Computer based Interaction Analysis supporting Self-regulation: achievements and prospects of an emerging research field

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- Field Purpose & field sources
- The field's Main Concepts
- The Achievements of the IA field
  - IA indicators, IA tools, IA tools' usages, Researches
  - Three Examples of Case studies on IA tools' usages
- The Perspectives of the IA field
  - Research dimensions and research questions

Interaction Analysis ⇨

- *Initial question:*

How to support learning activities'
single participants or groups of them,
so as to take the control of their own activity,
when they act in highly interactive environments ?

IA ⇨ Emergence's reasons

The need to support 'participants' in a metacognitive level:

➢ *In Learning environments (for standalone and social use)*

- Working in computer based LE is an activity more complex than in paper and pencil: it is difficult to be aware of «what we have done »
- Working in CSCL systems is an activity much more complex than working individually

⇩

↳ Students cannot create an 'image' of their own activity, or this of other students/collaborators (as individuals, group or a whole community).

↳ For teachers, it is very-very hard to understand/take into account what it happens in stand-alone systems or to manage activities in collaborative environments, due to the very complex interactions that occur.

➢ *In working groups and scientific communities*

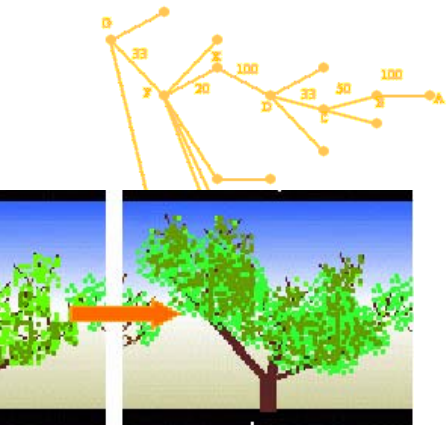
- Similar problems: ⇨ Need for support of Awareness of actions and interactions, of different actors or groups, intervening with different roles & needs.

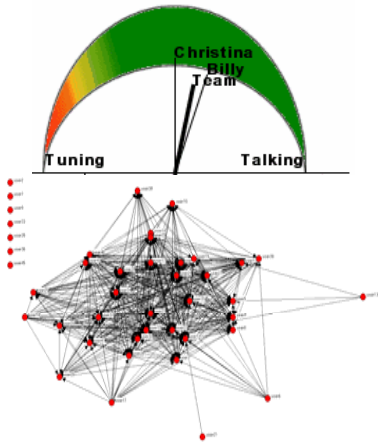
Interaction Analysis ⇨ Purpose

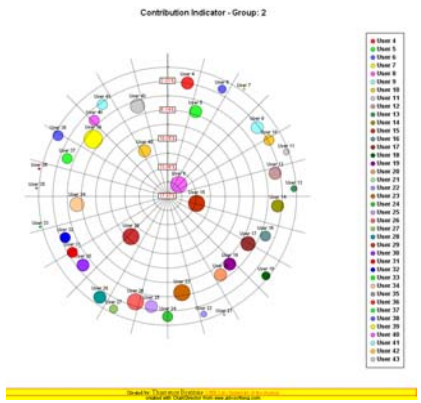
IA for self-regulation core purpose is to assist technology based activities' participants (with different profiles & roles), working on standalone or social environments, providing a cognitive or metacognitive support.

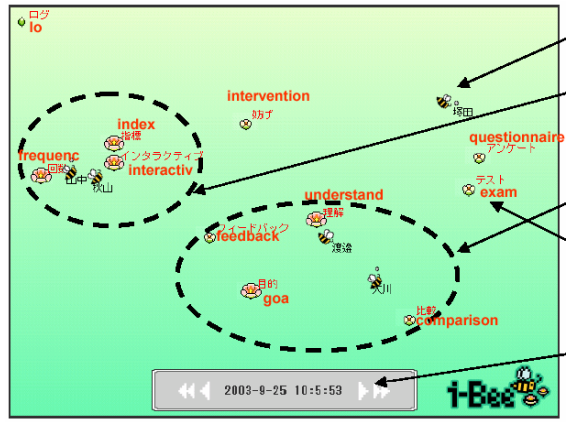
The support is provided via Interaction Analysis [IA] tools that

- offer directly information on interactions and activity products
  (e.g. via visualised IA indicators) to the participants, so as
- to be aware of and regulate their behaviour
  (either as individuals or groups)









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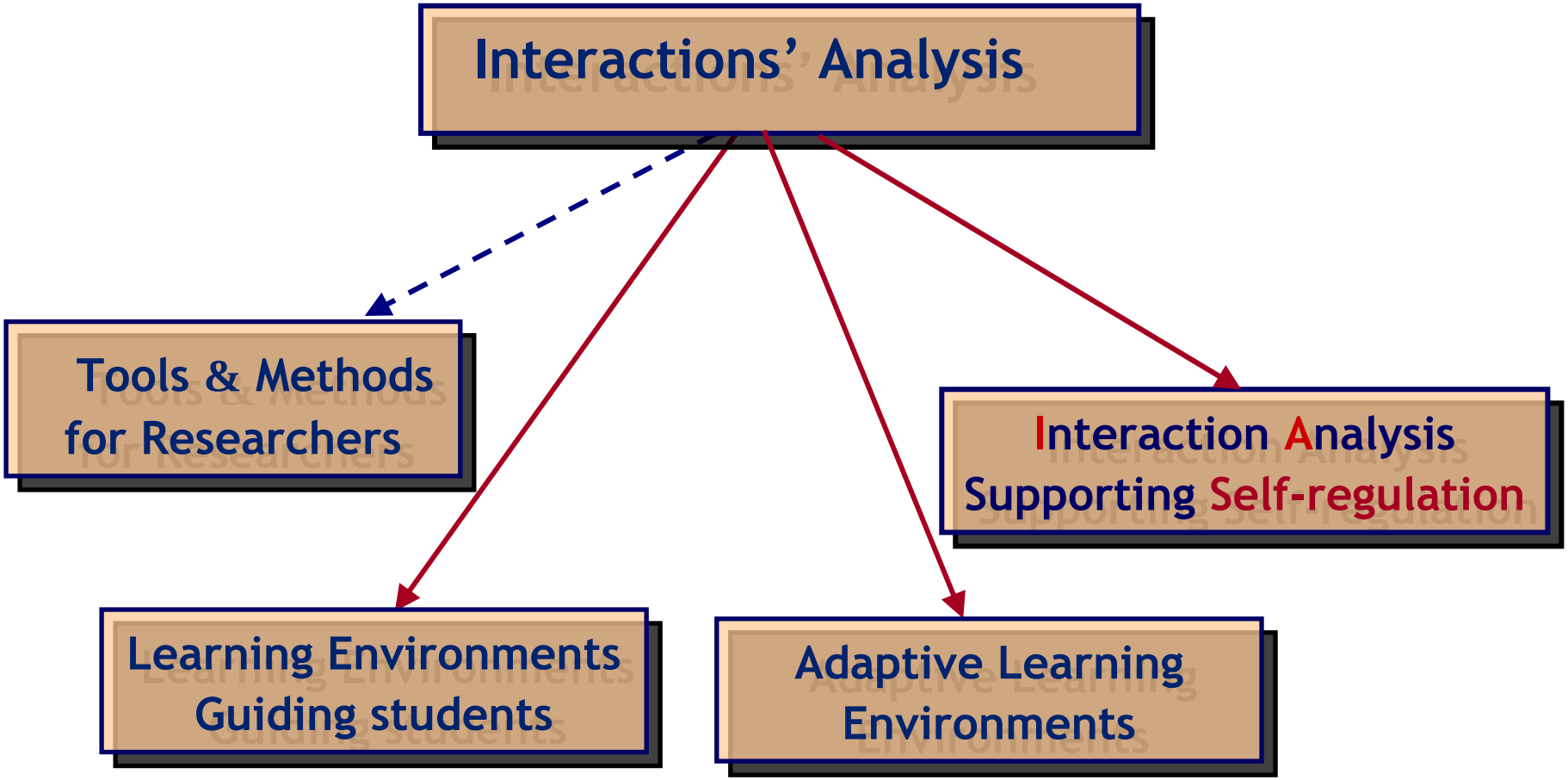
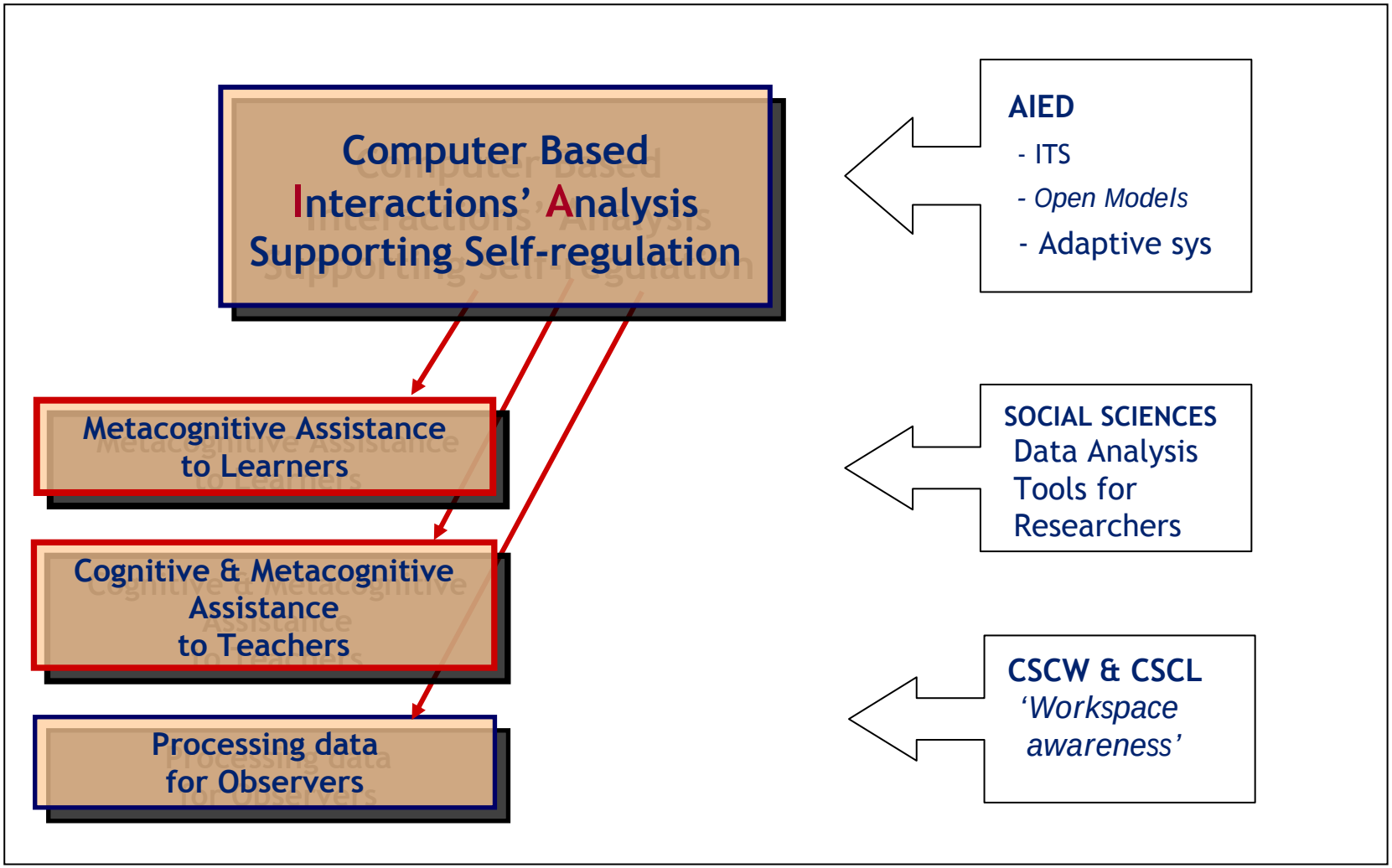
For instance, Interaction Analysis Tools could support:

- students, groups: awareness, self-assessment, metacognition ⇨selfregulation of their own activity
- teacher(s): diagnosis, assessment ⇨ teachers' strategies adaptation

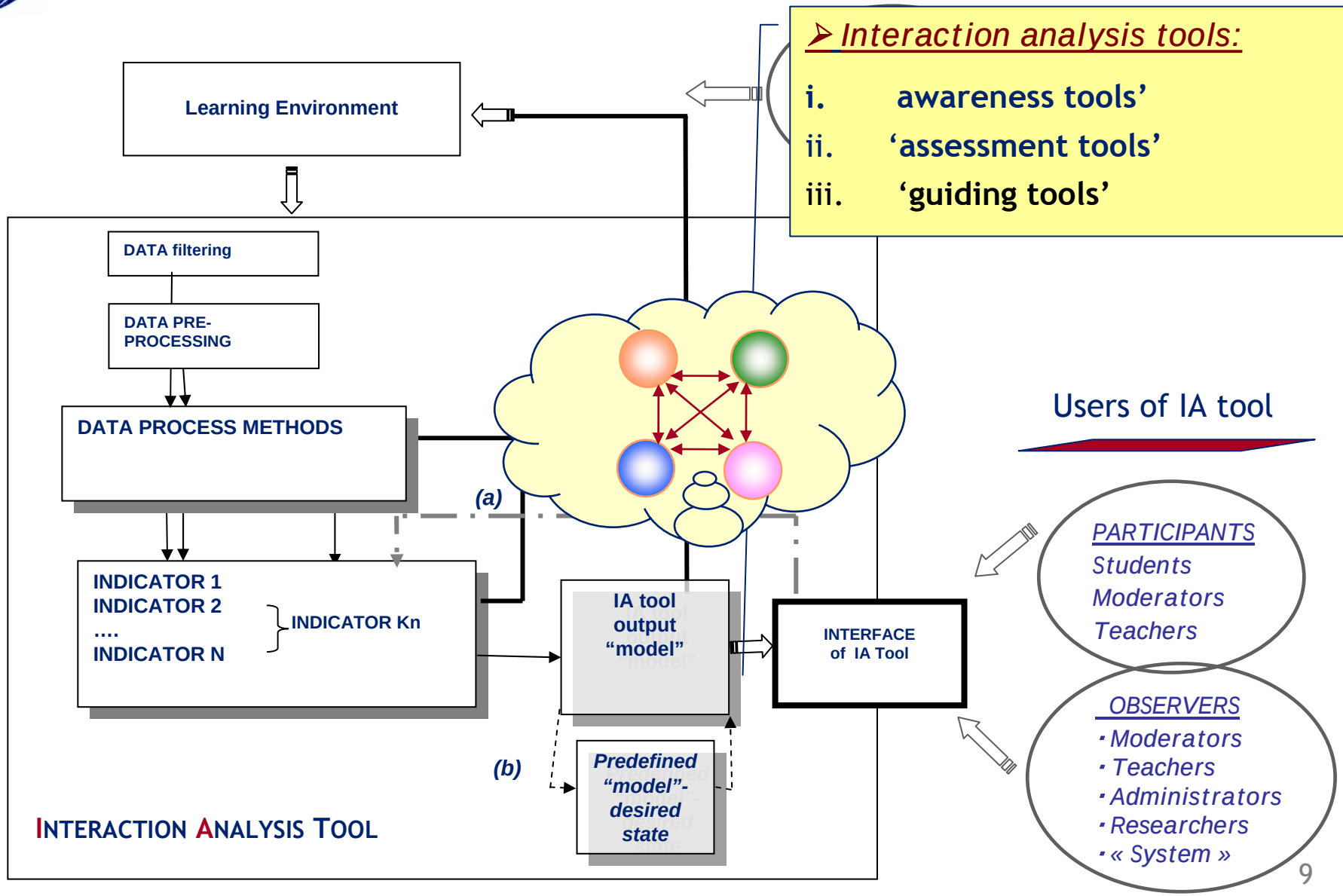
Interaction Analysis ⇨ Territory



Interaction Analysis ⇨ Influences



IA tool ⇨ Generic Process

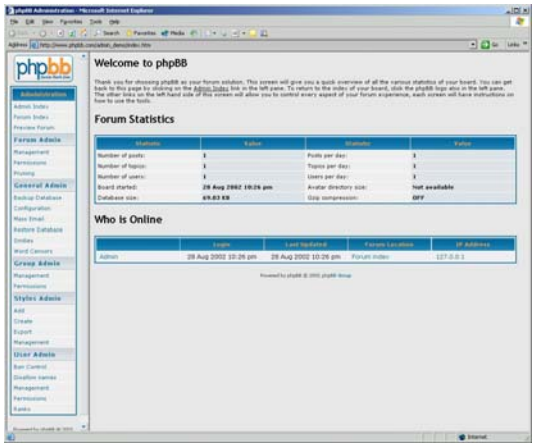


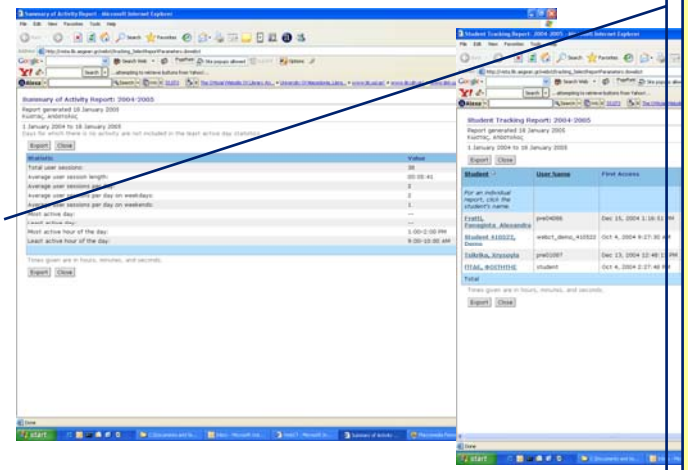
➢ *Interaction analysis tools:*

i. awareness tools'
ii. 'assessment tools'
iii. 'guiding tools'

IA ⇨ IA 'tools' examples e.g. in LE

'Awareness' functions addressed to the 'administrator' or the teacher

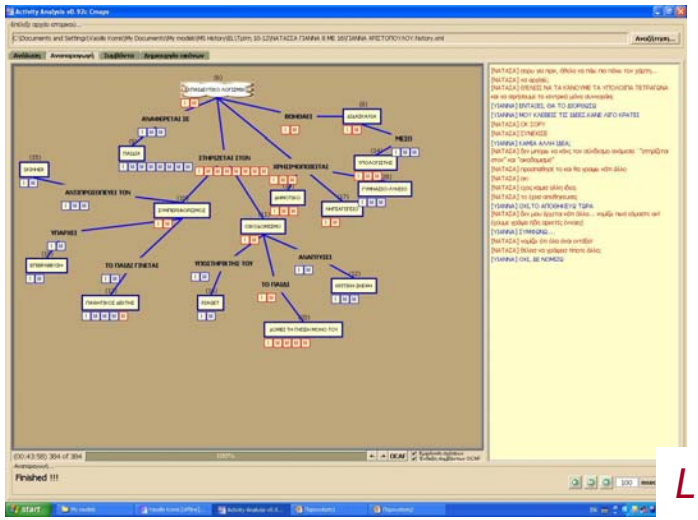




phpBB
Forum statistics
Number of posts
Number of users
Database size

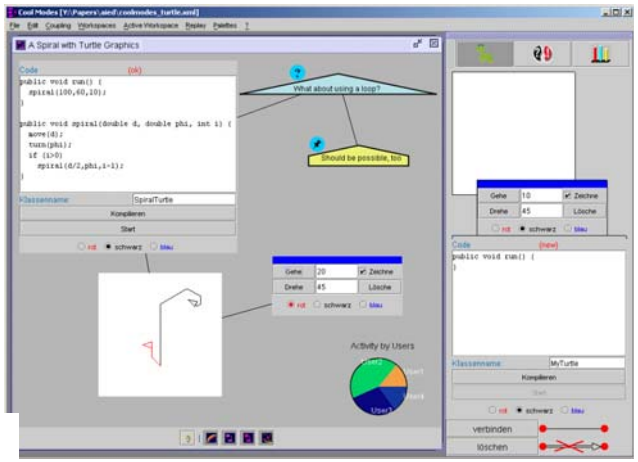
Webct,
Summary of activity report:
Most active day,
Most active hour per day,
Average users per day, etc.

'Awareness' functions addressed to students



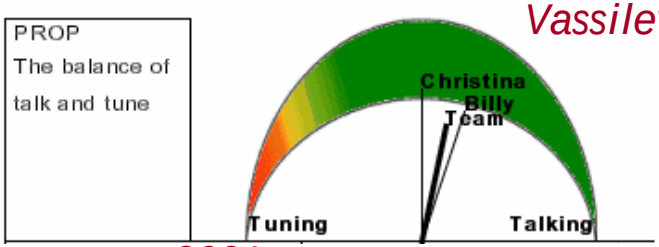
LTEE, 2001

Hoppe, 2001



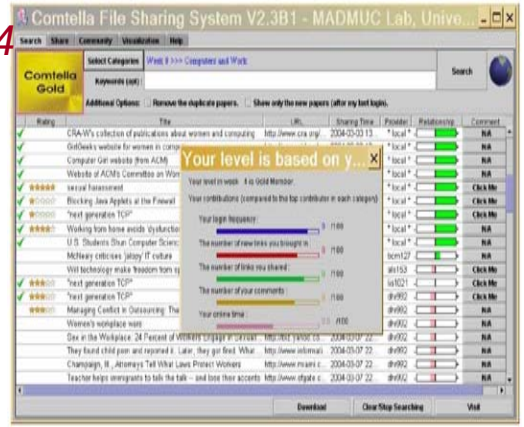
IA ⇨ IA 'tools' examples

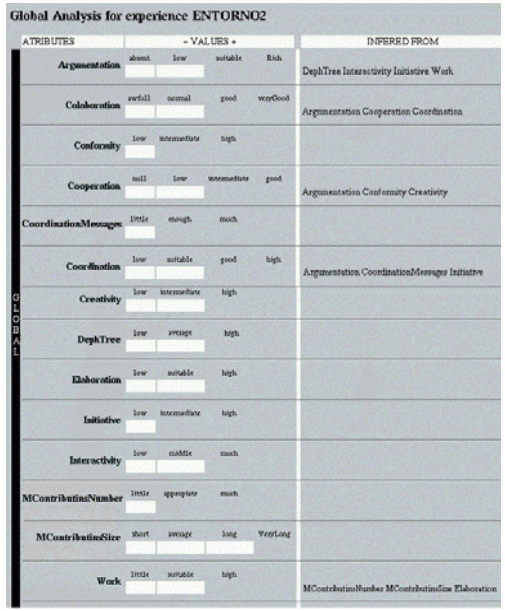
- Addressed to students: Assessement
  [collaboration mode & coll. quality assessment]



