

Korean Society of Educational Psychology  
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**How can *Asian*  
*educational psychologists*  
contribute to the  
advancement of learning  
sciences?**

**Naomi Miyake**  
(in place of Giyoo Hatano)  
Chukyo University

**What does the society  
wants us to do nowadays?**

**Maybe we need a vision,  
based on reliable theories  
of learning, to show  
how to create sustainable  
learning communities**

# Emerging new forms

- Practice-based research with research-based practice
- e-learning for sustainable learning
- CSCL Computer support for collaborative learning
- Distributed learning
- • • •

# Distributed learning

- We have a problem. You may have solved it in a way we never thought of. Let us try that, we might be able to give you feedback to improve it.
- You may have a problem, which we could have a solution. Why don't we compare and examine and learn from each other? Computers might be useful.

# Changes in goals of learning

- High academic performance “at the end of the course”

PLUS

- The knowledge learned has to be *usable* in the future, in new situations
  - Knowledge has to be “*Portable.*”

# What is “*portability*”?

- Procedural understanding is situated, bound with concrete examples and particular goals and tools.
- More abstract, conceptual or schematic understanding, which is flexible enough to be used in different, new situations.

# Key learning activities

- **Reflection** by the students on their own learning and problem solving processes.
- **Comparison** of varieties of solutions, and different ideas of others on the same problem.
- **Control** of one's own learning process and check its outcome.

# How to scaffold such activities

- Many studies in the U.S. and Europe, built on some theoretical/practical contributions by Asian researchers (including Hatano), use *“collaborative learning activities”* with scaffolds, some with technology.



# Why collaboration?

- It is an effective way to have learners engage in *active learning*, constructing of their own understanding.
- Collaboration provides learners with variety of *externalizations, for reflection*.
  - Targets for integration, abstraction, etc.
- As a research methodology, it provides us with chances to collect *process data*, so that we can understand the learning better.

# A “guide” book

- Bransford, J., et al. (1999) “*How people learn,*” National Science Academy

## **An example**

**A higher-ed,  
collaborative learning environment  
developed and tested  
of cognitive science  
at Chukyo University**

# Theoretical background

- *We believe that the students need to engage Iteratively in Cycles of Learning*
  - *the same learning content, in order to gain firm understandings with details,*
  - *at different times,*
  - *in different contexts, so that the students could abstract the gist and relate it to other pieces of knowledge.*

# Scale of our study

JST CREST: 2000-2004; SORST: 2005-2007

- Two 90 min. classes per semester
- Four semesters for the first two years of college
- Seventy students per year on average
- Data collection since 2000
- Serious data collection since 2003

# Classes

Freshmen Spring & Fall



Concept Mapping tool  
for sharing externalizations



Sophomores Spring & Fall



# Classes under study

	Admitted in 2001	Admitted in 2002	Admitted in 2003	Admitted in 2004
Spring 2001	Orientation to CogSci			
Fall 2001	CogSci Method 1			
Spring 2002	CogSci Method 2	Orientation to CogSci		
Fall 2002	CogSci 2	CogSci Method 1		
Spring 2003		CogSci Method 2	Orientation to CogSci A/B	
Fall 2003		Cogsci 2	Introduction to CogSci A/B	
Spring 2004			Medium CogSci CogSci Method 1	Orientation to CogSci A/B
Fall 2004			Advanced CogSci CogSci Method 2	Introduction to CogSci A/B

