Educ</i>
					
<i>Poli- tics</i>	Radical right	Conserv ative	Conserv ative/ liberal	Liberal	Demo- cratic
<i>Ntur Math</i>	Body of Knowle dge	Science of truth	Structu- re of truth	Process of Thinking	Social Activi- ties
<i>Mral Val.</i>	Good vs Bad	Pragmatis m	Hierark hies Paternal istics	Humani- ty	Justice, Free- dom



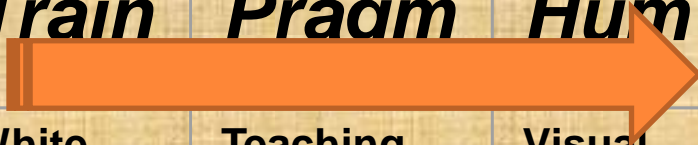
	<i>Idust Train</i>	<i>Tech Praam</i>	<i>Old Hum.</i>	<i>Progres Educ.</i>	<i>Public Educat</i>
<i>Theory Society</i>	Hierarchy , Market Orientati- on	Hierarchy	Hierarchy	Well-fare	Need a reform
<i>Nature Stdent</i>	Empty Vessel	Empty Vessel	Character Building	Student Orient.	Psych. Develop
<i>Theory Stdnts' Ability</i>	Talent and Effort	Talent	Talent Develop- ment	Student Needs	Culture, Relative



	<i>Idstrl Train</i>	<i>Techn Praam</i>	<i>Old Hum</i>	<i>Progrs Educ</i>	<i>Public Educ</i>
<i>Aim Math Educ</i>	Back to Basic (Arithmetics)	Certification	Transfer of knowledge	<i>Crea- tivity</i>	<i>Math. Cons- truct</i>
<i>Th. Lear ning</i>	Work Hard, Exercise s, Drill, Memorize	Thinking And practice	Understan ding and Applica- tion	<i>Explo- ration</i>	<i>Auto- nom, Inter- action</i>
<i>Th. Teac hing</i>	Transfer of knowledge (transmission)	External Motivation	Expository	<i>Const, Develp</i>	<i>Discus, Investi gation</i>

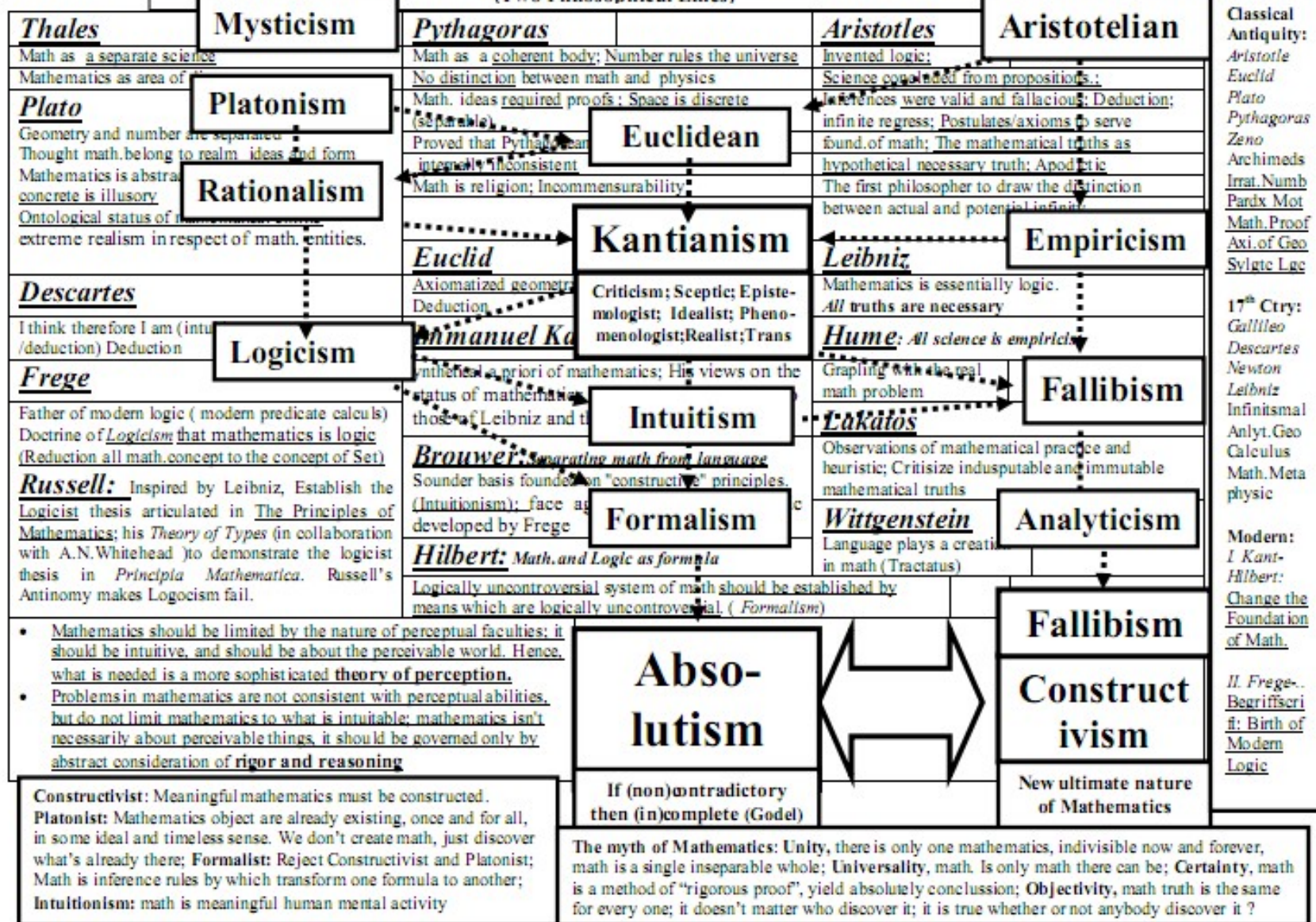


	<i>Idstrl Train</i>	<i>Tech Praam</i>	<i>Old Hum</i>	<i>Progre Educ</i>	<i>Public Educ</i>
<i>Reso urces</i>	White Board, Chalk, Anti Calcula- tor	Teaching Aid	Visual Teaching Aid for motiva- tion	Various resource s/environ ment	Social Environt ment
<i>Evalu ation</i>	External Test	External Test	External Test	PFolio, Assess ment	PFolio, Social Context
<i>Diver sity</i>	Monocult ure	Desentrali- zation	Compete nt Based Curricu- lum	Multiple Solution, Local Culture	Heterogo nomous



Philosophy-Epistemology-Mathematics-Foundation

(Two Philosophical Lines)



Kant's Theory Math Knowledge

Intrinsic to the mind; Contain internal structure;
Automatically synthesize the sensory input

Example:
pure logic
Referring to
Express T/F
Unified &
Self-Consci
Truth
functional
form
Not SP form

Transcendental Aesthetic
Form of Appearance of Outer Sense
SPACE
Not Empirical Pure Intuition

Discursivity

NOUMENA
Not sensory intu object (is problematic)
Impression

Receptivity
APPERCEPTION

Appearances
Vortellung

REPRESENTATION
SENSIBILITY

Capacity Receive Representati
APPERCEPTION

Object of Possible Experience
PHENOMENA

Transc. Deduction
Analytic Principle
Syn of Trans Ideas
Logical Constant:
All some this propo.
Predicate if-then etc

A P R I O R I
Analytic

Superserve
Subserve
Pure Form Sensible Intuit

TIME
Imagination

PERCEPTION
CONSCIOUSNESS

Degree
Anticip Of Percep(?)