Jermann, 2001

Vassileva,2004

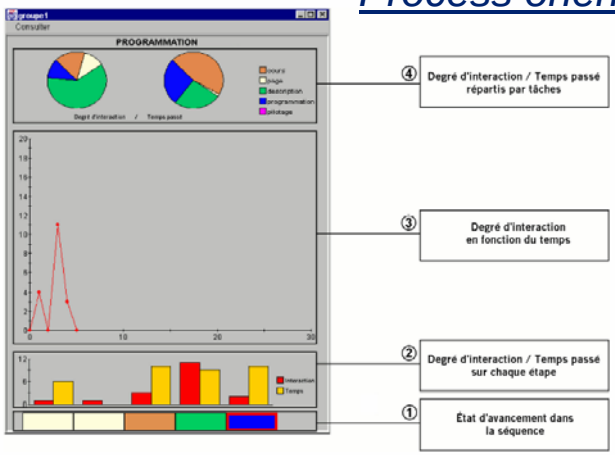




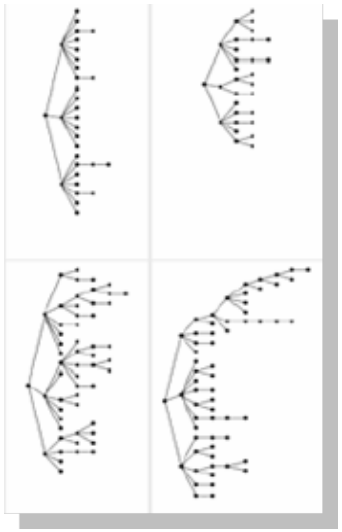
Barros, 2000

- Addressed to teachers

Process oriented Awareness

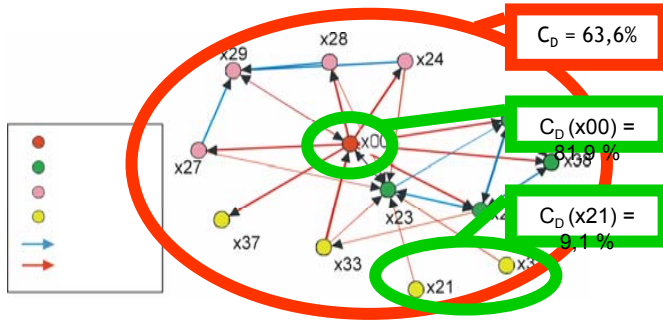


Despres, 2000



Gerrosa, 2005

Collaboration mode



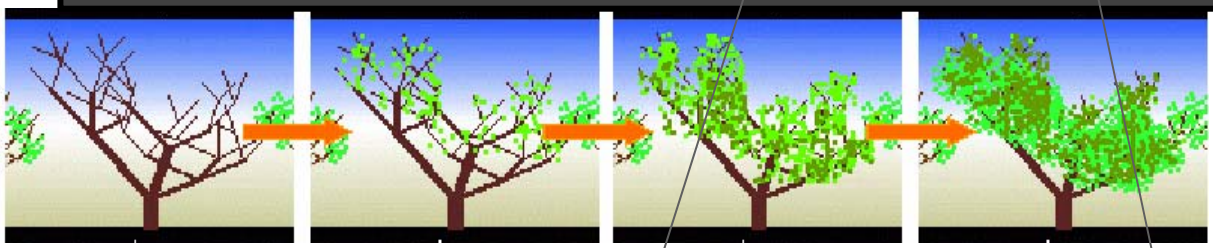
Martinez, 2004
Hlapanis, 2005

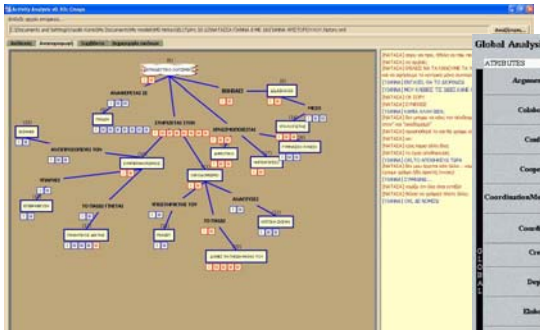
IA Indicator ⇨ A central Concept

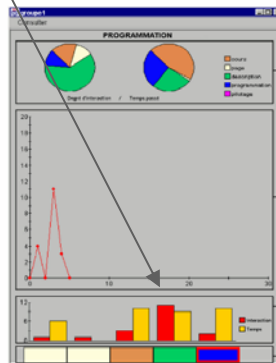
Interaction Analysis indicators constitute variables that describe 'something' related to:

- the mode, the process of the activity of the considered 'cognitive system' (individual, group, community)
- the features or the quality of the interaction product,
- the mode or the quality of the participants interaction and collaboration, (when acting in the frame of a social context formed via the technology based learning environment).

These variables have to be interpreted taking into account, the learning activity, the profile of the participants, the context of interaction, etc.

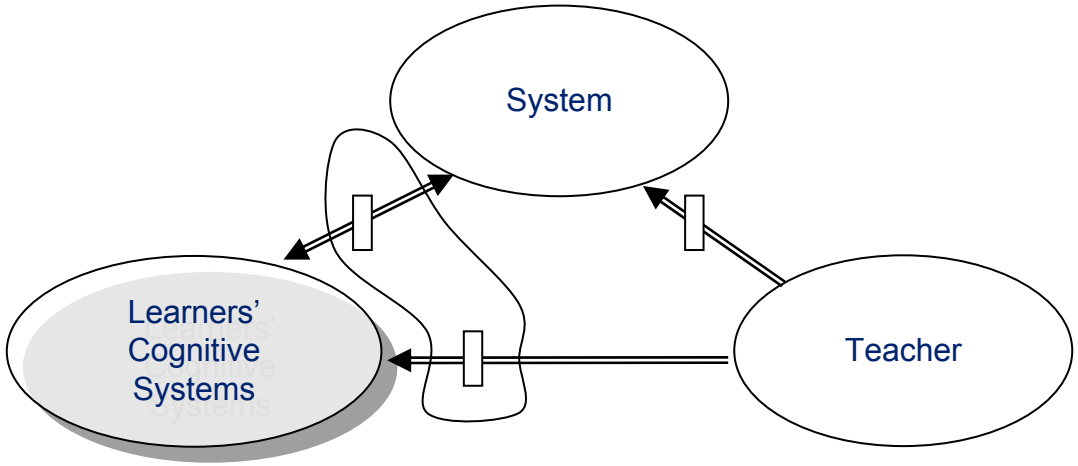






IA ⇨ Conceptual Framework: Considerations

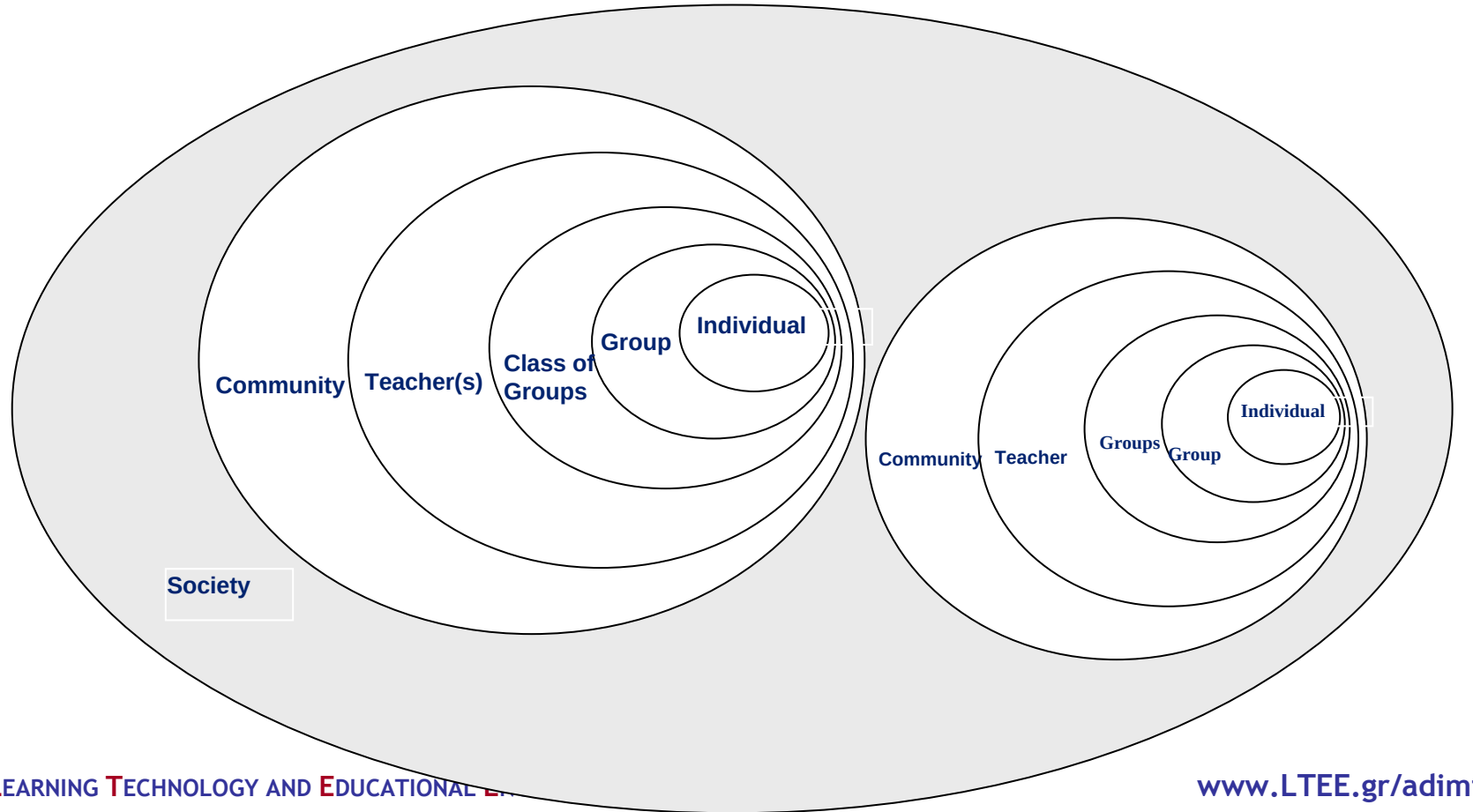
↳ **C1**: *A consideration of the control of learning activity process as distributed to all the agents*



