



HELSINGIN YLIOPISTO  
HELSINGFORS UNIVERSITET  
UNIVERSITY OF HELSINKI

# TEACHERS' PRACTICES IN SCAFFOLDING PRIMARY STUDENTS' TECHNOLOGY- ENHANCED COLLABORATIVE INQUIRY

**Minna Lakkala<sup>1</sup>, Marjaana Veermans<sup>2</sup> & Liisa Ilomäki<sup>1</sup>**

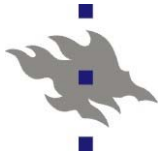
<sup>1</sup>Department of Psychology, University of Helsinki

<http://www.helsinki.fi/science/networkedlearning>

Minna.Lakkala@helsinki.fi

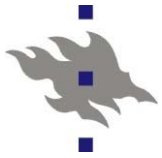
<sup>2</sup>Educational Technology Unit, University of Turku

ITK'06

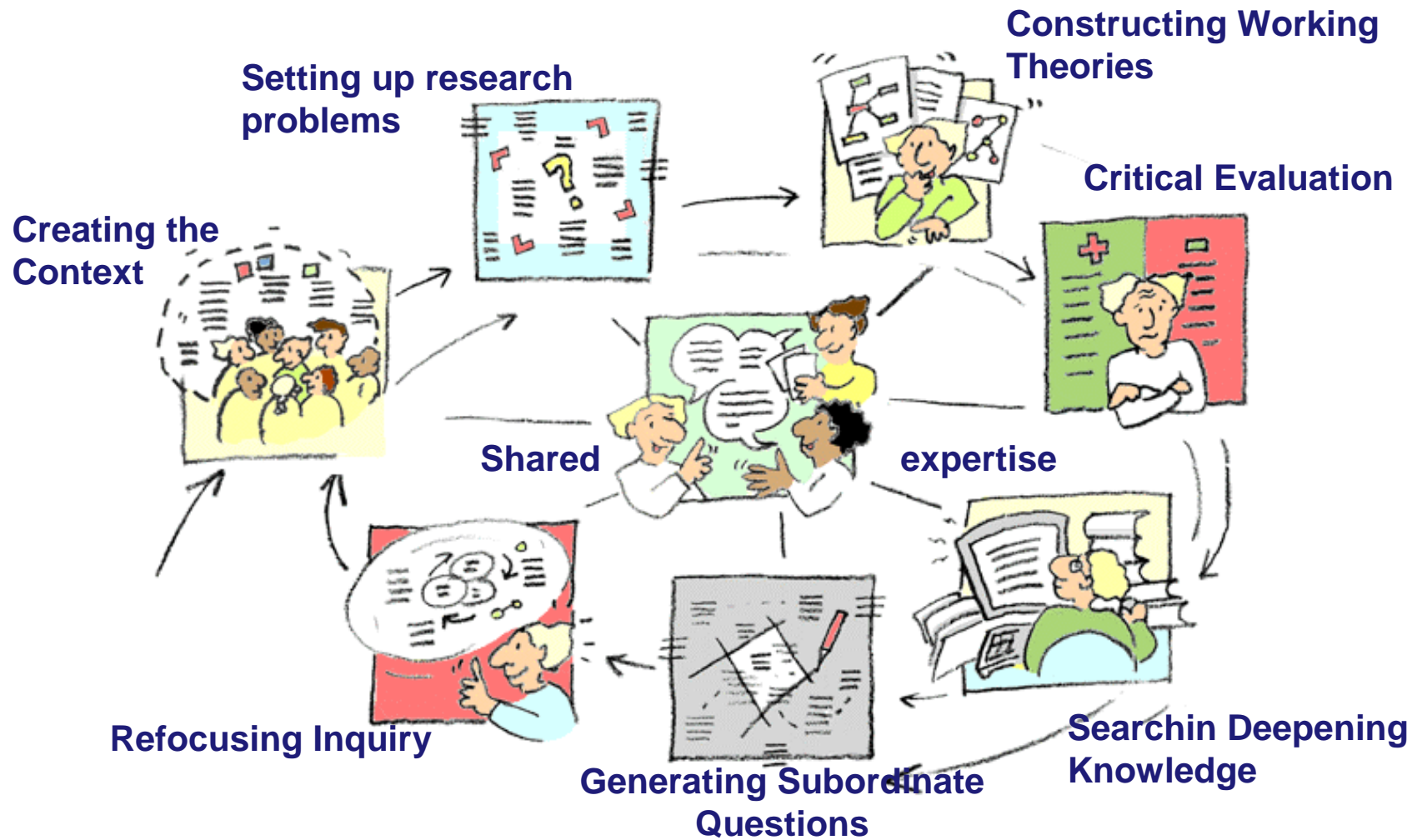


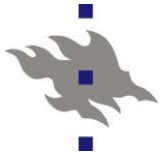
## Introduction

- Question: How should teachers support young students to learn expert-like practices of inquiry and utilisation of collaborative technology?
- Focus: Analysing elementary teachers' authentic pedagogical designs and practices in real school settings.
- Context: The data were collected during the international ITCOLE project funded by European Union:  
Innovative Technology for Collaborative Learning and Knowledge Building (<http://www.euro-cscl.org/site/itcole>)



# Progressive Inquiry as a pedagogical framework in the project (Hakkarainen, 2003)





## Collaborative technology used: FLE3 (<http://fle3.uiah.fi>)

- Open Source and Free Software
- The pedagogical model of Progressive Inquiry is embedded in the FLE design
- *Knowledge building* (KB) module
  - threaded discourse forums
  - labelling of notes by Progressive Inquiry knowledge types
- *Virtual WebTops* for storing and sharing documents
- *Jamming* for sharing and structuring the versions of elaborated, shared artefacts.