Generates:
Spatial Temporal
form intuit
Neuronal
Imagery: Schem

Transc. Ded. Method
Transcend Schema
Transcend Dialectic

C o g n i t i o n
Procedur base Innate
Axiom of Intuit(1)

KNOW-LEDGE
Ekenntnis (Oby.)

Spontaneity
Apprehension
Reproduction
Recognition

SENSA-TION
Empfindung(Sby.)
Togetherness
Principle

Princip of Contradic
Analytic of Concepts
Postulat

CON-CEPT
Analogy
Begriff
Quantity
Quality
Realtion
Modality

INTUI-TION (M)
Anschauung
A P O S T E R I O R I

Magnitude; Quality;
Relation; Modality

Experient(D)
General Represent: Discursive Represent;
Complex Intention: Represent Of Object;
Rule of Classifying Perception

Logical Reason

Paralogic
Antimony

PURE

Impure
Synthetic

EMPI-RI(D)

Architectonic of Pure Reason
Empty Concept
Blind Intuition

Synthetic

Contingen

Experient(D)

Trans Ideas

IDEA

Jdgmt

Propo Content
Semantic Cont.

NOTION

(Categor)
Undrsdg)

Otty
Uni
Part
Sing

Relat
Cat
Hyp
Disj

Modal
Probl
Assert
Anodi

Antropocen
tric empiri-
cal referen-
cial mean-
ingfulness
of judgment
(Robert Hana)

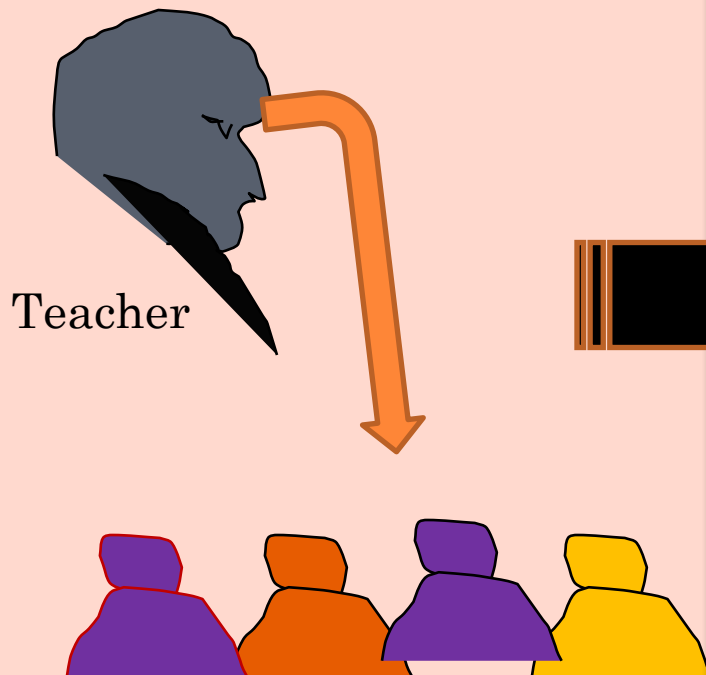
Analogies of Experience(3)

Postul Emp Thought(4)