# Research context

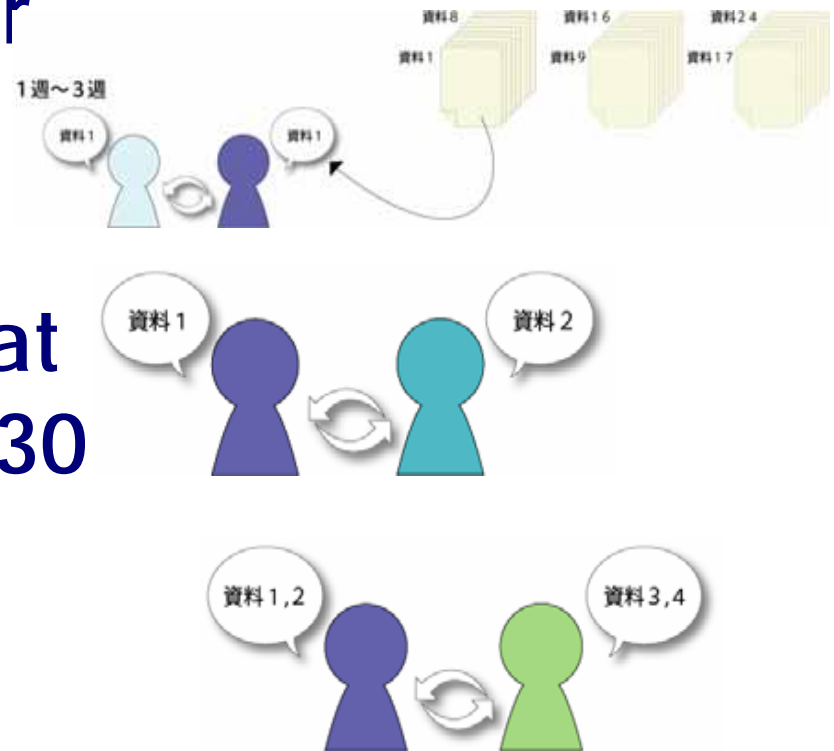
At the second semester of the second year

- Collaborative comprehension and integration of 24 short scientific texts in the method named “Dynamic Jigsaw” (*somewhat like what a lecturer prepares as lectures*)



# Dynamic jigsaw

- Jigsaw as a tool for collaborative reflection, and
- Dynamically repeat this to cover 20 to 30 research findings.



# Learning materials

- Material

  - Twenty-four literature pieces

    - Eight on development
    - Eight on perception and knowledge representation
    - Eight from problem solving, culture and society

## Essentialism

認知科学上層資料 2004 夏の巻 34, 35

平野元也の中心理解の文章法

平野元也の中心理解の文章法

平野元也の中心理解の文章法



図：動物の習性としての犬の行動

認知科学上層資料 2004 夏の巻 34, 35

平野元也の中心理解の文章法

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平野元也の中心理解の文章法

Two sided A4 each

# With 24 texts, what an $n^{i+1}$ expert does

1 x 1	$n^{i+1}$ and $n^{i+2}$
2 x 2	$n^{i+1} + n^{i+2}$ and $n^{i+3} + n^{i+4}$
4 x 4	$n^{i+1} + n^{i+2} + n^{i+3} + n^{i+4}$ and $n^{i+5} + n^{i+6} + n^{i+7} + n^{i+8}$
1 <sup>st</sup> 8 x 8	$n^{i+1} + n^{i+2} + \dots + n^{i+7} + n^{i+8}$ and $n^{i+9} + n^{i+10} + \dots + n^{i+15} + n^{i+16}$
2 <sup>nd</sup> 8 x 8	$n^{i+1} + n^{i+2} + \dots + n^{i+7} + n^{i+8}$ and $n^{i+17} + n^{i+18} + \dots + n^{i+23} + n^{i+24}$

# Learning activities

- Aggressive reading focused on one's own point of view
- Concept mapping for integration of viewpoints
- Generating and exchanging various explanations according to listener's needs within a given time
- Collaborative reflection
- Question asking and critiquing
- Integration of exchanged explanations

# Overall performance

- All 24 learning materials were covered in 83% of the term papers, out of which 56% had the necessary components, including the theme, evidence, conclusions, and implication.

# Outcome evaluation

- How does this compare against lectures?
- How integrated are their concept maps?
- How much relations could student make between cognitive science and its utility?
- What is the process of collaborative integration under this iterative learning cycles?

# How does this compare against lectures?

## Retrospective interview

Four to six months after the completion of the two-year course, comparing regular lectures and dynamic jigsaw classes.