# FLE3's Knowledge Building area



Microsoft Internet Explorer window showing the FLE3 Knowledge Building area. The browser title is "Fle3 / course 10 salaisuutta 5A / context Kuvia seinällä 1 / thread Kuvia seinällä / note muumi". The address bar shows the URL: [http://fle3.edu.hel.fi/FLE/courses/2758/3255/3266/3359/index\\_html?state\\_url=12,19cc\\_order80978270,8518,8626,897812,44cc\\_order26813245,3247,3239,3241,3243,3235](http://fle3.edu.hel.fi/FLE/courses/2758/3255/3266/3359/index_html?state_url=12,19cc_order80978270,8518,8626,897812,44cc_order26813245,3247,3239,3241,3243,3235).

The page has three tabs: "WebTop", "Knowledge Building" (active), and "Jamming". Below the tabs, there is a "Change to another course" dropdown menu set to "10 salaisuutta 5A".

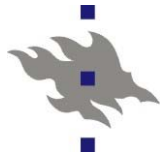
The main content area is titled "10 salaisuutta 5A" and lists a long list of user names. Below this, it shows the current context: "You are in: course 10 salaisuutta 5A / context Kuvia seinällä 1 / thread Kuvia seinällä / note muumion paluu".

The "Oma selitys" (My explanation) section shows a note titled "muumion paluu" by user "IlariaH" dated "10:30 2002-10-23". The note text reads: "Minun mielestäni...kuva on egyptistä,faaraon haudasta.Seinällä on ihmisiä jotka ehkä muumioivat faaraon ja valmistelevat sen hautaa." Below the note is a "Reply" button and a "knowledge type" dropdown menu.

At the bottom, there are navigation options: "Show notes", "as thread" (selected), "by knowledge type", "by person", and "by date". A "Show bodies of all notes" link is also present.

The bottom of the page shows a tree view of notes:

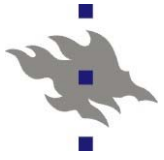
- o (ong) Kuvia seinällä / VelimattiH / 2002-10-23
  - (oma) muumion paluu / IlariaH / 2002-10-23
    - o (oma) Entä kuvat seinällä? / VelimattiH / 2002-10-27
    - o (tietoa) kuva faaraosta / IlariaH / 2002-10-30



## Analysing five classroom projects applying progressive inquiry and FLE3

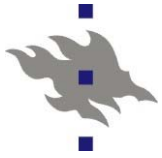
NOVICE TEACHERS EXPERIENCED TEACHERS

<i>Title of the project</i>	<i>Subject domains</i>	<i>School grade</i>	<i>Age of students (years)</i>	<i># of students</i>	<i>Duration (weeks * hours /week)</i>	<i>Special features</i>
<b>1. Ten secrets A</b>	History, native language	Primary 5 <sup>th</sup>	11-12	29	8 * 4-8 h	The idea was to interpret historical pictures from various time periods to understand history. Two classes from the same school conducted similar units and collaborated.
<b>2. Ten secrets B</b>	History, native language	Primary 5 <sup>th</sup>	11-12	27 (+ 6 from A)	8 * 4-8 h	
<b>3. Studying sea coast organisms</b>	Natural sciences	Primary 3 <sup>th</sup>	9-10	18	11 * 2 h	Students visited a nature-education centre, and collected research material from a near seacoast as a start for their inquiry.
<b>4. Beculiar seas</b>	Natural sciences, native language	Primary 6 <sup>th</sup>	12-13	29	11 * 2 h	The purpose was to study how seas, especially sea currents, affect the milieu in different parts of the world.
<b>5. Phenomenal Baltic sea</b>	Natural sciences, native language	Primary 3 <sup>th</sup>	9-10	23	7 * 4 h	The purpose was to study the components of ecosystem, vegetation, and animal world in Baltic Sea.



## Two main aspects examined from the teachers' pedagogical designs

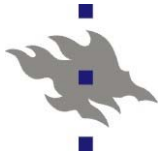
1. Pedagogical infrastructures – Organisation and structuring of the overall activity by establishing the underlying conditions for collective effort.
2. Scaffolding – The nature of teacher's adapted, situation-specific guidance and expert participation during the inquiry process.



## Pedagogical infrastructures

- *Technical infrastructure* – Access to technology, technical advice, use of technology, the nature of tools provided.
- *Social infrastructure* – Arrangements to support collaboration, sharing of the process and outcomes, the integration of face-to-face and technology-mediated activity (Bielaczyc, 2001).
- *Epistemological infrastructure* – Conception of knowledge that the practices reflect, knowledge-creating inquiry goals, the role of knowledge sources, participants' role in producing knowledge (Paavola et al., 2002).
- *Cognitive infrastructure* – Modelling of the strategies of inquiry, methods used to promote metacognition, cognitive support and structuring embedded in tools.