Criterion
Truth-Isomorph

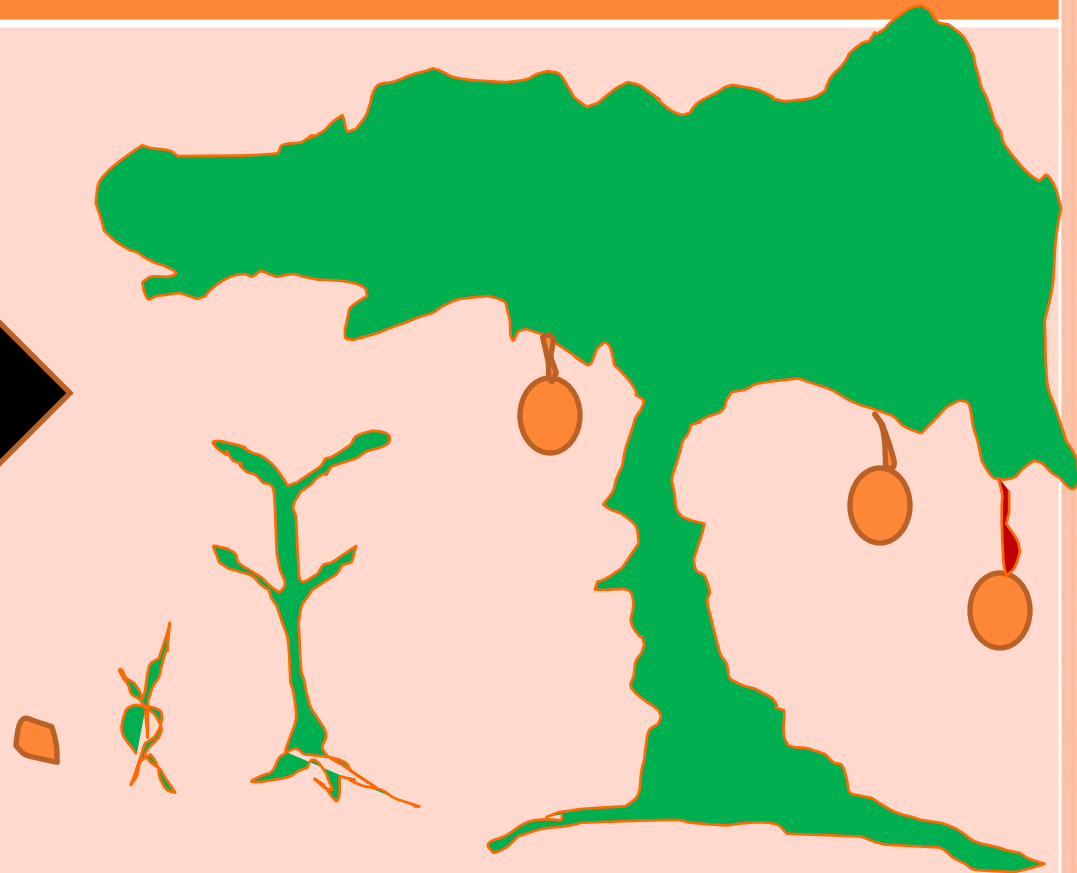
EMERGING MATHEMATICAL ATTITUDE AND CREATIVITY

Traditional



Students

Innovative

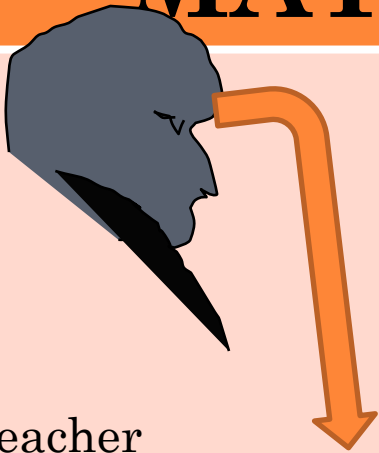


Constructive Teaching

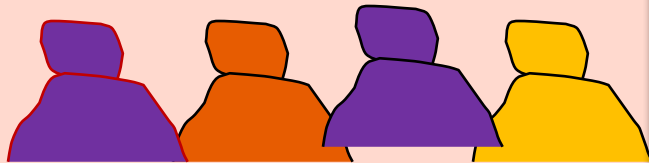
EMERGING MATHEMATICAL ATTITUDE AND CREATIVITY

FORMAL MATH

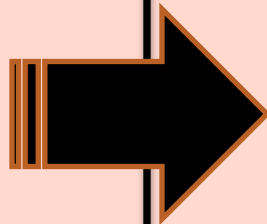
SCHOOL MATH



Teacher

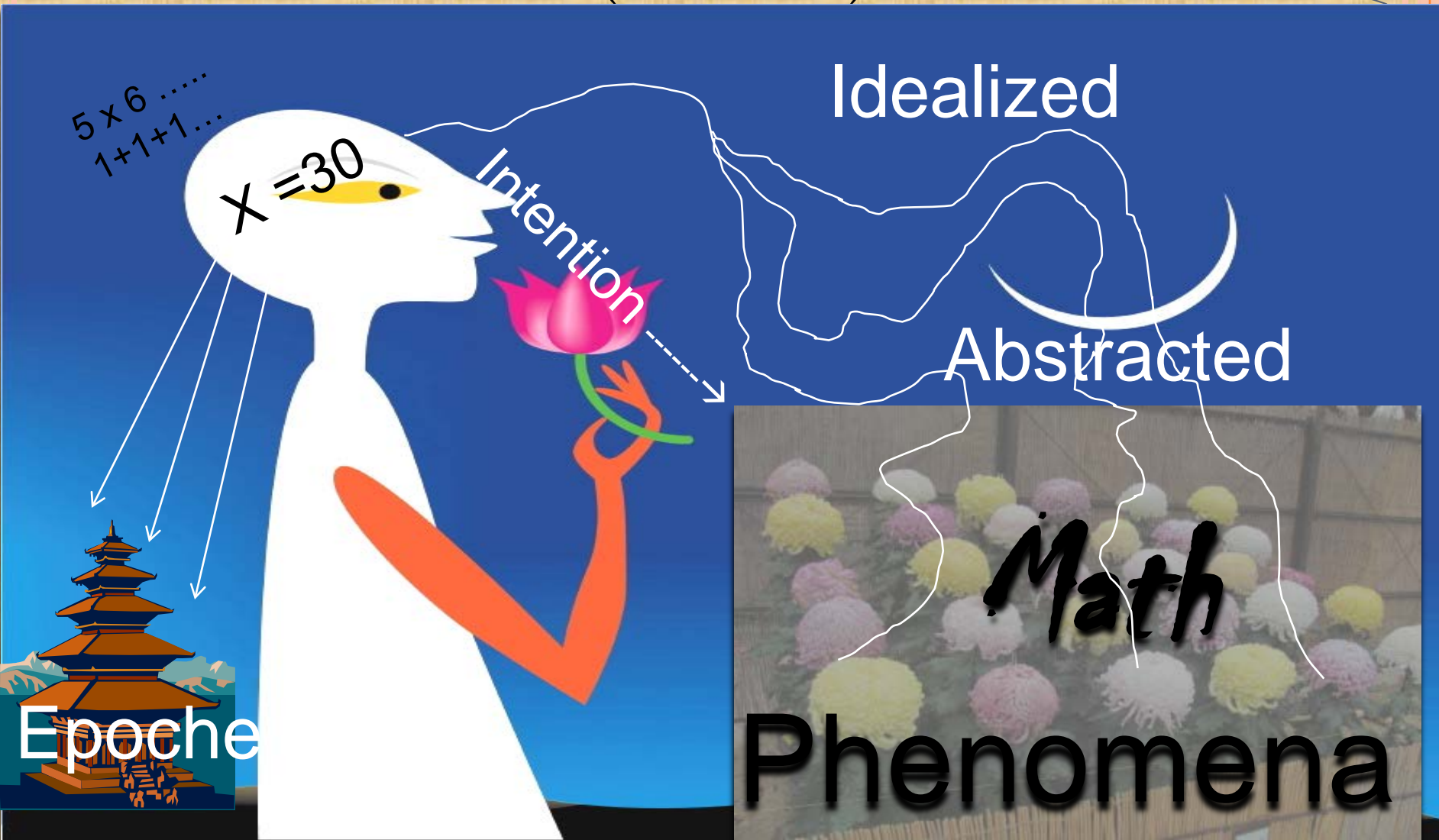


Students

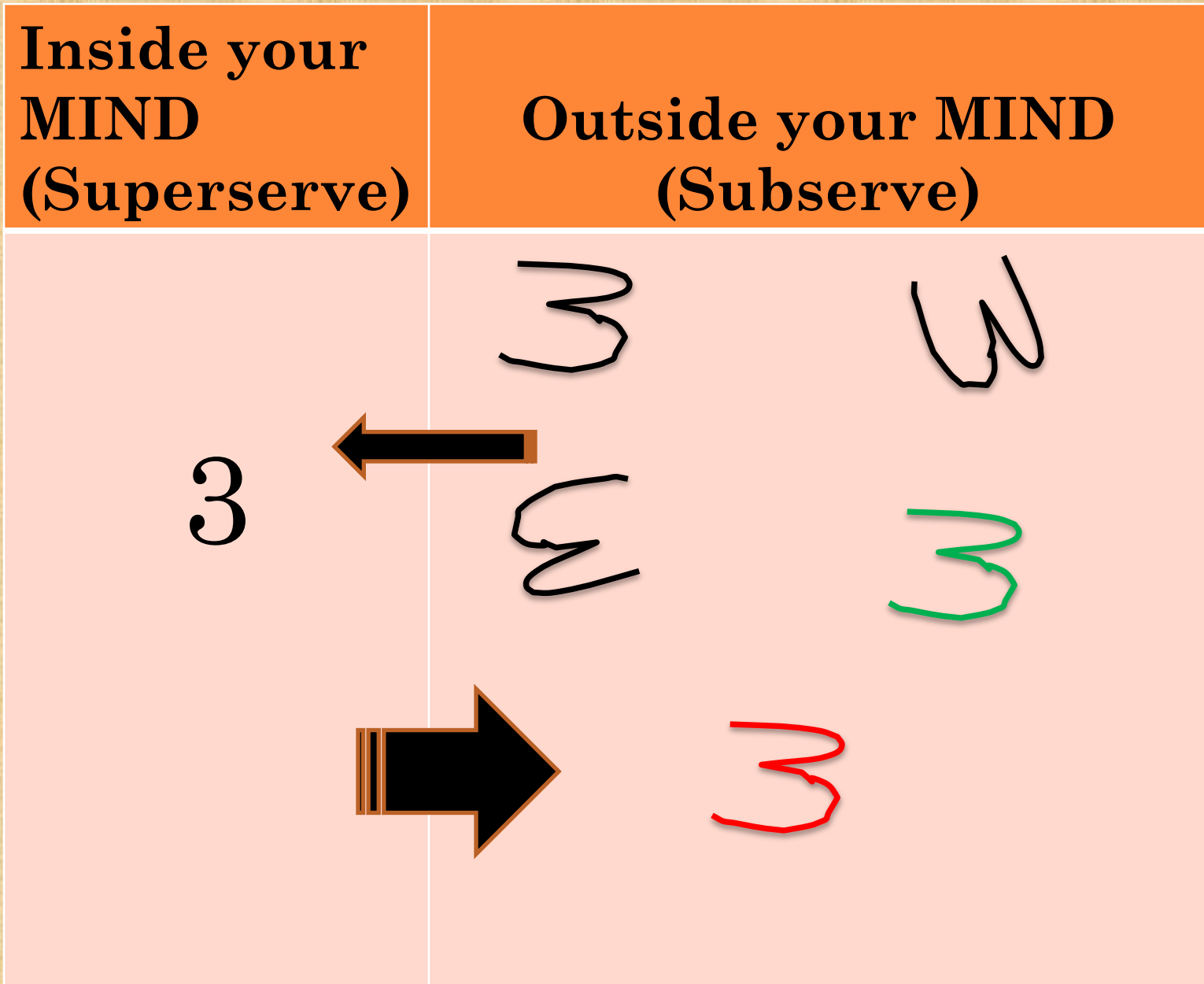


Constructive Learning

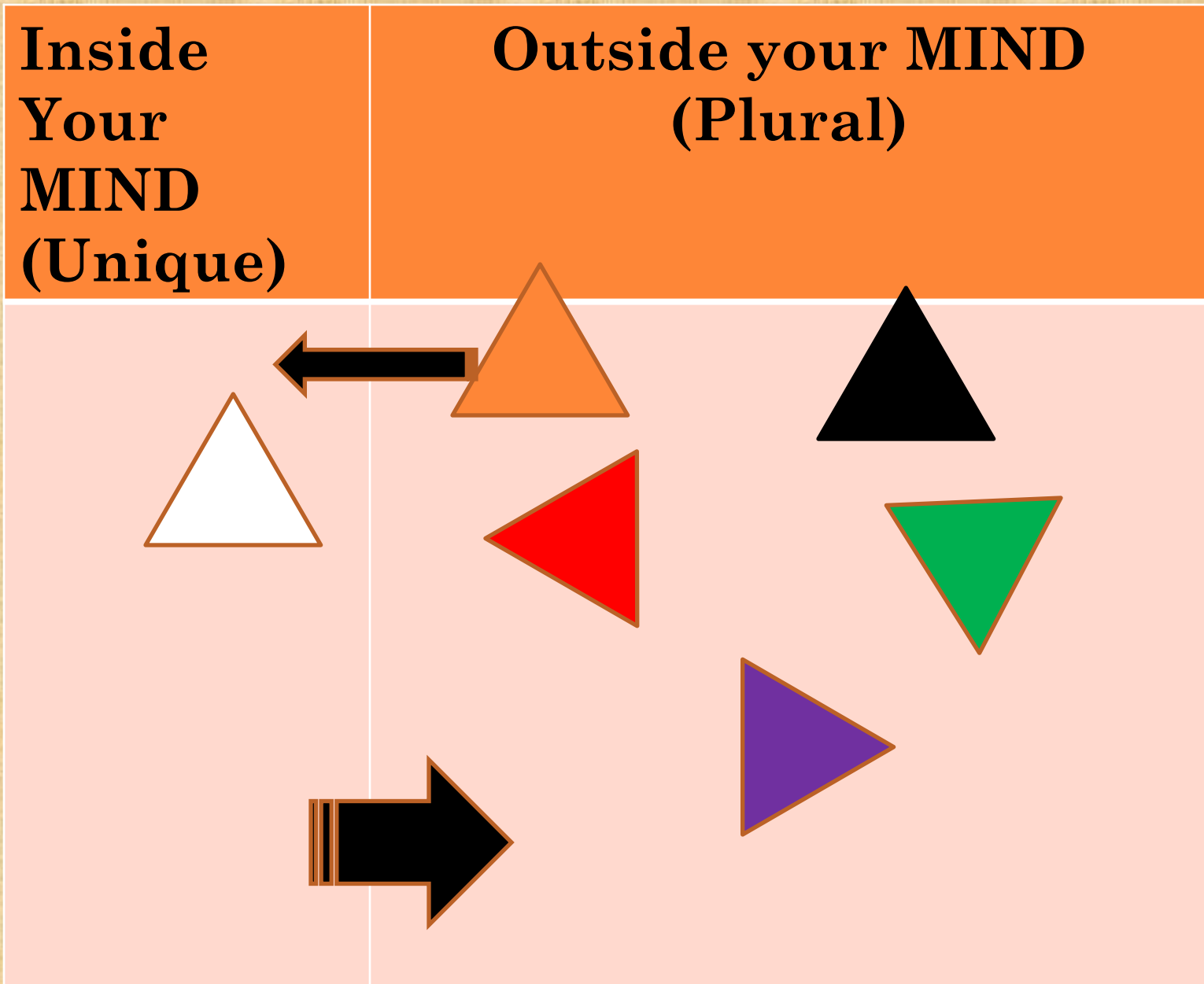
PHENOMENOLOGY OF MATHEMATICAL ATTITUDE (HUSSERL)



The Component of Math Atttd.



The Component of Math Atttd.



The Component of Math Att'd.

**Inside your
MIND
(analytic/co
herence)**

**Outside your MIND
(synthetic/
Correspondence)**

$$3+2=5$$

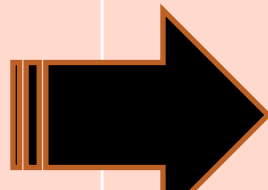


$$3 \text{ book} + 2 \text{ book} = 5 \text{ book}$$

$$3 \text{ pencil} + 2 \text{ pencil} = 5 \text{ pencil}$$

$$3 \text{ book} + 2 \text{ pencil} = 5 \quad ?$$

$$3 \text{ book} + 2 \text{ pencil} = 5 \quad ?$$



The Component of Math Atttd.

**Inside your
MIND
(abstract)**

**Outside your MIND
(concret)**

$$X=30$$

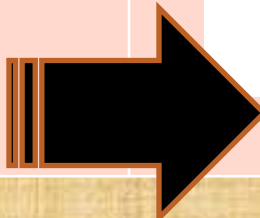