# Remembering “a lecture”

5 months later

**EXP: What do you remember?**

**ST: ... uhh, he talked about meta-cognition, and uhh, he talked about the baseball player, Ichiro, and, and ...that’s all.”**



Class type	# of targets	% recall Facts + Implication	% recall Keywords only
Lectures	11	2.2%	56.1%



# Remembering “a lecture”

5 months later

“ (What did you remember?) ...  
uhh, he talks about **meta-**  
**cognition**, and uhh, he talks  
about the baseball player,  
Ichiro, and, and ...nothing.”



Class type	# of targets	% recall Facts + Implication	% recall Keywords only
Lectures	11	2.2%	56.1%

# Remembering from jigsaw

**EXP:** What did you read? What kind of a story?

**ST:** Okay. It was about an experiment of pigeon's memory.

If we destroy a particular part of her brain, it can still distinguish the edible things from the non-edible, but cannot tell a triangle from other figures. So, the functions needed for living are distributed among different parts of the brain, even pigeon's brain"

4 months later

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Jigsaw	22	15.8%	7.7%

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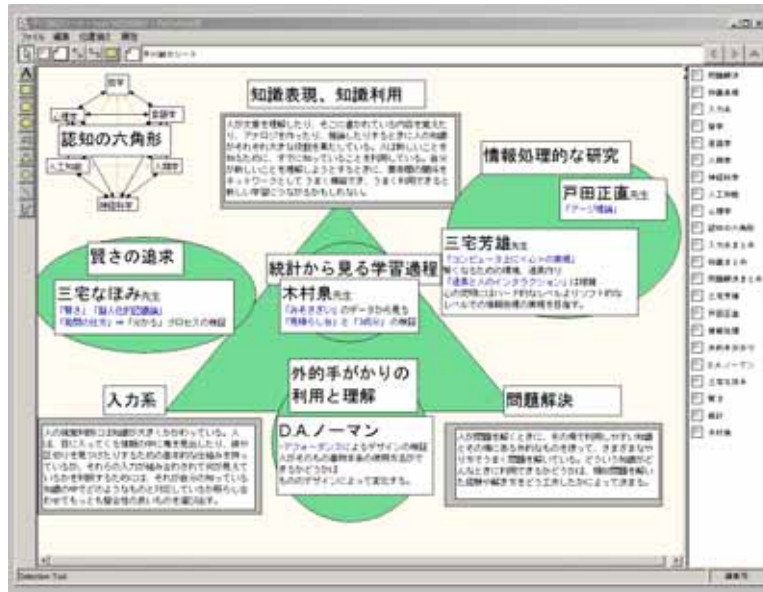
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# ReCoNote:

## A concept mapping tool



- Notes on sheet, with relations
- Layered sheets
- Free referring to others' notes and sheets
- Free copying of others' sheets and notes

# How integrated are the final concept maps?

- “Width”
  - How many research pieces on one layer?

by

- “Depth”
  - How many interlinked layers?

# Concept map categories

<b>Deep and Wide</b>	<b>26%</b>
<b>Shallow but Wide</b>	<b>22%</b>
<b>Deep but Narrow</b>	<b>20%</b>
<b>Shallow and Narrow</b>	<b>19%</b>
<b>No maps</b>	<b>13%</b>

# Term papers

## Part 1

- **Short summaries of all 24 texts.**

## Part 2

- **Your view of what cognitive science is, by integrating the 24.**

## Part 3

- **How you could/would use this integrated knowledge in your everyday situations.**

# Usefulness of cognitive science

<b>Concrete with evidence</b>	<b>45 %</b>
<b>Concrete without evidence</b>	<b>33 %</b>
<b>Abstract</b>	<b>12 %</b>
<b>No description</b>	<b>20 %</b>



# Process of collaborative integration

- Yes, we want to do the process analyses...