## The metaphor of scaffolding

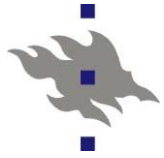
- *Scaffolding* – Help that should be given to a child or novice to solve a problem, carry out a task or achieve a goal which would be beyond one's unassisted efforts (Wood et al., 1976).
- *Fading* is considered being an essential feature of scaffolding – The support is given only as long as needed, until independent performance is achieved (Pea, 2004).



HELSINGIN YLIOPISTO  
HELSINGFORS UNIVERSITET  
UNIVERSITY OF HELSINKI

# Results

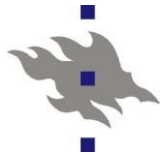




# Social infrastructure

## Organisation of social practices

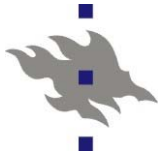
	<i>Experienced teachers</i>			<i>Novice teachers</i>	
	<i>Ten secrets A</i>	<i>Ten secrets B</i>	<i>Studying sea coast organisms</i>	<i>Beculiar seas</i>	<i>Phenomenal Baltic sea</i>
<b>Organization of collaboration</b>					
Individual activities					
Individual product			<b>X</b>	x	<b>X</b>
Collaborative activities	<b>X</b>	<b>X</b>	<b>X</b>	x	x
Collaborative product	<b>X</b>	<b>X</b>		x	
<b>Structuring of collaboration</b>					
Open collaboration					
Loosely organized groups				x	x
Structured collaboration	<b>X</b>	<b>X</b>	<b>X</b>		x