The Component of Math Atttd.

**Inside your
MIND
(Realistic Math:
Vertical)**

**Outside your MIND
(Realistic
Math:Horizontal)**

1
 $\frac{1}{2}$
 $\frac{1}{4}$



THE APPROACH TO MATHEMATICAL ATTITUDE

(EBBUT AND STRAKER, 1995)

- 1. Mathematics is a search for PATTERN and RELATIONSHIP
- 2. Mathematics is PROBLEM SOLVING activity
- 3. Mathematics is a mean of INVESTIGATION
- 4. Mathematics is a mean of COMMUNICATION



Mathematical Attitude (Katagiri, 2007)

1. Attempting to grasp one's own problems or objectives or substance clearly, by oneself

- *Attempting to have questions*
- *Attempting to maintain a problem consciousness*
- *Attempting to discover mathematical problems in phenomena*



Mathematical Attitude (Katagiri, 2007)

2. Attempting to take logical actions

- *Attempting to take actions that match the objectives*
- *Attempting to establish a perspective*
- *Attempting to think based on the data that can be used, previously learned items, and assumptions*



Mathematical Attitude (Katagiri, 2007)

3. Attempting to express matters clearly and succinctly

- Attempting to record and communicate problems and results clearly and succinctly
- Attempting to sort and organize objects when expressing them