- **Self-regulation (via metacognitive support)**
- **Teacher supervision and/or evaluation & also self-assessment**
- **Advisors ('pedagogical agents') and/or environment adaptations activated by the system**

IA ⇨ Conceptual Framework: Considerations

- C2: *A consideration of all agents and cognitive systems involved in collaborative learning settings*



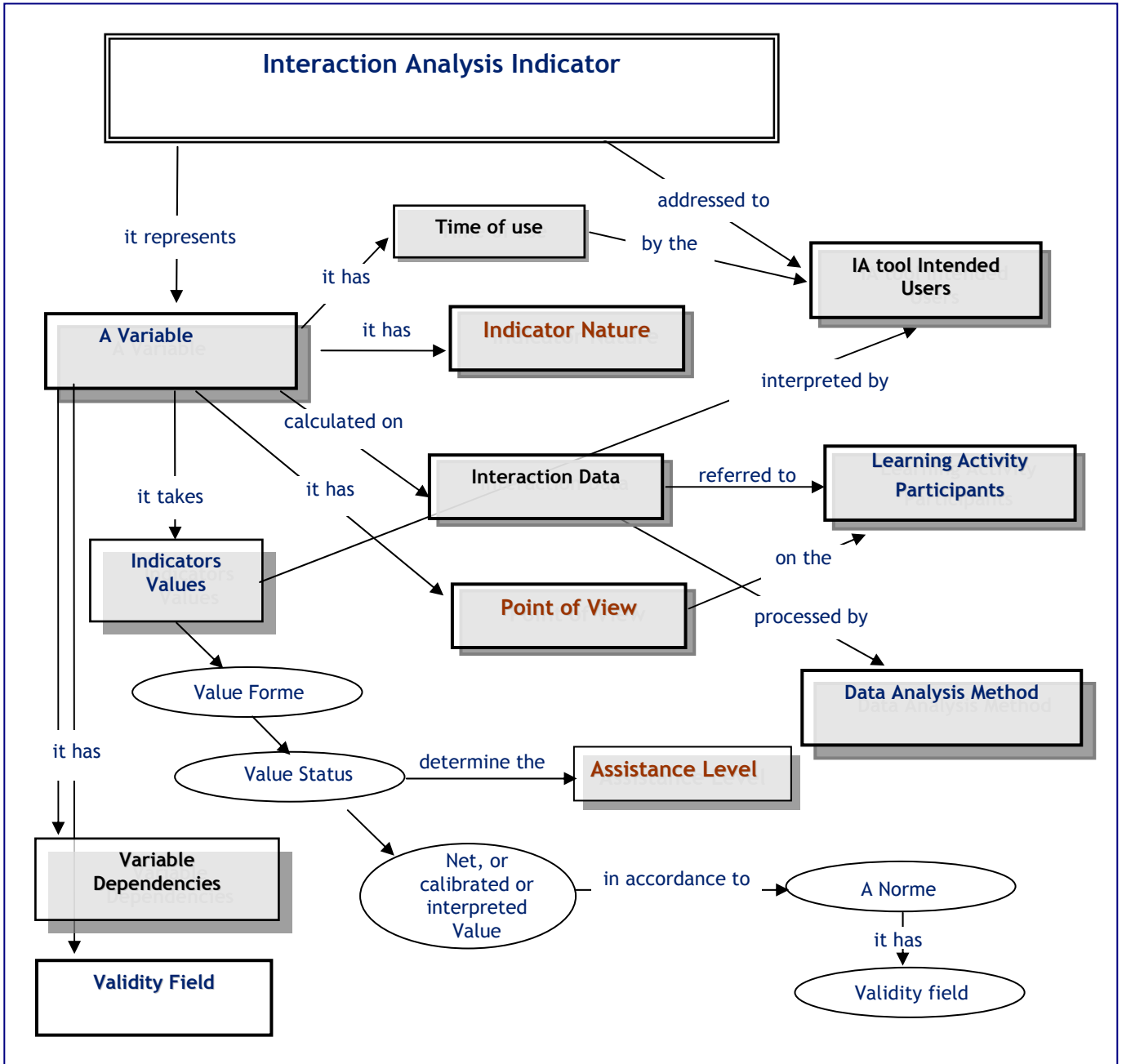
IA ⇨ Conceptual Framework: Considerations

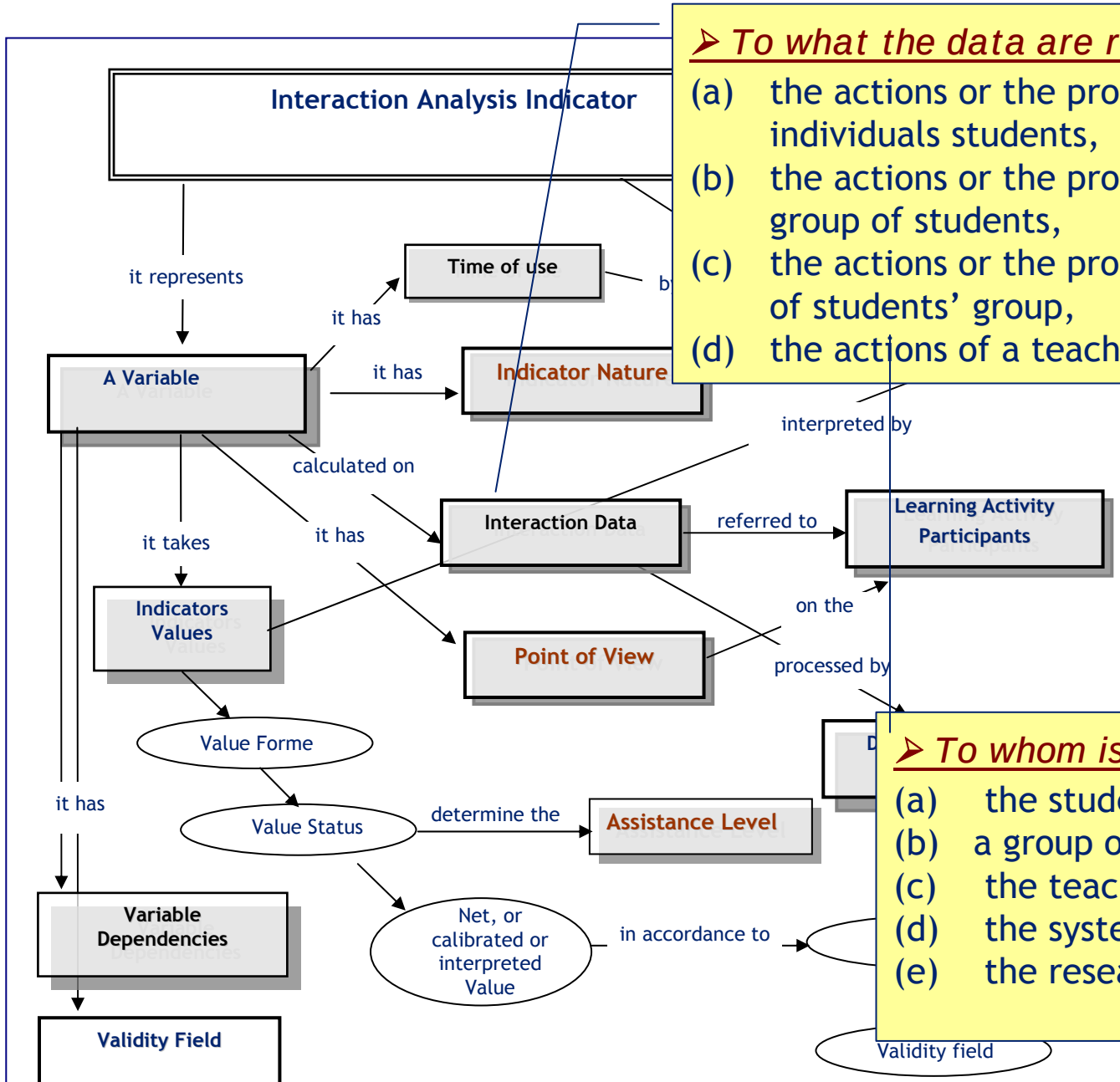
↳C3: *Make emerge the core nature of indicator regarding the diversified aspects of participants' behaviour*