# Class dialogue data of the dynamic jigsaw

One Recorder  
per Student



*They talk in  
Japanese...*

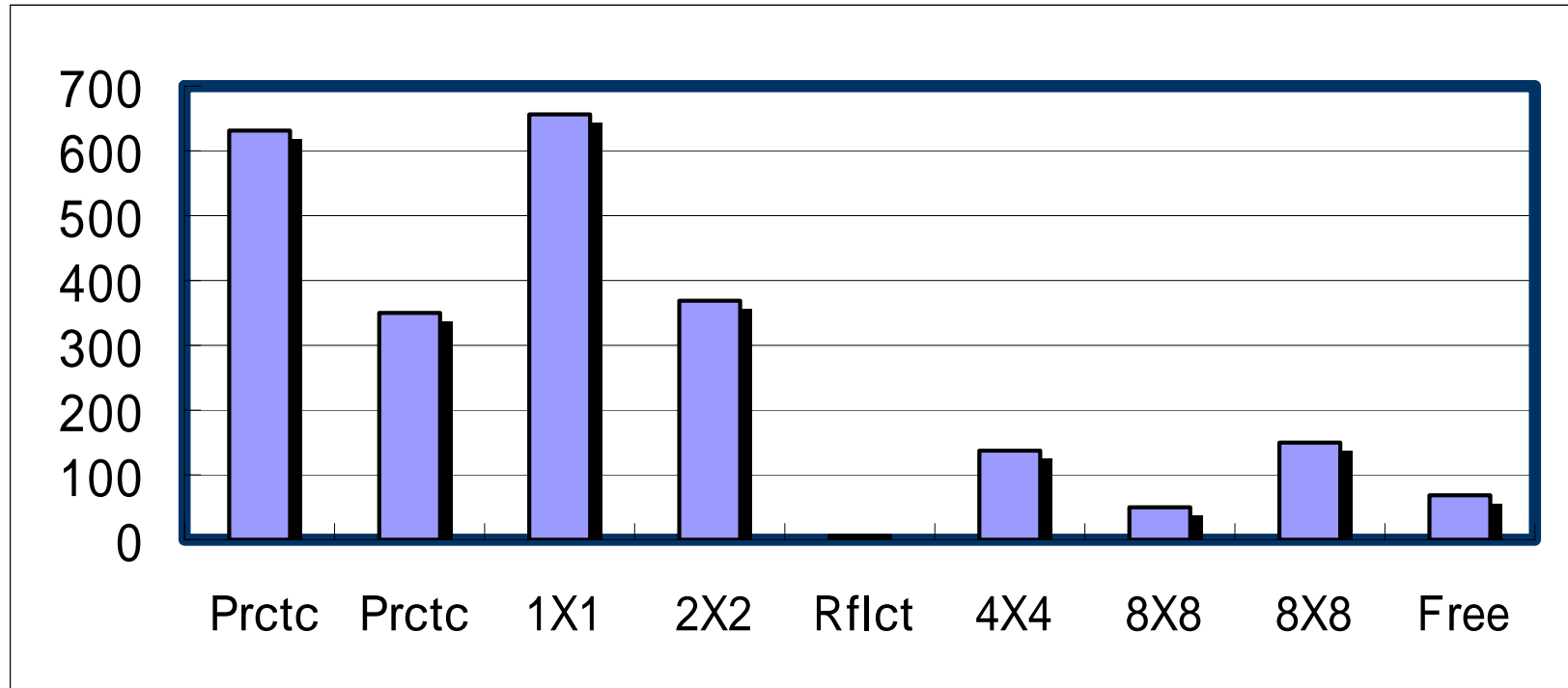
# Cases of content learning

- Depth of understanding achieved by Y.O.

# The dynamic jigsaw for Y.O.

19/Oct	Select 16 of (15, 16)
26/Oct	Answer quiz on 16, 15
02/Nov	Practice explaining 16 to TA
09/Nov	Practice explaining 15 to TA
16/Nov	1X1 15 & 16
30/Nov	2X2 (15,16)&(13,14)
07/Dec	Reflection on 2X2
08/Dec	4X4 (13-16)&(09-12)
14/Dec	8X8 (09-16)&(17-24)
15/Dec	8X8 (09-16)&(01-08)
22/Dec	Reflection on all 24

# Length of explanations of 16



Y.O.