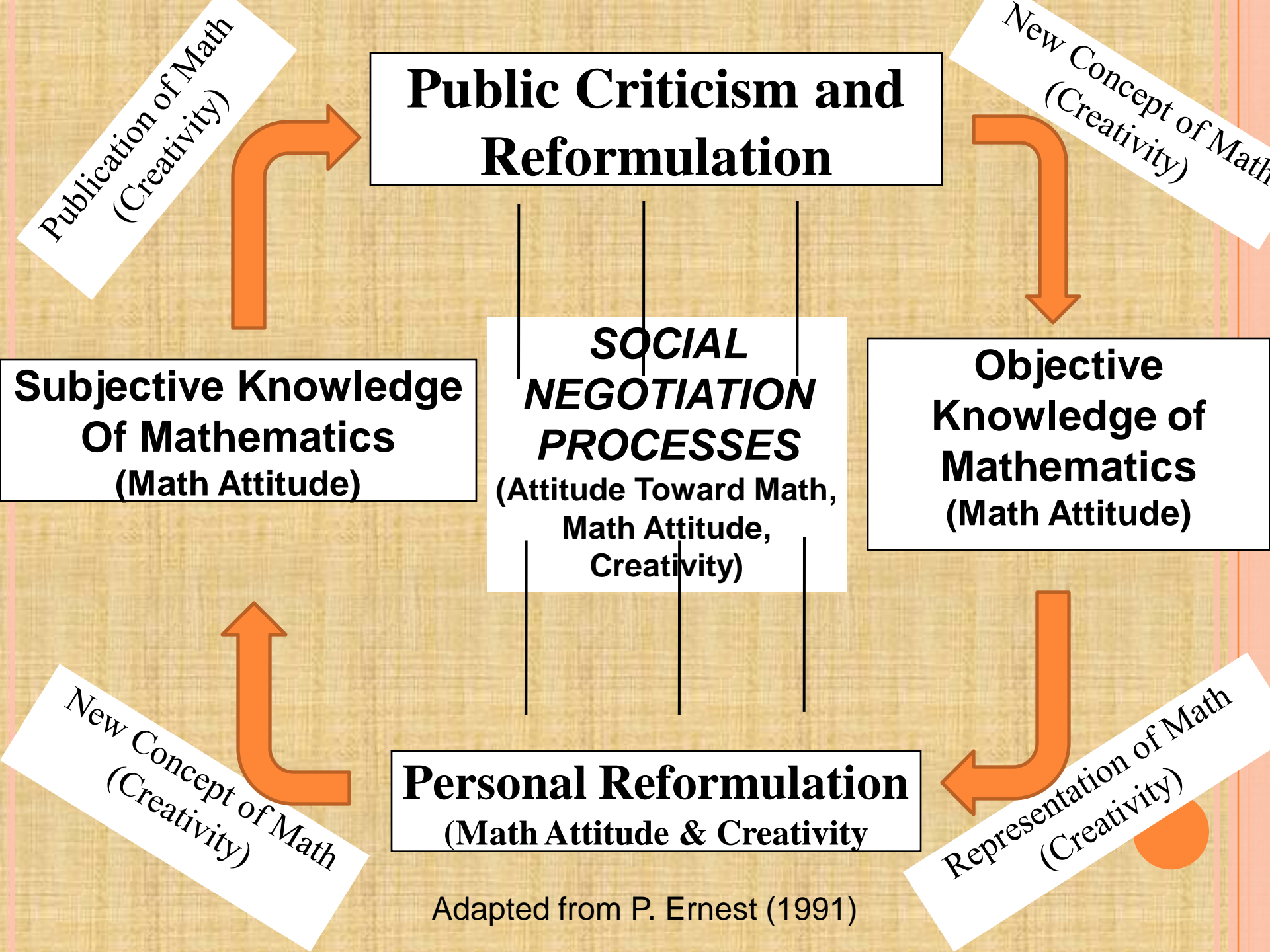


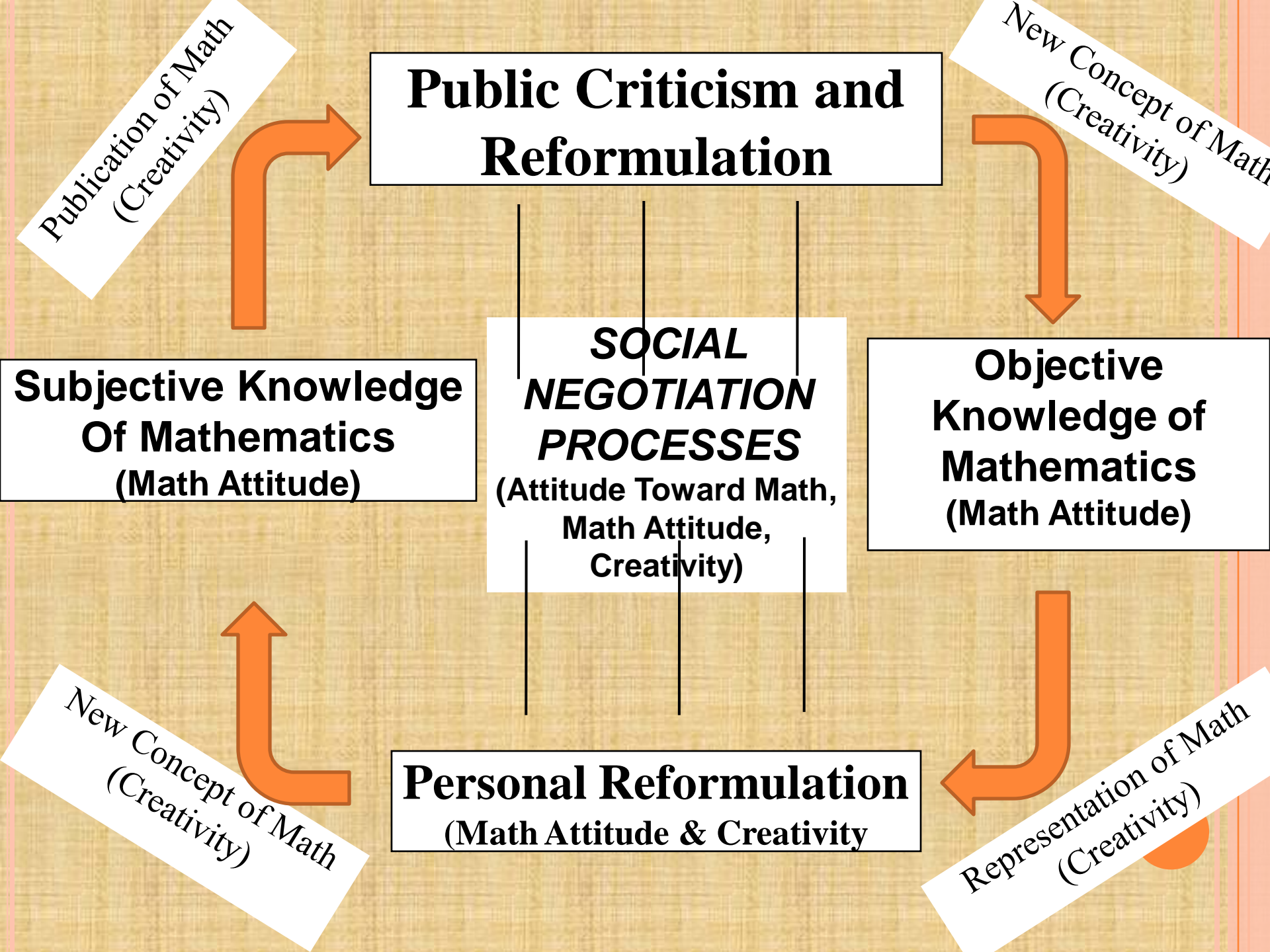
Mathematical Attitude (Katagiri, 2007)

4. Attempting to seek better things

- Attempting to raise thinking from the concrete level to the abstract level
- Attempting to evaluate thinking both objectively and subjectively, and to refine thinking
- Attempting to economize thought and effort









EVIDENCES

INDICATE:



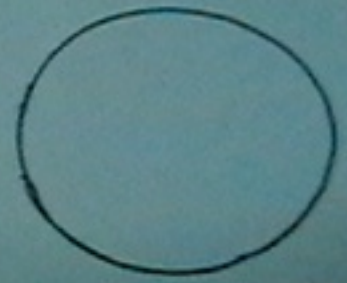
**THE STUDENTS ARE TO DEVELOP
MATHEMATICAL ATTITUDE AND CREATIVITY
THROUGH SOME FOLLOWING ACTIVITIES:**