↳C4: *Dispose a coherent set of indicators which provide different types of assistance*

↳C5: *An indicator is a mathematical variable, which has a serie of related features.*

IA Indicator Conceptual Framework





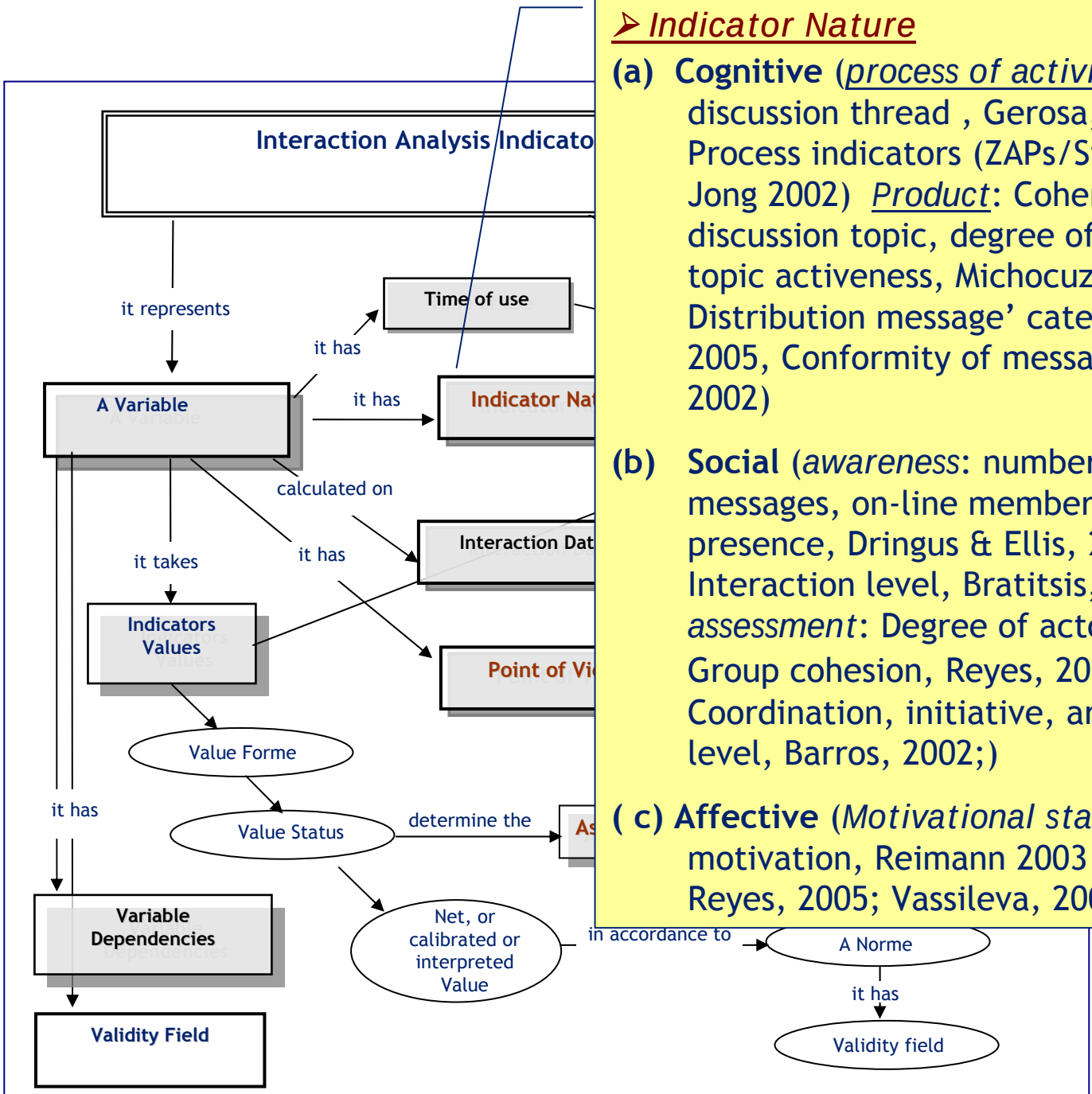
➢ *To what the data are referred?*

(a) the actions or the product of individuals students,
(b) the actions or the products of a specific group of students,
(c) the actions or the product of a number of students' group,
(d) the actions of a teacher, etc

➢ *To whom is it addressed to ?*

(a) the student,
(b) a group of students,
(c) the teacher,
(d) the system it-self,
(e) the researcher

IA Indicator Conceptual Framework

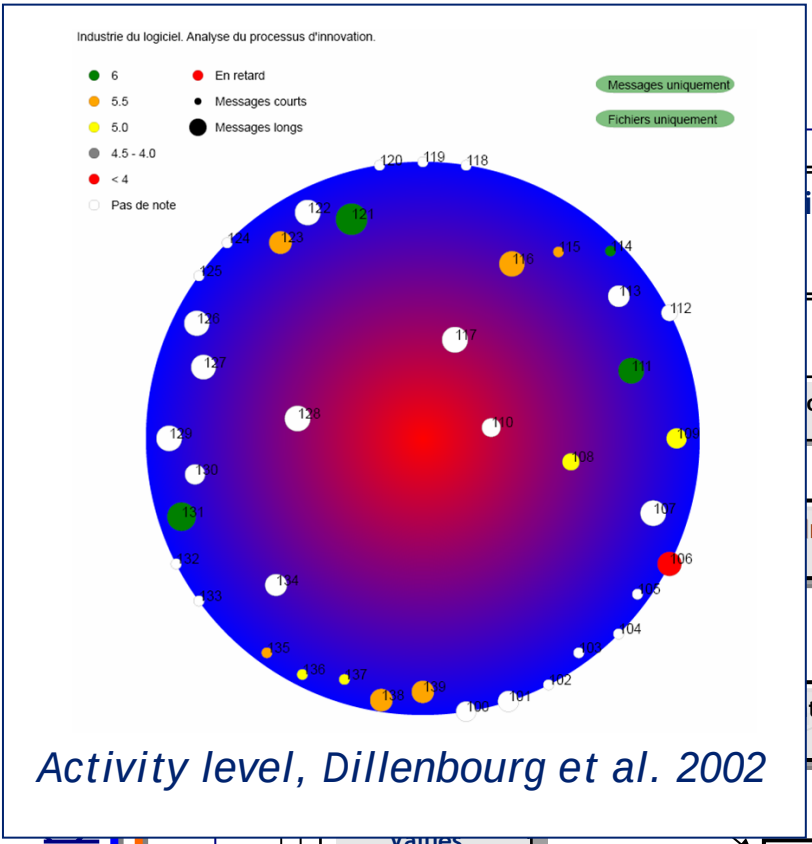


➢ *Indicator Nature*

(a) Cognitive (*process of activity*: Depth of discussion thread , Gerosa, 2005), Inquiry Process indicators (ZAPs/Simquest, de Jong 2002) *Product*: Coherence in a discussion topic, degree of discussion topic activeness, Michocuzi, 2005, Distribution message' categories, Gerosa, 2005, Conformity of message, Barros 2002)

(b) Social (*awareness*: number of new posted messages, on-line members, Degree of presence, Dringus & Ellis, 2004, Interaction level, Bratitsis,2005; *assessment*: Degree of actors centrality, Group cohesion, Reyes, 2005; *evaluation* Coordination, initiative, argumentation level, Barros, 2002;)

(c) Affective (*Motivational state*: individual motivation, Reimann 2003 ; Social status: Reyes, 2005; Vassileva, 2004)



Activity level, Dillenbourg et al. 2002

- ***Point of View***

(a) **Individual Point of view** (e.g. category of posts per participant)

(b) **Group point of view**
b1.differentiated, e.g. SNA
b.2.undifferentiated: e.g. collaboration level of the group)

(c) **Community point of view** (eg. Community activity level, Dillenbourg et al. 2002)