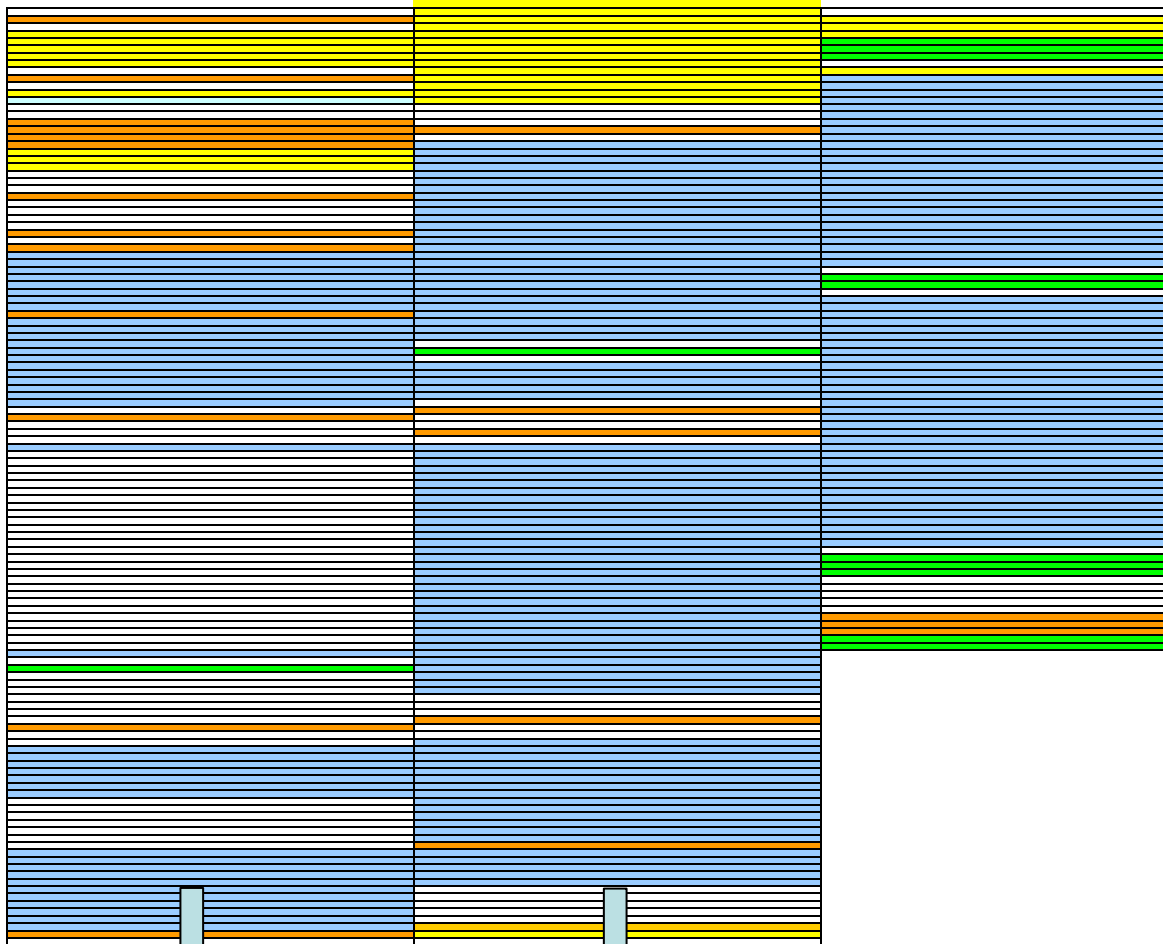
# Component structure of the explanations

Theme	The theme of the findings
Evidence	Experiments, observations, systems, line of logic...
Implications	Author's interpretations and implications
Connections	Student's interpretations and abstractions