- 1. Identifying or describing the specific mathematics :
 - a. in the routine activities*
 - b. in the non-routine activities**
- 2. Schematizing, formulating and visualizing a problem in different ways*
- 3. Discovering relations among mathematical concepts*



425

Permukaan



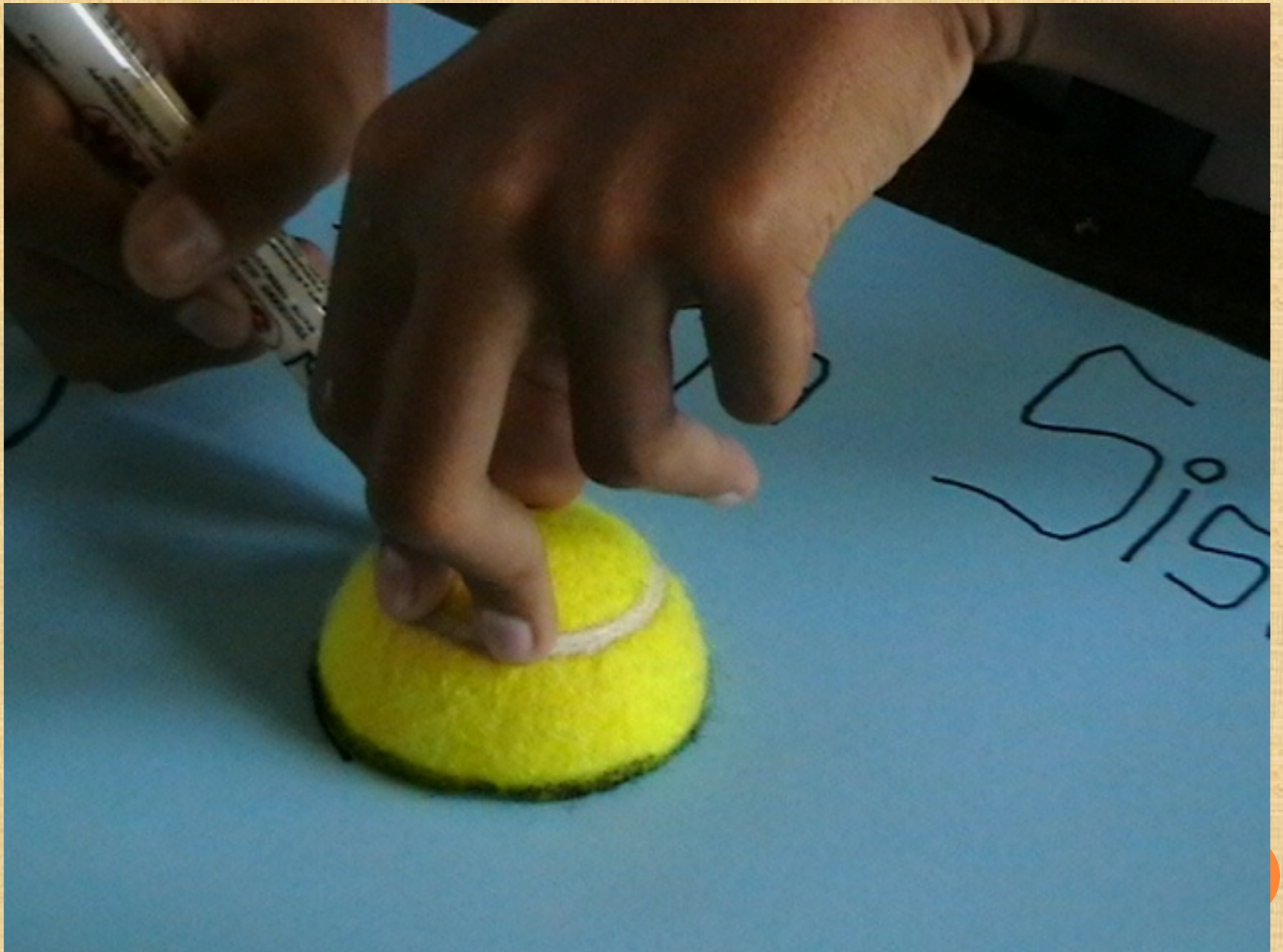
berapa daerah lingkaran yang tertutup tali?
daerah lingkaran yang tertutup tali
dapat kalian simpulkan?



**THE STUDENTS ARE TO DEVELOP
MATHEMATICAL ATTITUDE AND CREATIVITY
THROUGH SOME FOLLOWING ACTIVITIES:**

- 4. Discovering regularity arousing
from the concepts of “routine
activities”*
- 5. Recognizing isomorphic aspect
in different problems*
- 6. Transferring a real world problem
to a mathematical problem*