# Epistemological infrastructure

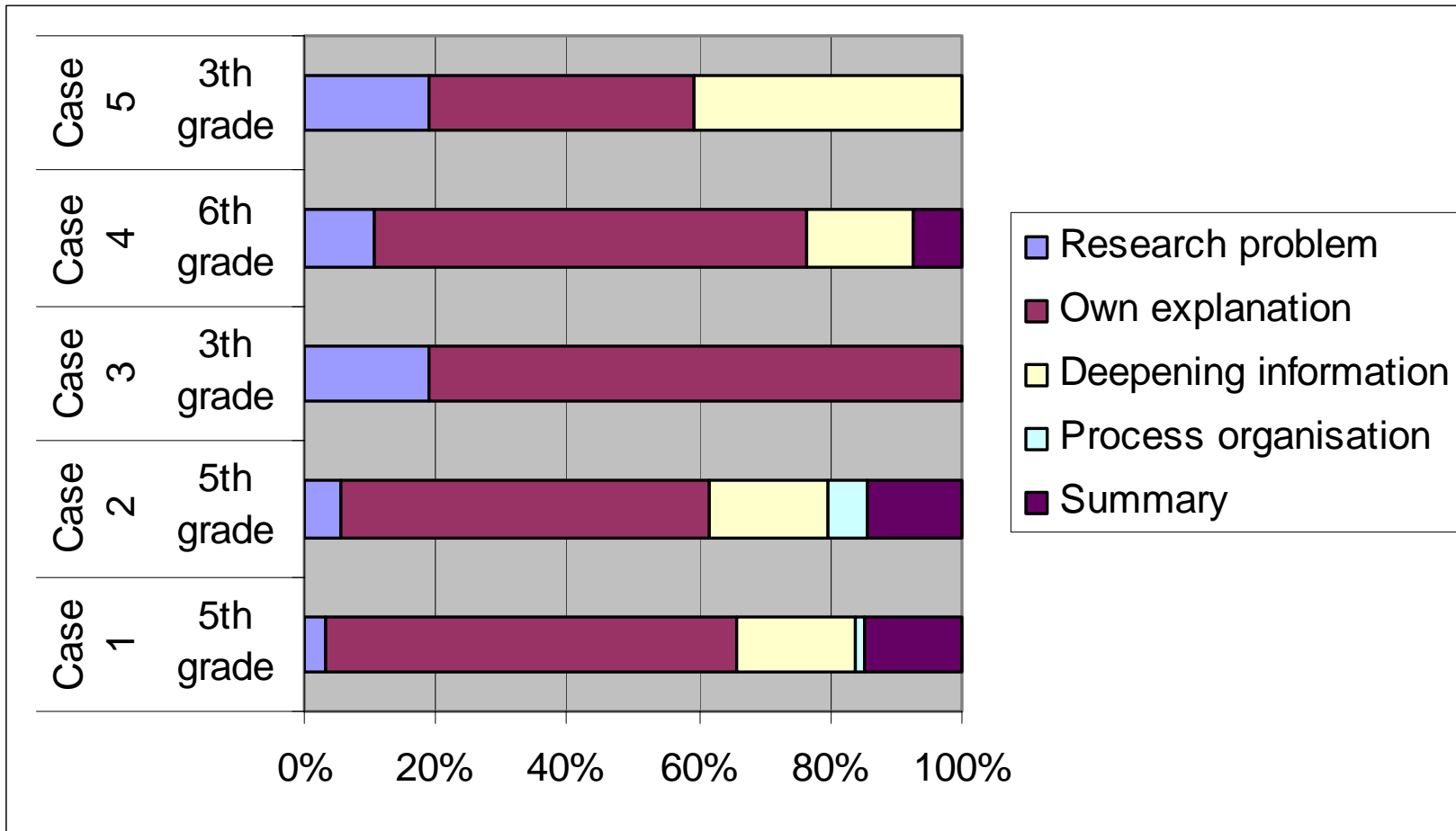
## Organisation of the inquiry process

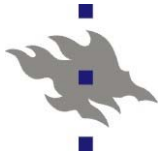
	<i>Experienced teachers</i>			<i>Novice teachers</i>	
	<i>Ten secrets A</i>	<i>Ten secrets B</i>	<i>Studying sea coast organisms</i>	<i>Beculiar seas</i>	<i>Phenomenal Baltic sea</i>
<b>Epistemic nature of activities</b>					
Task-accomplishment					
Sharing of ideas					
Purposeful inquiry in abstract context				<b>X</b>	<b>X</b>
Purposeful inquiry anchored in concrete, authentic context	<b>X</b>	<b>X</b>	<b>X</b>		
<b>Structuring of the activity</b>					
Rigidly structured activity					
Open inquiry				x	x
Structured inquiry	<b>X</b>	<b>X</b>	<b>X</b>	x	x



# Cognitive infrastructure

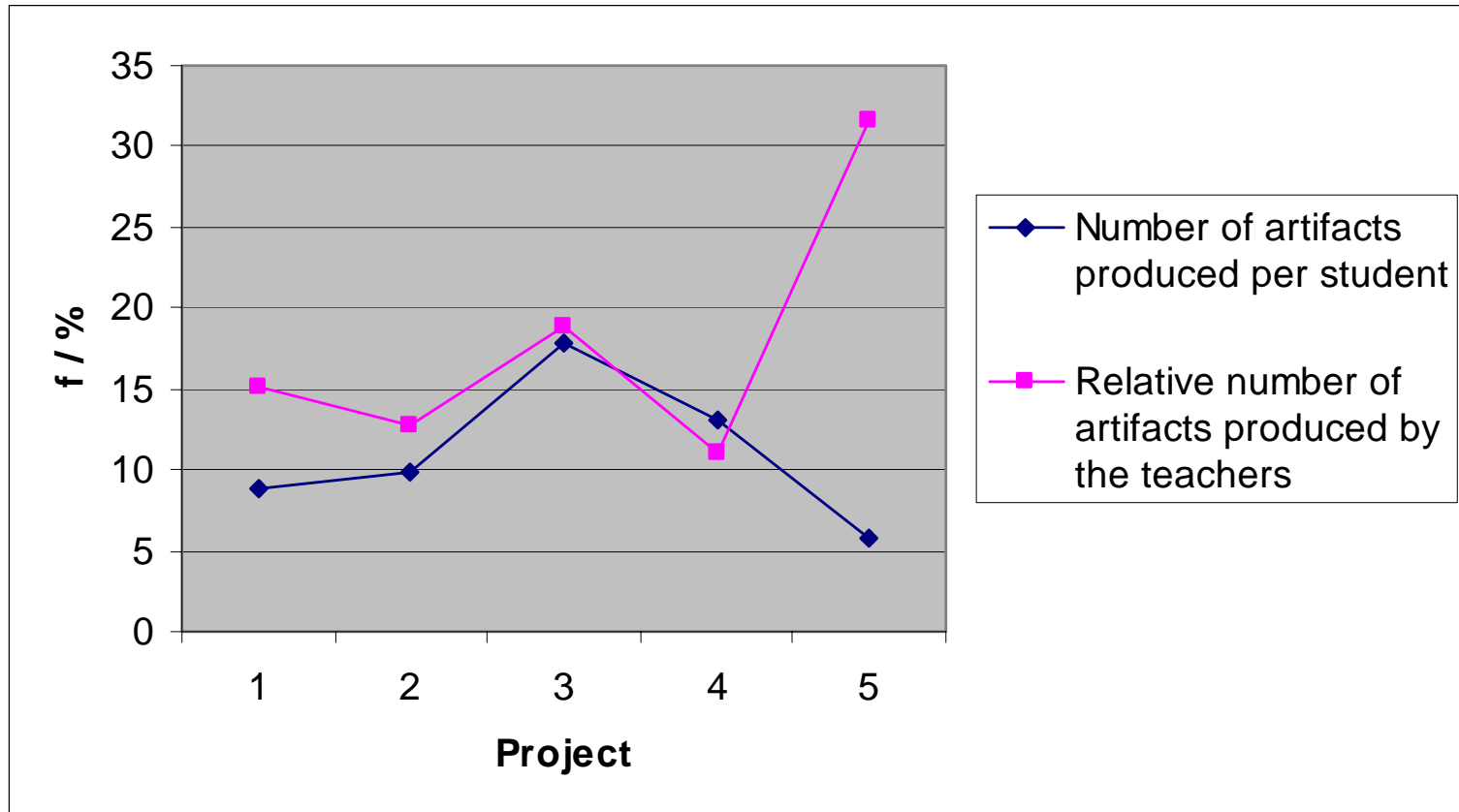
## The usage of the Knowledge type labels in FLE3