(d) **Society point of view**

IA Indicator Concep

is Indicator
address
of use
by the
Indicator Nature
teraction Data
Point of View
Data Analysis Method
Value Forme
it has
Value Status
determine the
Assistance Level
Variable Dependencies
Net, or calibrated or interpreted Value
in accordance to
A Norme
it has
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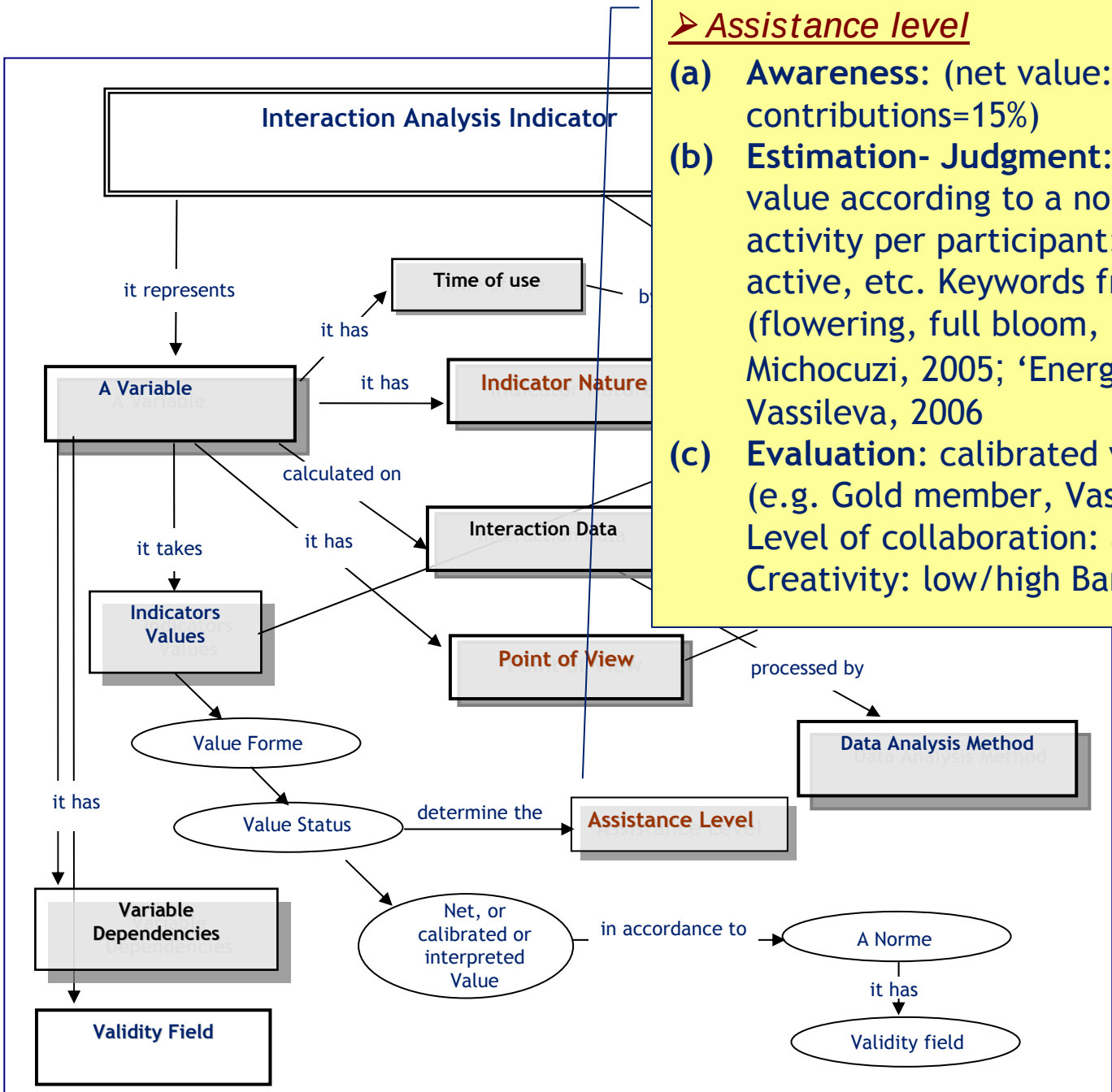
IA Indicator Conceptual Framework



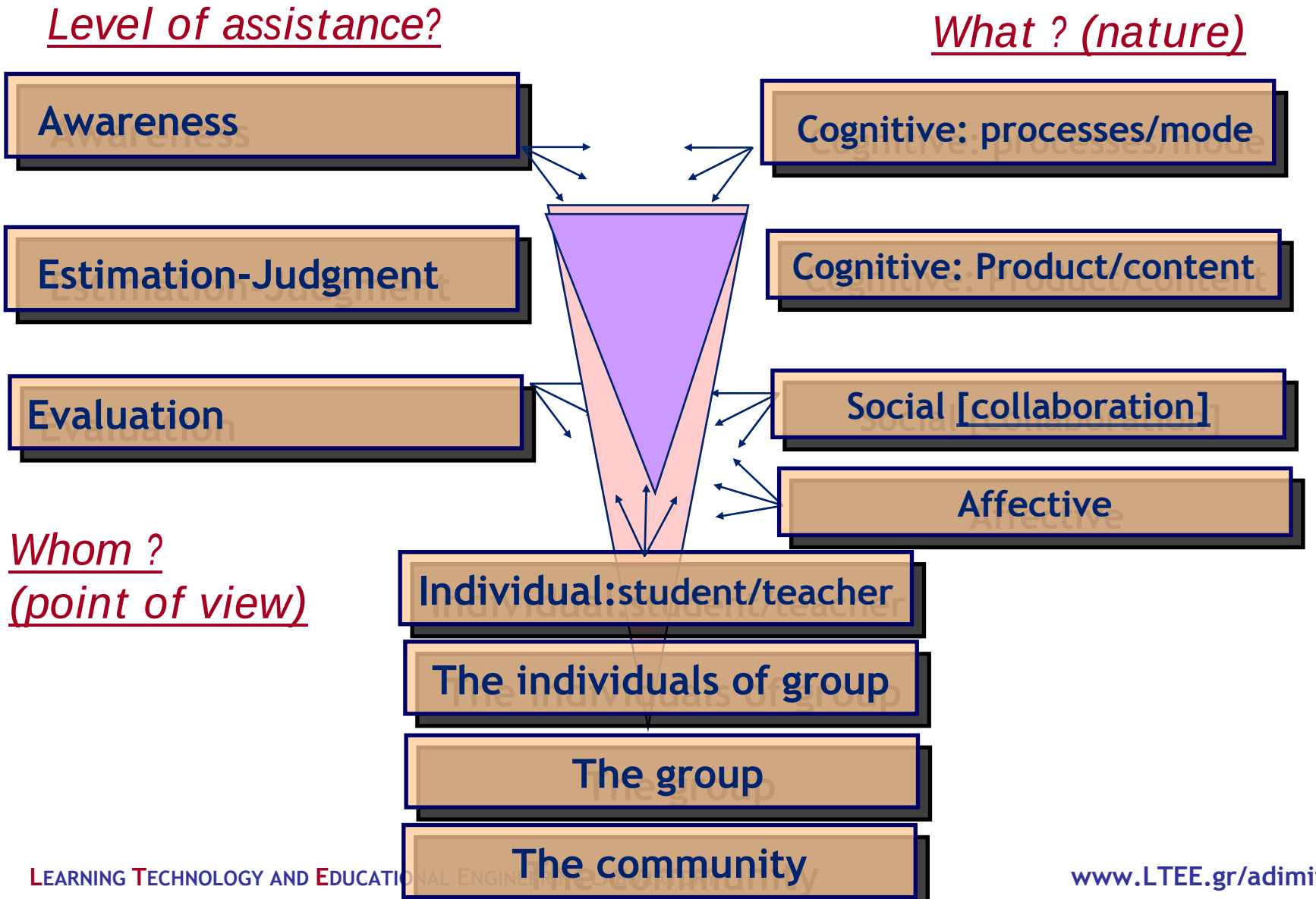
➢ *Assistance level*

(a) **Awareness**: (net value: percentage of contributions=15%)

(b) **Estimation- Judgment**: calibrated value according to a norm. Eg. Level of activity per participant: sleeping, active, etc. Keywords frequency (flowering, full bloom, bud of flower), Michocuzi, 2005; 'Energy Level', Vassileva, 2006

(c) **Evaluation**: calibrated value and score: (e.g. Gold member, Vassileva, 2004, Level of collaboration: awful/excellent Creativity: low/high Barros, 2002)

IA ⇨ Indicators attributes



IA ⇨ Indicators attributes

Level of assistance?