11/09  
Prctc

12/07  
4X4

12/15  
8X8



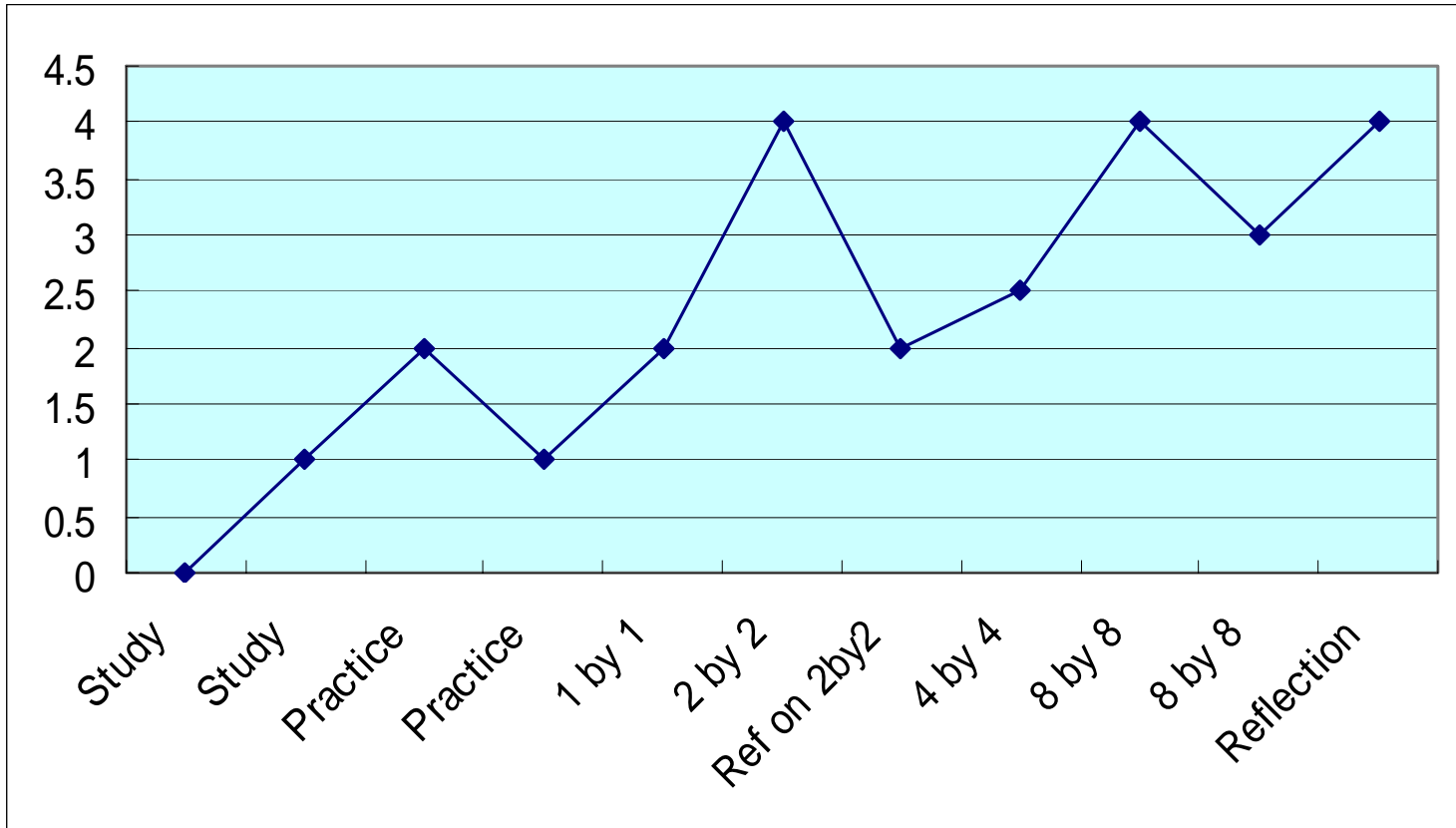
1st IC\_KSEP 2005

# Very schematic description of Y.O.'s understanding process

Level 4	Integration with confidence, expansion
Level 3	Integration neutral
Level 2	Integration with doubts, misunderstandings
Level 1	Trials of integration



# Pattern of growth (Y.O.)





# 16/Nov: While checking their notes, his partner voices a question about the text.

646	NT	We have written that knowledge gets transformed from declarative to procedural. Is this final?
649 - 655	YO	Yes, we finalized it...ah... maybe we can put it as a last comment.
666 - 675	NT	We have talked... from declarative to procedural transformation rather extensively. But couldn't it be reversed, like the other way around? Is this actually related to automatization? I don't understand.
686 - 687	YO	We don't have good examples of automatization, yeah.