# Scaffolding

## Teachers' activity in the technology-mediated discourse

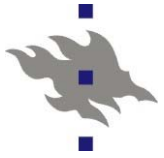


### EXPERIENCED TEACHERS

1. Ten secrets A, 5<sup>th</sup> grade
2. Ten secrets B, 5<sup>th</sup> grade
3. Studying sea coast organisms, 3<sup>rd</sup> grade

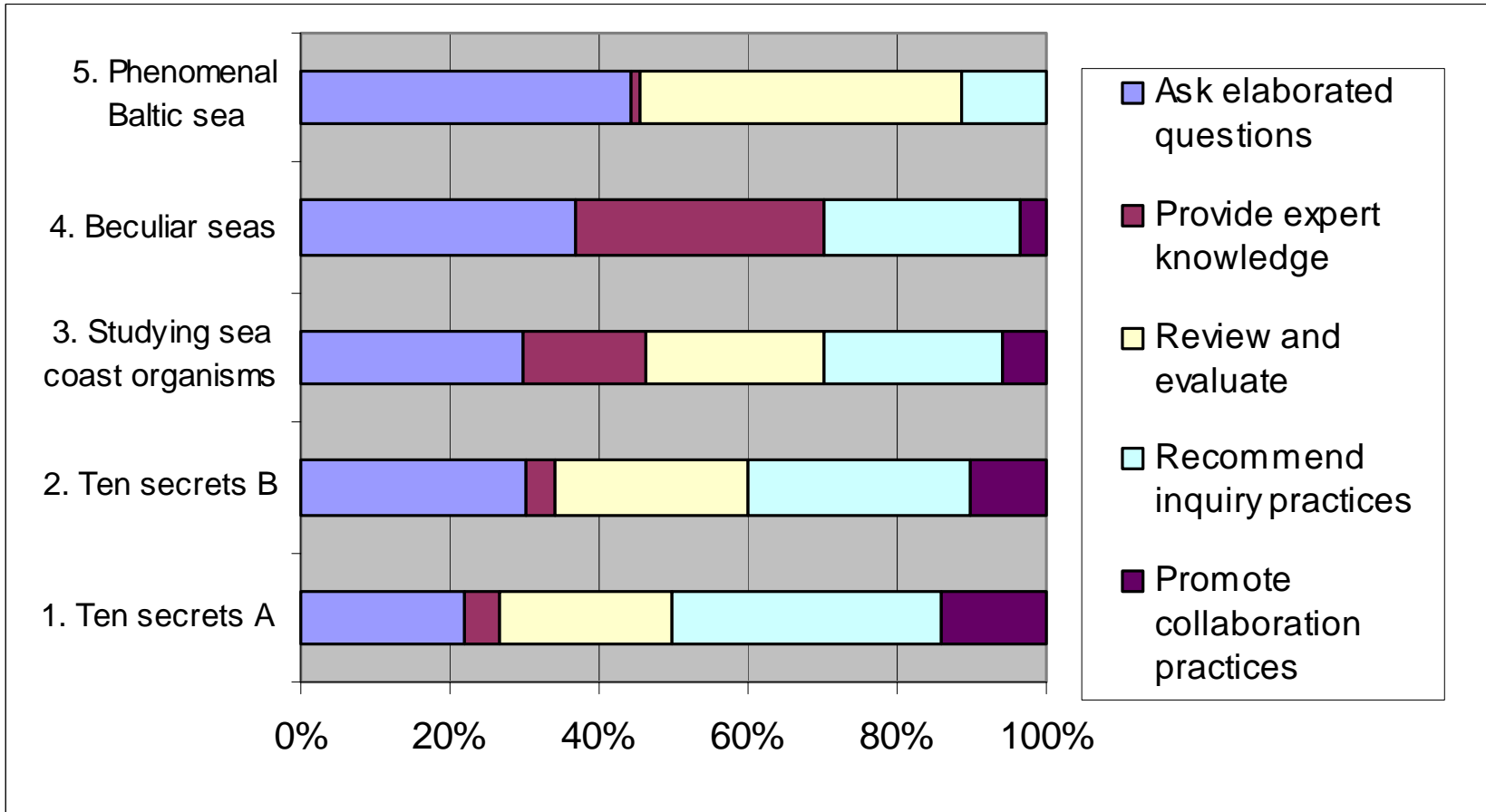
### NOVICE TEACHERS

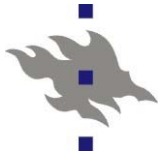
4. Beculiar seas, 6<sup>th</sup> grade
5. Phenomenal Baltic sea, 3<sup>rd</sup> grade



# Scaffolding

## The focus of the teachers' guidance





## Scaffolding

### The nature of the teachers' notes

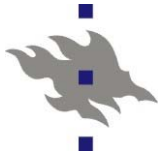
- In projects 1 and 2 the teachers included rich guidance in their notes, addressed the guidance to whole groups and fostered collaborative activities:

*I would say that Anttu has advanced your group's understanding very much. The right location and the size of the statues came out like a shot. It's great that you have a similar vision of their location! The timing is not yet quite clear. When are they made? How could they have been put up with the ancient tools? Do the books tell that?*

*And another issue that you should explain: Why have they been made? For what purpose? Olavi suggested that the reasons are religious; where the statues gods?*

*Study the reasons together and justify your opinions. Eagerness in your work!*

(Case 2, Experienced female teacher, 5th grade students)



# Scaffolding

## The nature of the teachers' notes

- In project 3, the teacher promoted advanced inquiry practices by writing structured instructions to all (and by suggesting questions and ideas to individual students):

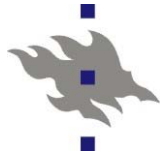
*1.a In the title of the note, write your own research problem that was created in the classroom. Choose the thinking type Problem.*

*1.b In the note text, write your first explanation, your answer to your question.*

*2. In the second phase we read each other's theories and elaborate them based on the knowledge we have now. We evaluate critically what knowledge is good and what probably is not valid. We also share our knowledge to friends.*

*Everybody has knowledge about these issues and it is nice to share it together!*

(Case 3, Experienced male teacher, 3rd grade students)



## Scaffolding

### The nature of the teachers' notes

- In project 4, the teacher commented individual students by providing source knowledge, suggesting many subordinate questions and guiding the inquiry process:

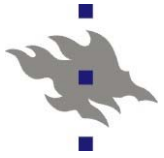
*Good start for explaining. Now start to examine more accurately whether your suggestions are in the right track, or is there possibly a totally new explanation for your problem.*

*Examine for example:*

*How deep do the jellyfishes live? How deep or to how high pressure they can go? What is the structure of jellyfishes in more detail? How have the jellyfishes developed?*

*Continue the inquiry!*

(Case 4, Novice male teacher, 6th grade students)



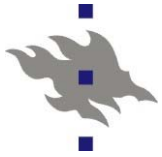
## Scaffolding

### The nature of the teachers' notes

- In project 5, the teacher directed the inquiry by frequently writing short comments to each student's notes. She evaluated the knowledge produced by the students and produced herself deepening questions:

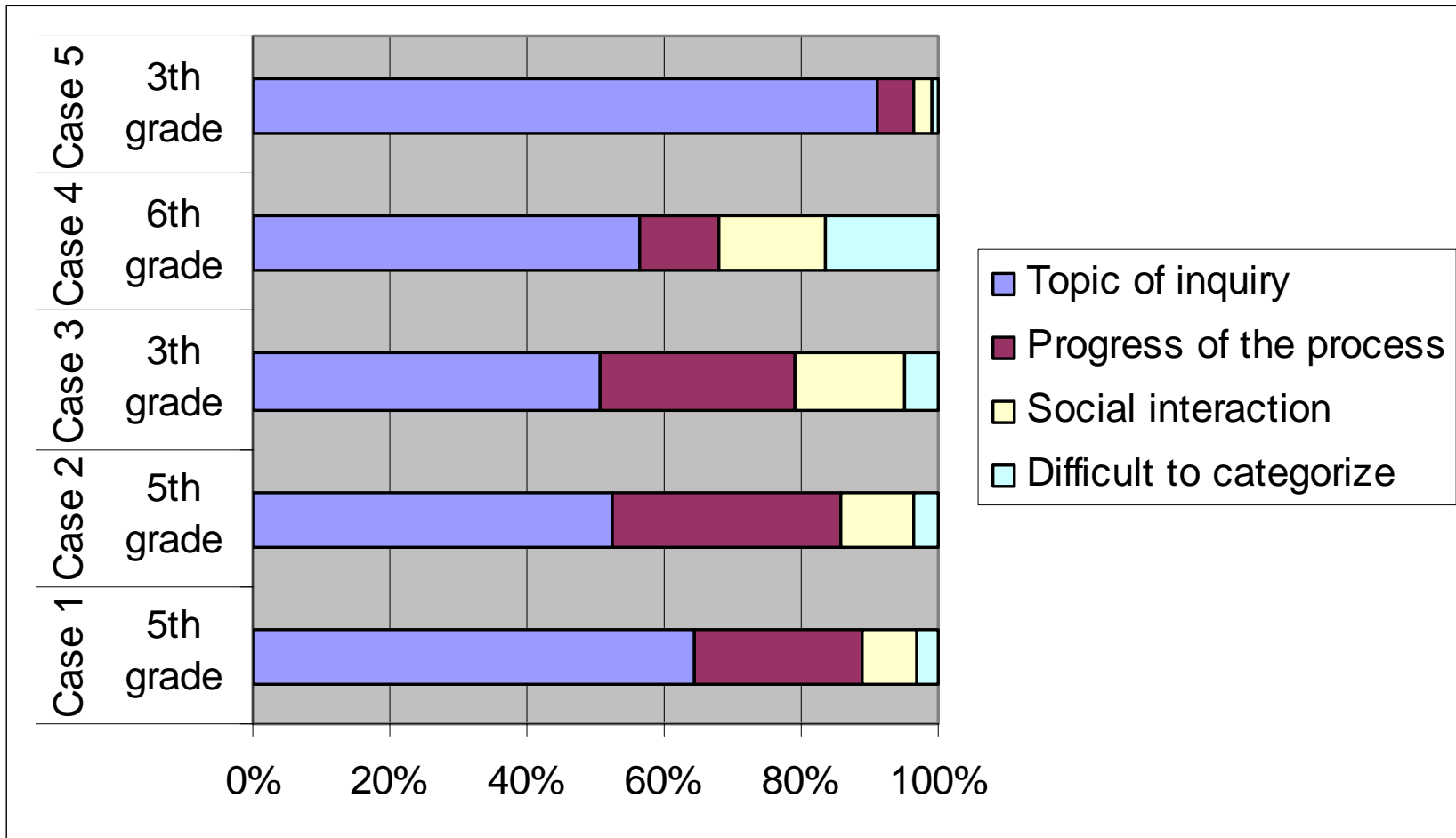
*You have found relevant and important information about the origin of the species in the Baltic sea. How can the species that are originally from lakes can now live in the Baltic sea, when the Baltic sea is still a SEA?*