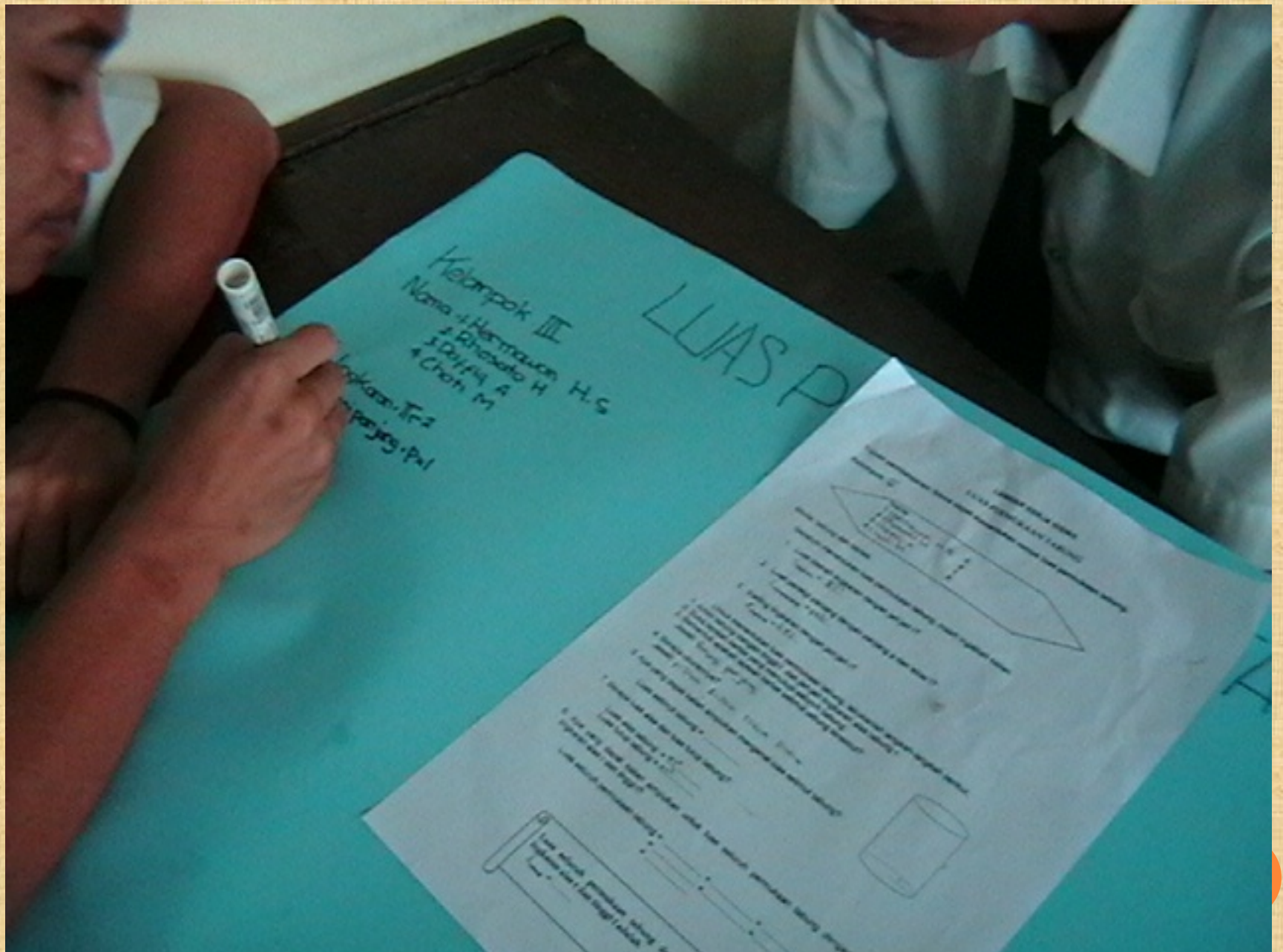




**THE STUDENTS ARE TO DEVELOP
MATHEMATICAL ATTITUDE AND CREATIVITY
THROUGH SOME FOLLOWING ACTIVITIES:**

- 7. Striving to represent daily problems in a related mathematical formula*
- 8. Strived to prove regularities of consisting concepts*
- 9. Refined and adjusting mathematical models*
- 10. Performing vertical mathematization by employing different models*



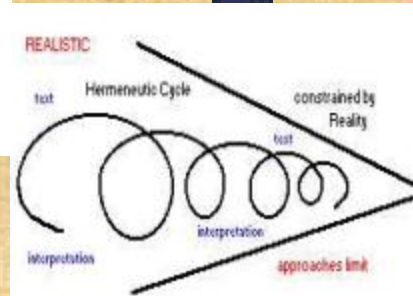
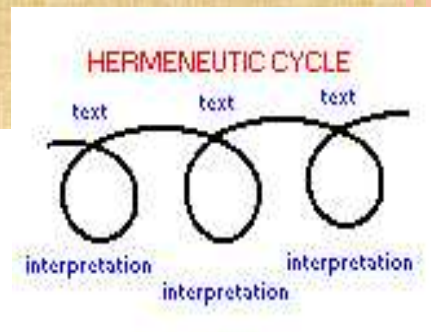
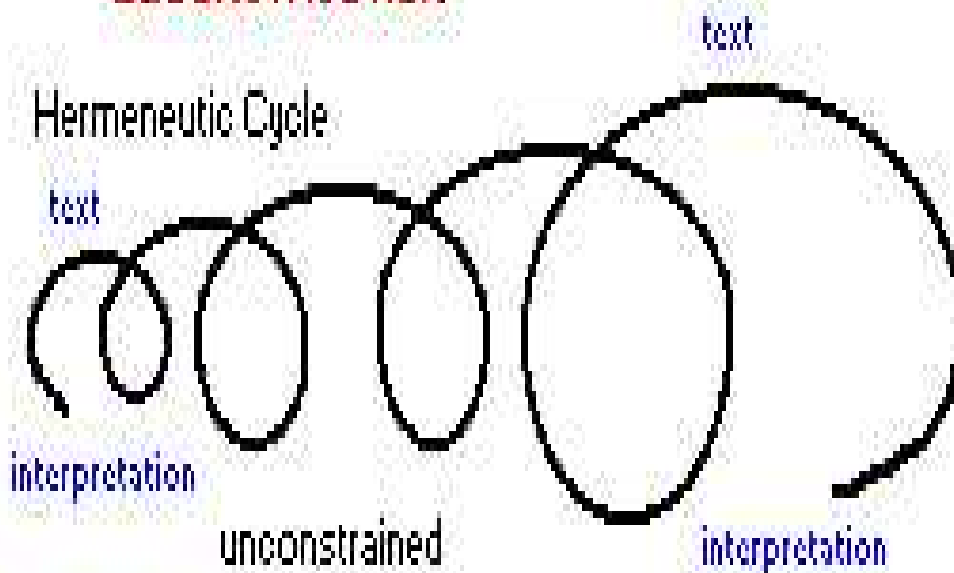




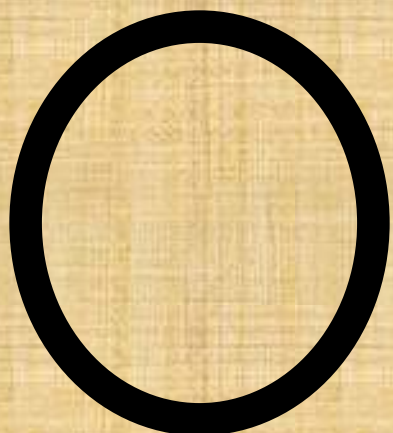
ICEBERG APPROACH TO MATH ATTD.