## 30/Nov -1: After exchange, YO develops his own interpretation

441 445	YO	I just thought... we might not use procedural knowledge intentionally, but to be conscious about it is, maybe, cognitive science...
446	NT	Ah...
447 - 448	YO	So, those human behaviors are difficult to explain,
449 - 450	KT	...but we make them explainable in words.
451 - 464	YO	Let me try again, cognitive science is a process of transforming procedural knowledge into declarative knowledge. How s that?



# How does Y.O. stand out against other students?

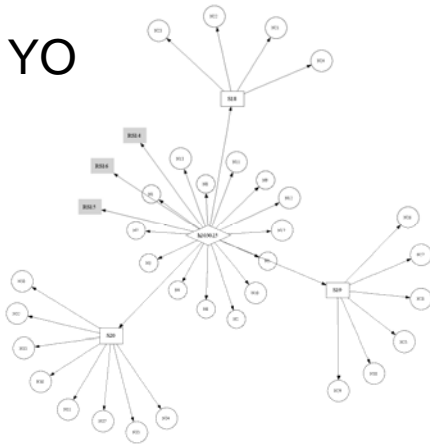
- This aspect of knowledge integration gives us one aspect or a form of learning outcome.
- There are other aspects where Y.O. does not always stand out.

# Cases of content learning

- S.T. finished the course with a good breadth and width of integrated knowledge of the 24 materials.

# Comparison of final CM's (Schematic)

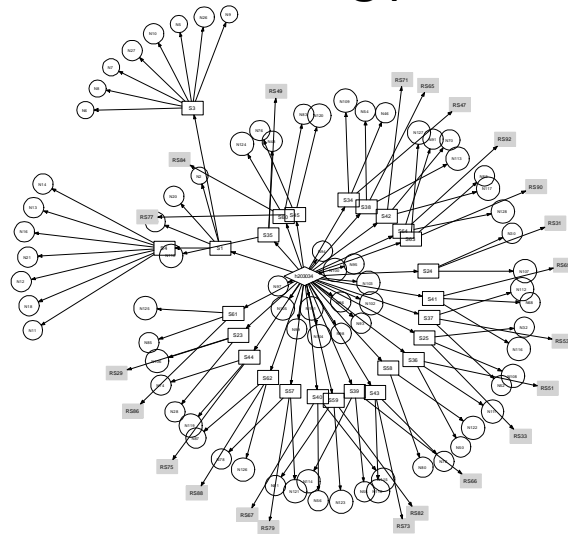
YO



KM



ST



# Cases of content learning

- S.T. finished the course with a good breadth and width of integrated knowledge of the 24 materials.
- *"Ask me what each of these researches is like next year. If you give me access to this map, I'm pretty sure I can give you details."*

# Learning of cognitive skills

- Question asking skill by K.M.
- Y.O. and S.T. are less verbal about their learned cognitive skills in their term papers.



# K.M.'s QA strategy

- *"Most of, maybe all of the materials come with some obvious halls inviting questions. I start with those, and think of a deeper question while my partner is giving me the expected answer—that gives me time to think."*
- She tried this in upper level classes, and has found out so far that this does not always work, but...

# Emerging pattern

- Y.O. gives more concise explanation towards the end, in more “generalizable” form.
  - This pattern appears to be general ...
- S.T. created a highly integrated grasp of all the materials.
  - The pattern is often more fragmental, quite satisfying for the creators, and shows strong trace in retrospective interviews.
- K.M. acquired a rudimental QA skill, which she is willing to develop further.
  - This takes many different forms differing for each individual.
- Thus a call for new methods of learning studies, with new evaluation methods.

# What can EdPsych contribute to the world?

- Diversity *IS* the power.
- We don't always know each other even among us, but that can be a source of our new learning.
- We can, both individually and collaboratively, contribute to the world with *our culturally supported learning practices, with methodologically sound analyses and evaluation*, to increase the credibility and diversity in learning research, for higher levels of education worldwide.

*Thank you very much!*