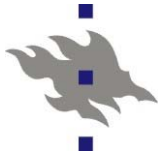
(Case 5, Novice female teacher, 3rd grade students)



# The content of discourse

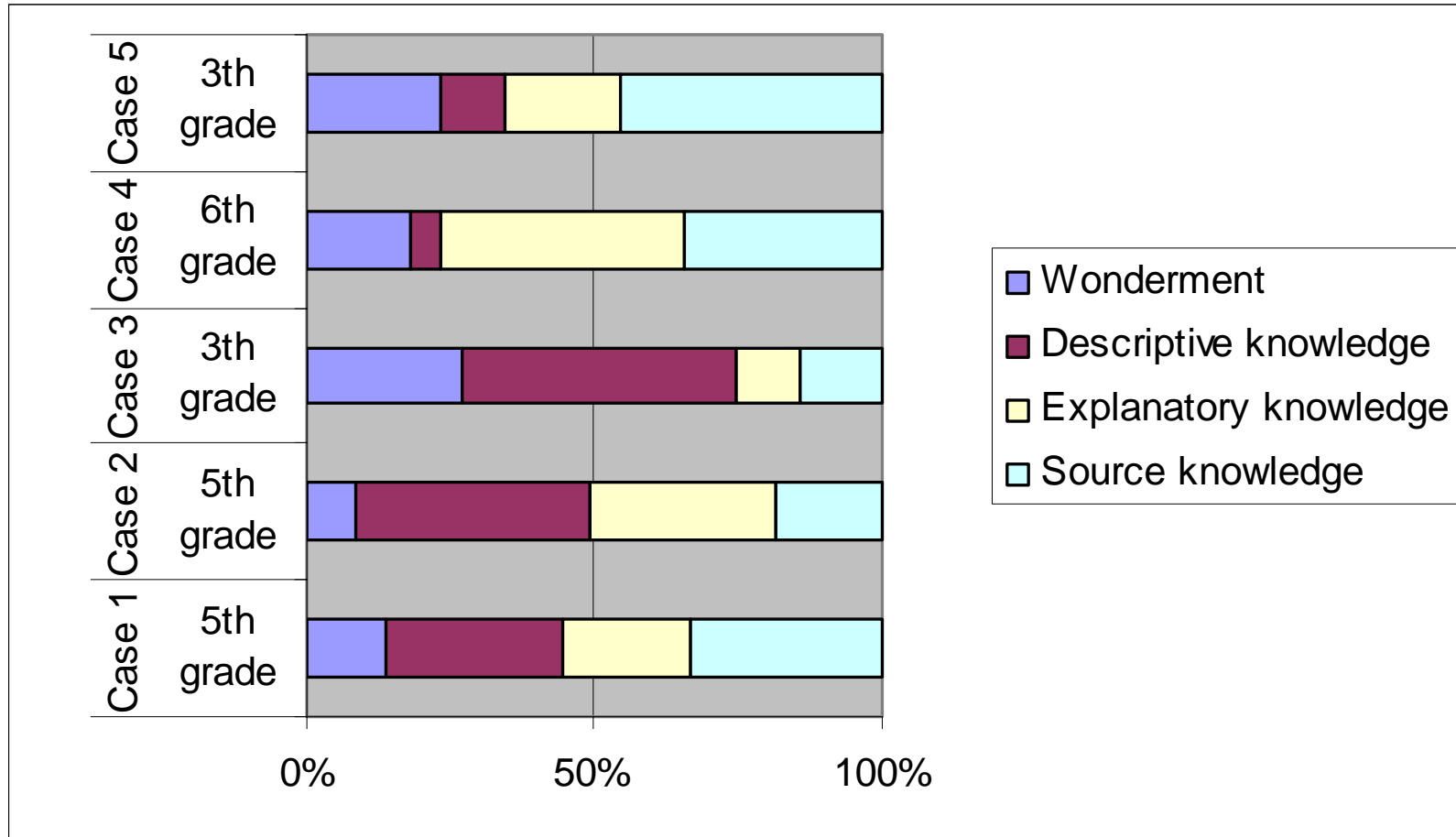
The content of all student notes

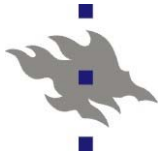




# The content of discourse

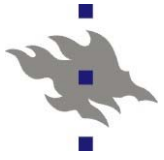
## The epistemic nature of students' "Topic of inquiry" notes





