

# MANIPULATIVES AND CREATIVITY

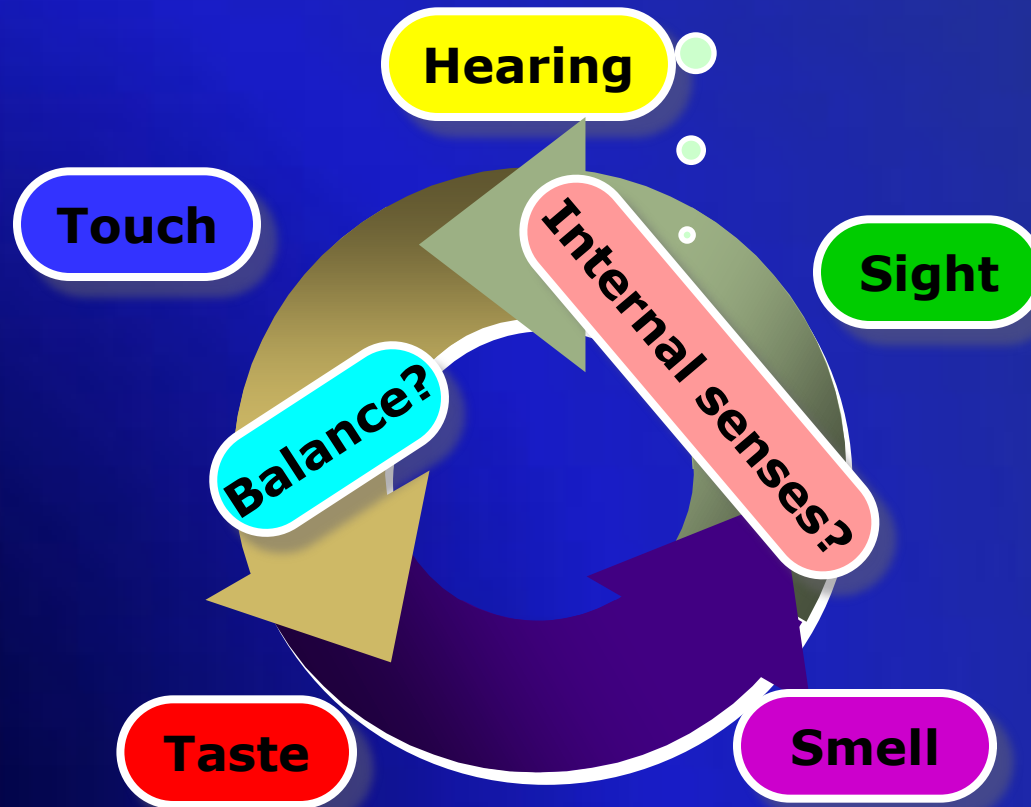
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# Epistemology and Sense

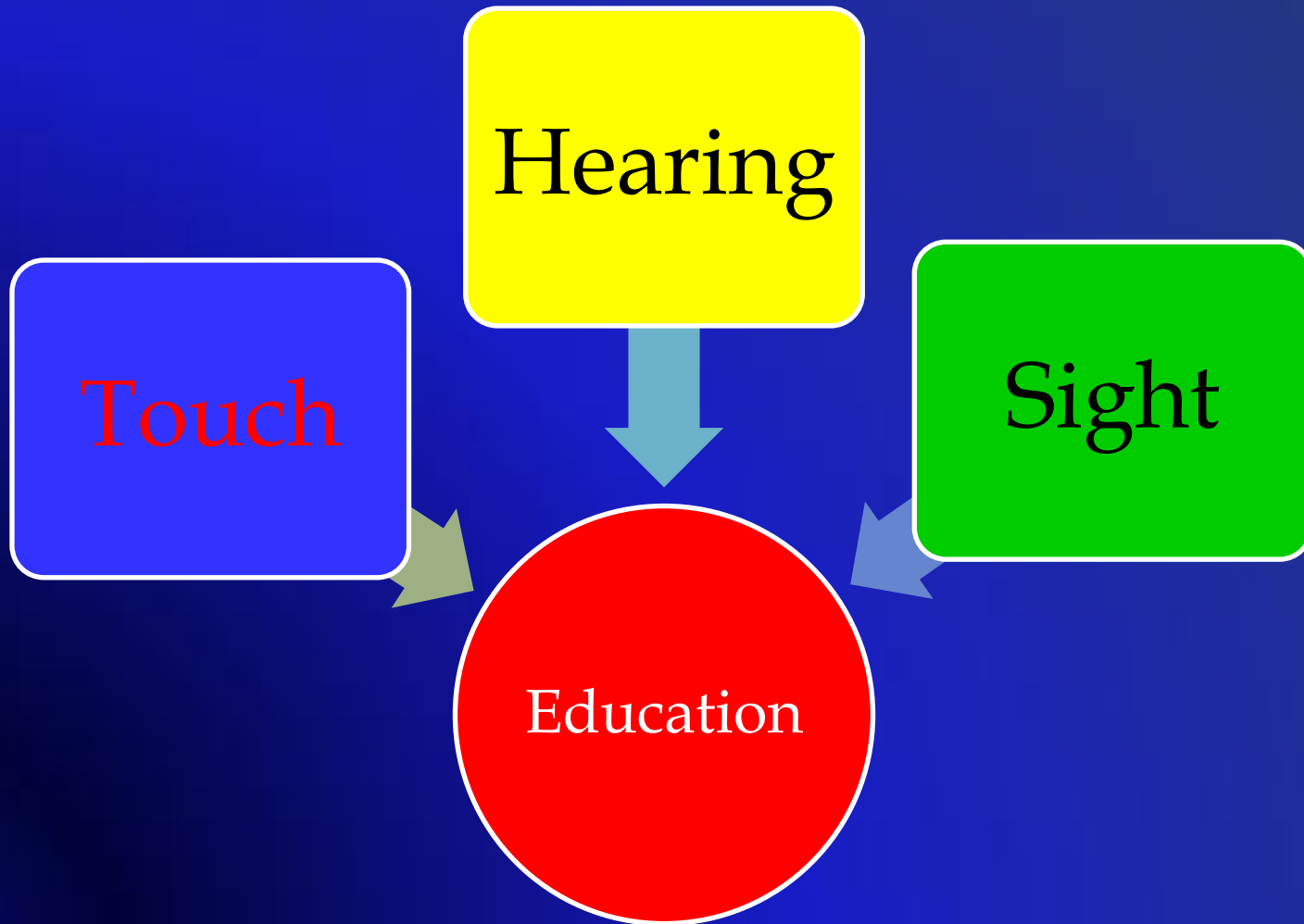
- ▣ Senses are physiological capacities of organisms that provide data for perception (Wikipedia, 2013)
- ▣ Five senses: hearing, sight, touch, taste, and smell
- ▣ Other senses: balance, pain, other internal senses
- ▣ How are senses related to students' epistemology?