Vertical Mathematics

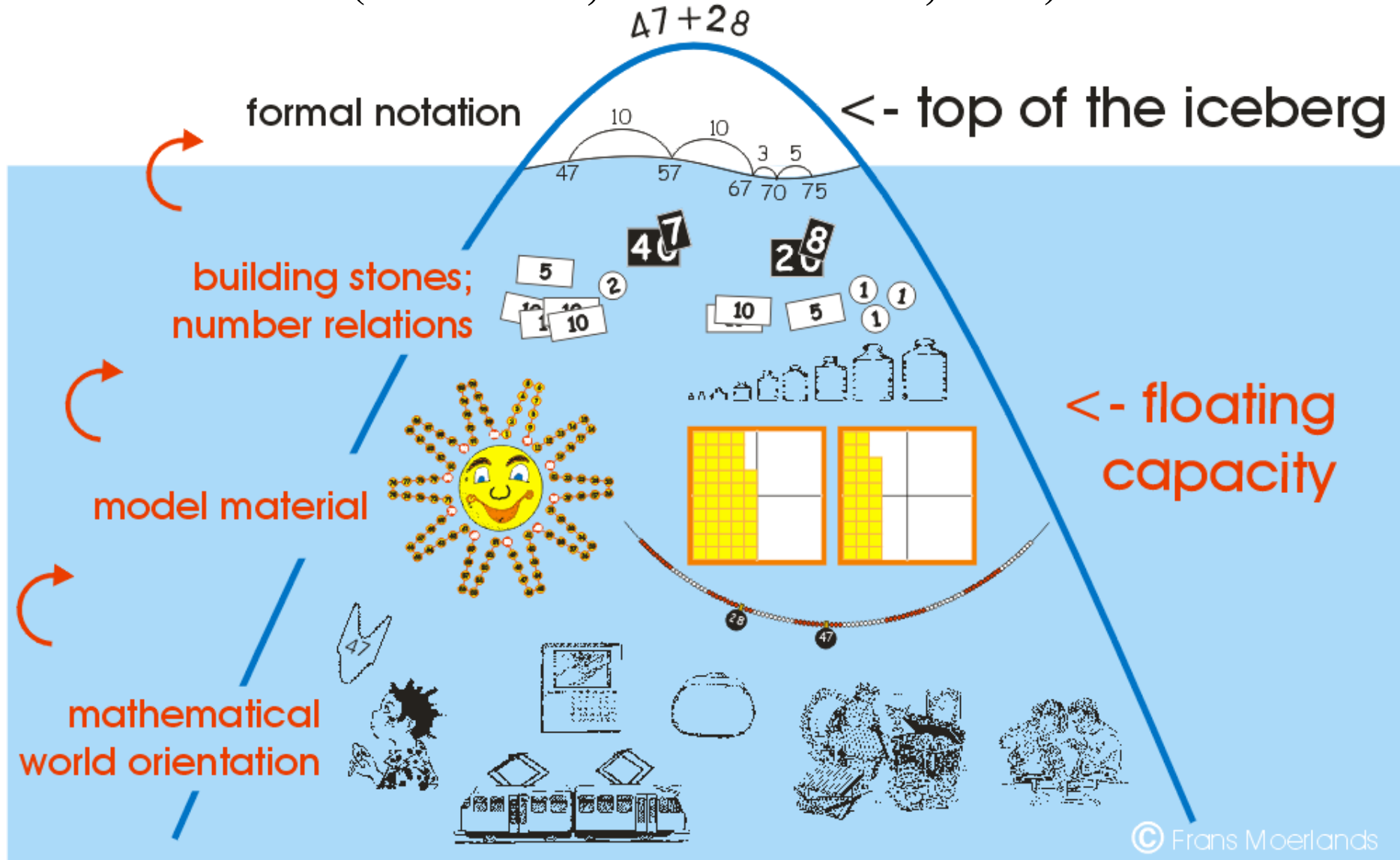
DECONSTRUCTION



Horizontal Mathematics



Iceberg Approach in Realistics Mathematics (Moerlands, 2004 in Sutarto, 2008)



THE ICEBERG

$$\frac{1}{8} - \frac{3}{8}$$

$$\frac{3}{5} - \frac{1}{2}$$



KPK (a, b)

$$\frac{1}{4} = \frac{4}{16}$$

$$\frac{3}{2} \neq \frac{9}{4}$$



Sisa kue



Sisa pupuk



Volume suara

GROUP 1

THE ICEBERG

25 % = ---
60 % = ---
75 % = ---
80 % = ---

Formal
Abstrak.

Membangun
Pengetahuan.

$$\frac{2}{3} \times 100 \%$$

$$\frac{2 \times 100}{3} \%$$

Membagi 200 dengan 3

$$\frac{200}{3} \%$$

Pemben-
tukan
Skema



Dunia
Nyata



AIR LAUT

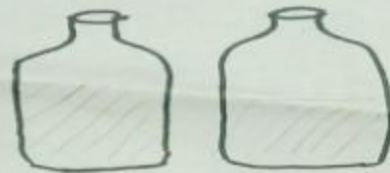
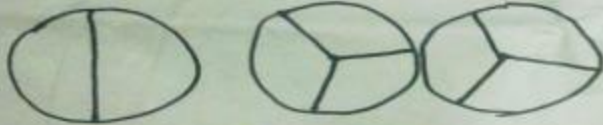
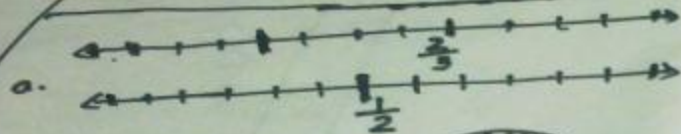
GROUP 2

THE ICEBERG

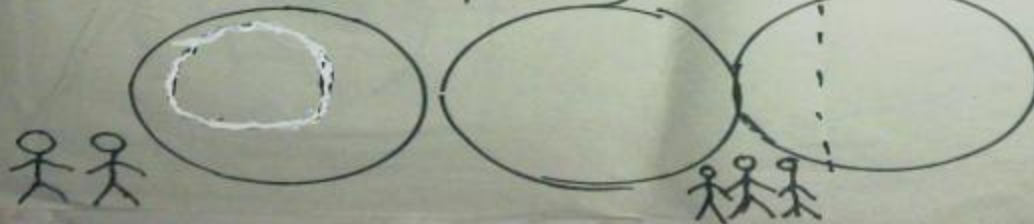
GROUP 3

$$\frac{2}{3} \cdot \frac{2}{3} = \frac{1}{2}$$

$$\frac{8}{12} \dots \frac{6}{12}$$



Membandingkan besar bagian dua potongan kue



kemasan barang

THE ICEBERG

$$0,35 = \frac{\dots}{\dots}$$

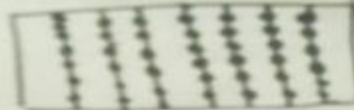
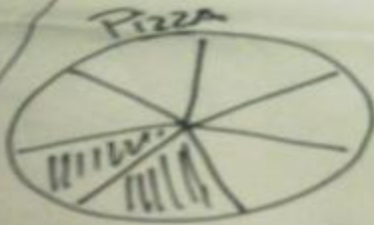
→ Formal
abstrak

$$0,35 =$$

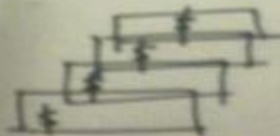
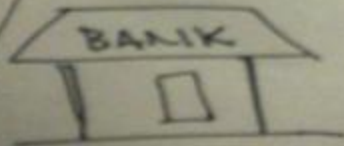
=

35
.....	20

→ Membangun pe-
ngetahuan



→ Pembentukan
Skema



→ Dunia Nyata

GROUP 4



MAGNET

Das Magnetfeld ist nach der Richtung der magnetischen Kraft eine magnetische Linie



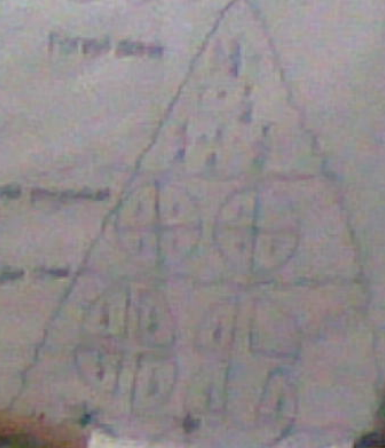
MAGNET



Die magnetische Kraft ist nach der Richtung der magnetischen Kraft eine magnetische Linie

THE ICEBERG

Forest area



Forest area

Forest area

Forest area







• C

• (4, 2)

• (5, 7)

• (12)

x
5
4
3
2



EVIDENCES

INDICATE:



**IN ORDER TO
PROMOTE MATHEMATICAL ATTITUDE
AND CREATIVITY:**

*The teachers need to have clear
picture of the NATURE OF
SCHOOL MATHEMATICS,
REALISTICS MATHEMATICS,
and CONSTRUCTIVE TEACHING*





IN ORDER TO PROMOTE MATHEMATICAL ATTITUDE AND CREATIVITY:

The teachers need to organize presentation, demonstrate and interconnected relationships among the components of mathematical attitude





IN ORDER TO PROMOTE MATHEMATICAL ATTITUDE AND CREATIVITY:

The teachers need to promote students' mathematical attitude and creativity on using concrete materials (i.e., manipulatives) before proceeding to semi-concrete materials (e.g., pictorial representations); and before proceeding to abstract problems (e.g., numerical representation)





IN ORDER TO PROMOTE MATHEMATICAL ATTITUDE AND CREATIVITY:

The teachers need to develop methods to uncover the variations of all problem types lead the students to make generalizations (e.g., that all fractions represent parts of a whole)





**IN ORDER TO
PROMOTE MATHEMATICAL ATTITUDE
AND CREATIVITY:**

*The teacher need to develop various
methods of teaching, various
learning resources, and various
interaction / communication*



元直でう！ 田んぼの自然



IN ORDER TO PROMOTE MATHEMATICAL ATTITUDE AND CREATIVITY:

The evidences indicated that most teachers still have problems in developing mathematical attitude in the frame of mathematical world orientation to formal form of mathematics.





**IN ORDER TO
PROMOTE MATHEMATICAL ATTITUDE
AND CREATIVITY:**

Material model of mathematics and searching the relationship help the teacher to develop method to encourage students to develop their mathematical attitude and creativity.







THANK YOU