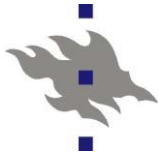
## Conclusions (1)

- Even relatively young students were capable of conducting basic-level inquiry with support: produce questions and explanations, comment on each other, use information sources, and bring that information into the shared discourse.
- Older students (from 5<sup>th</sup> and 6<sup>th</sup> grade) had also spontaneous meta-commenting of the inquiry process in their notes.
- Anchoring the inquiry into authentic context seems to have affected the epistemic nature of the discourse: There were a lot of concrete, descriptive knowledge and comments of the inquiry practices.



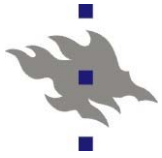
## Conclusions (2)

- The teachers adjusted the cognitive challenges of the activity and their scaffolding according to the age and experience of the students:
  - 3<sup>rd</sup> grade teachers introduced only some of the software scaffolds and gave more focused instructions to individual students;
  - 5<sup>th</sup> and 6<sup>th</sup> grade teachers introduced all software scaffolds and gave complex guidance to individual students.



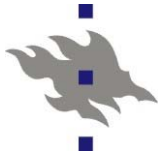
## Conclusions (3)

- There were some differences in the nature of scaffolding practices of the experienced and novice teachers:
  - Experienced teachers anchored the inquiry into an authentic context, structured the inquiry process and collaborative practices more precisely, and gave the students explicit guidance to collaborate with each other.
  - Novice teachers based the inquiry into abstract themes, gave more direct instructions and questions to the students, and guided the students individually in the technology-mediated discourse.
- Nevertheless, the novice teachers benefited from the experience teacher's collegial advice and support.



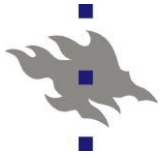
## References

- Bielaczyc, K. (2001). Designing Social Infrastructure: The Challenge of Building Computer-Supported Learning Communities. In P. Dillenbourg, A. Eurelings & K. Hakkarainen (Eds.), *European Perspectives on Computer-Supported Collaborative Learning*. Maastricht: Maastricht McLuhan Institute.
- Paavola, S., Lipponen, L., & Hakkarainen, K. (2002). Epistemological Foundations for CSCL: A Comparison of Three Models of Innovative Knowledge Communities. In G. Stahl (Ed.), *Computer Support for Collaborative Learning: Foundations for a CSCL community*. Hillsdale, NJ: Erlbaum. Saatavilla: <http://newmedia.colorado.edu/cscl/228.html>
- Pea, R. (2004). The Social and Technological Dimensions of Scaffolding and Related Theoretical Concepts for Learning, Education, and Human Activity. *Journal of the Learning Sciences* 13, 423-451.
- Wood, D., Bruner, J. S. & Ross, G. (1976) The role of tutoring in problem solving, *Journal of Child Psychology and Psychiatry* 17, 89–100.



## Related publications (1)

- Hakkarainen, K. (2003). Emergence of progressive inquiry culture in computer-supported collaborative learning. *Learning Environments Research*, 6(2), 199-220.
- Lakkala, M., Lallimo, J., & Hakkarainen, K. (2005). Teachers' pedagogical designs for technology-supported collective inquiry: A national case study. *Computers & Education*, 45(3), 337-356.
- Veermans, M., & Cesareni, D. (2005). The nature of the discourse in collaborative virtual learning - Case studies from four different countries. *Computers & Education*, 45(3), 316–336.
- Rubens, W., Emans, B., Leinonen, T. Skarmeta, A. G., & Simons, R.-J. (2005). Design of web-based collaborative learning environments. Translating the pedagogical learning principles to human computer interface. *Computers & Education*, 45(3), 276-294.



## Related publications (2)

Emans, B. & Sligte, H. (toim.) 2003. Final field test and evaluation report. A report for the European Commission, ITCOLE Project, IST-2000-26249.

[http://www.euro-cscl.org/site/itcole/D7\\_5\\_final\\_field.pdf](http://www.euro-cscl.org/site/itcole/D7_5_final_field.pdf)

Lakkala, M., Rahikainen, M. & Hakkarainen, K. (Eds.) (2001). *Perspectives of CSCL in Europe: A Review*. A report for the European Commission, ITCOLE Project, IST-

2000-26249. [http://www.euro-cscl.org/site/itcole/D2\\_1\\_review\\_of\\_cscl.pdf](http://www.euro-cscl.org/site/itcole/D2_1_review_of_cscl.pdf)

Lakkala, M., Muukkonen, H., & Hakkarainen, K. (2005). Patterns of scaffolding in computer-mediated collaborative inquiry. *Mentoring & Tutoring*, 13(2), 281-300.

Lakkala, M., Ilomäki, L., & Palonen, T. (in press). Implementing virtual, collaborative inquiry practices in middle school context. *Behavior & Information Technology*.