# Senses for Epistemology

Interwoven and interrelated senses and their synergic effects on students' epistemology



# How to enact creativity education? Senses?



# How to enact creativity education? Contents?



# Detailed Course Schedules

Hearing

- Week 1: Classroom rules
- Week 2 – 5: **Storytelling** & creativity
- Week 6 – 7: Discussion & field experience
- Week 8 – 9: **Manipulatives** & creativity
- Week 9 – 10: Field experience & discussion
- Week 11 – 12: **Representation** & creativity
- Week 13: Discussion
- Week 13 – 15: Group presentation
- Week 16: Survey

Touch

Sight

# What are manipulatives?

- ▣ Manipulatives is any of various objects or materials that students can touch and move around in order to help them learn mathematical and other concepts (Dictionary.com, 2013)
- ▣ Manipulatives is any of physical objects to support (develop or reinforce) students' mathematical thinking

# Why manipulatives?

- ▣ Students' active engagement in learning process (by physical movement and interests)
- ▣ From the concrete to the abstract level
- ▣ From the semiconcrete (representation of a real situation) to the semiabstract (symbolic representation of concrete items) (Heddens, 1986)
- ▣ From knowing to doing



# Learning and the use of manipulatives

(Adding it up, 2001)

- ❑ Manipulatives should be considered as not an end, but as a means in themselves.
- ❑ Students need sufficient time to build meaning and make connections.
- ❑ It can be a challenge for students to see mathematical ideas in them (manipulatives).

# Learning and the use of manipulatives

(Adding it up, 2001)

- ▣ Manipulatives also help students correct their own errors.
- ▣ If students do not see the connections among object, symbol, language, and idea, using a manipulatives becomes just one more thing to learn rather than a process learning to a larger mathematical learning goal.

# First Example of manipulatives (Sums of interior and exterior angles)

- <http://www.mathlove.kr/shop/board/view.php?id=mathmovie&tm=1&menus=share2&no=49>

From [www.mathlove.co.kr](http://www.mathlove.co.kr)

**Second Example of manipulatives  
(circular cone =  $1/3 \times$  circular cylinder)  
(pyramid =  $1/3 \times$  prism in volume)**

□ <http://www.mathlove.kr/shop/board/view.php?id=mathmovie&tm=1&menus=share2&no=44>

from [www.mathlove.co.kr](http://www.mathlove.co.kr)

# Third Example of manipulatives (Pythagorean Theorem)

- <http://www.mathlove.kr/shop/board/view.php?id=mathmovie&tm=1&menus=share2&page=3&no=5>  
from [www.mathlove.co.kr](http://www.mathlove.co.kr)
- **Paper folding from MATHEMATICA 1: The Pythagorean theorem 1**

# Fourth Example of manipulatives

$$(a-b)^2 = a^2 - 2ab + b^2$$

▣ 김유정 선생

# Reference

- ▣ Heddens, J. (1986). Bridging the gap between the concrete and the abstract. *Arithmetic Teacher*, 33(6), 14-17.
- ▣ Kilpatrick, J., Swafford, J., & Findell, B. (Eds.). (2001). *Adding It Up: Helping Children Learn Mathematics*. Washington, DC: National Academies Press.

Q&A