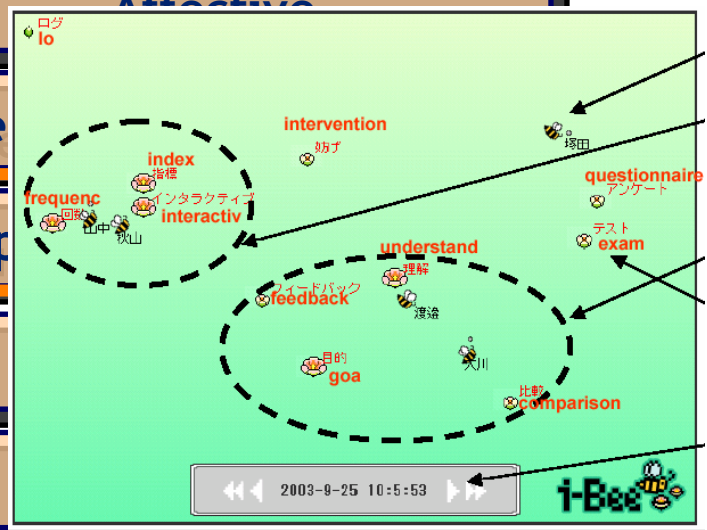
- Awareness
- Estimation-Judgment
- Evaluation

What ? (nature)

- Cognitive: processes/mode
- Cognitive: Product/content
- Social [collaboration]
- Affective

Whom ? (point of view)

- Individual:student/teache
- The individuals of group
- The group
- The community



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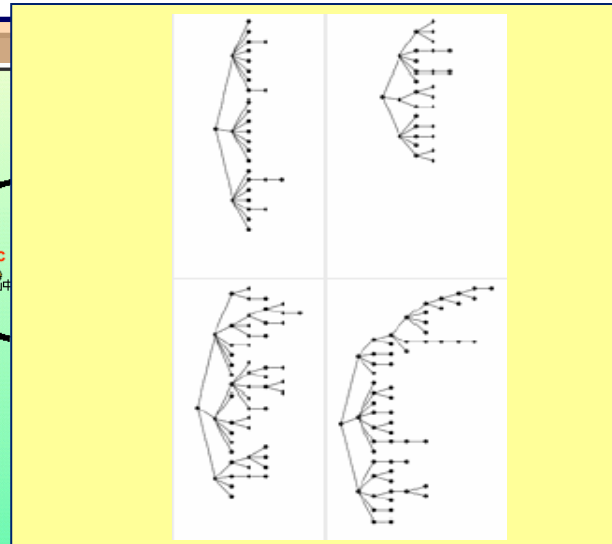

'Discussion depth, Gerrosa, 2005

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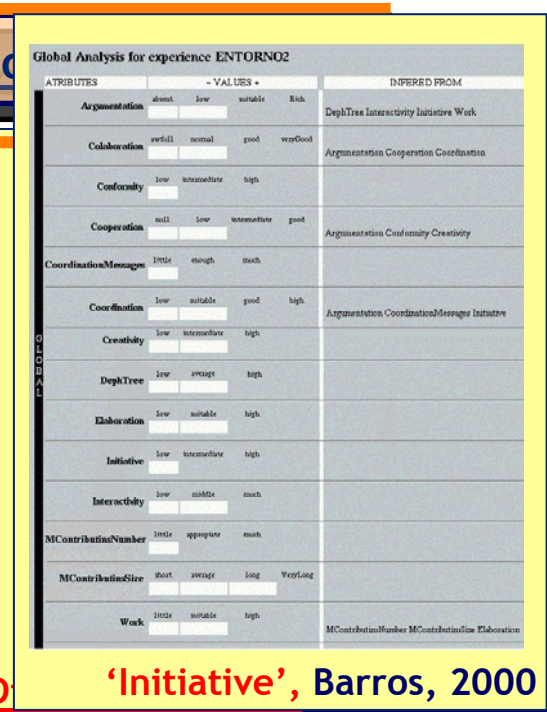


'Initiative', Barros, 2000

IA ⇨ IA Indicators: State of the Art

Current state of IA indicators

➢ *Interpretative value & Significance of Interaction Analysis Indicators:*

- High Level Indicators that have an inherent interpretative value (usually infered via complex processing: e.g. *'argumentation quality')*
- Low level Indicators, those that do not have an autonomous interpretative value

⌦ *Current state of available indicators:*

⇨ Most of them are low level indicators (e.g. participation rates)

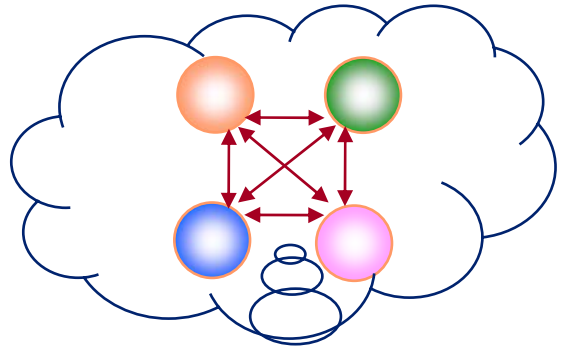
⇨ Lack of indicators that analyse cognitive aspects

⇨ Lack of indicators that analyse, in the same time, various aspects of expression {dialogue + action}

IA ⇨ IA Indicators: State of the Art

Current state of IA Models

IA Indicator & Interaction Model :



In an ideal case, for each learning activity, a number of complementary indicators could be produced.

Differents indicators & combinations could form **a descriptive model or even evaluative model** according to specific categories of learning activities, for a specific population and context.

Current state of available IA models/tool:

⇨ Very few IA tools offer a sufficient number of indicators belonging in multiple dimensions of indicators' nature. Thus, it is rare to caracterise the output of a current IA tool: as a « model ».

IA ⇨ IA Tools State of the Art

⌦ Main Features of IA Tools

(i) The status of the IA tool (*regarding the Learning Environment*)

(ii) The visualisation space of IA Tool outputs

(iii) The IA tool output Interaction Model(s)

(iv) The intented Users of IA Tool

IA ⇨ IA Tools state of the Art

(i) The status of the IA tool

➢ **State of current IA support**

- Function(s) in a system: phpbb, etc.
- Component in a learning environment: "Analytic Tools"- Knowledge Forum, Scardamalia et al.; "Activity Analysis"-ModellingSpace, LTEE Lab
- Complete IA tool: DIAS, LTEE lab; "Argunaut", Collide Group.

➢ **IA tools current developments for environments:**

- Forums (*e.g. Aula IA support; DIAS tool*)
- File exchange- contribution systems (*e.g. Cordella, Vassileva et al.2004*)
- Learning environments (*like MODELLINGSPACE, Knowledge Forum, CoolModes*)
- Web-based platforms (partial tools)
- Scientific communities platforms (e.g. *CCI-IA service Kaleidoscope NoE*)

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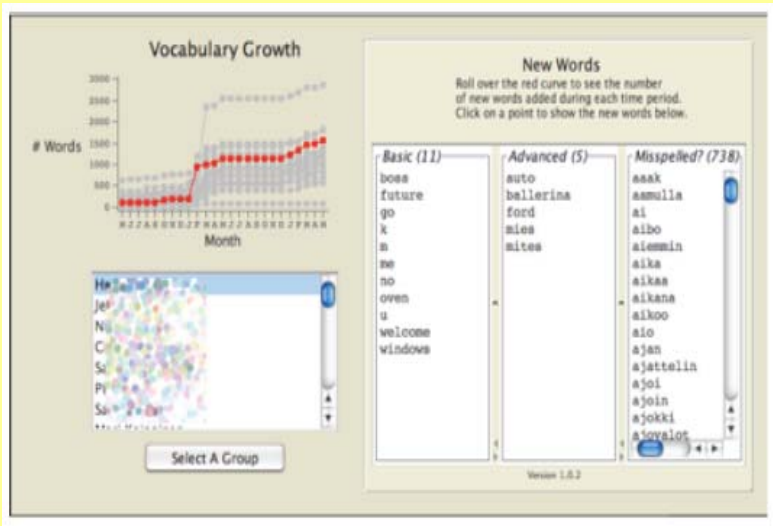
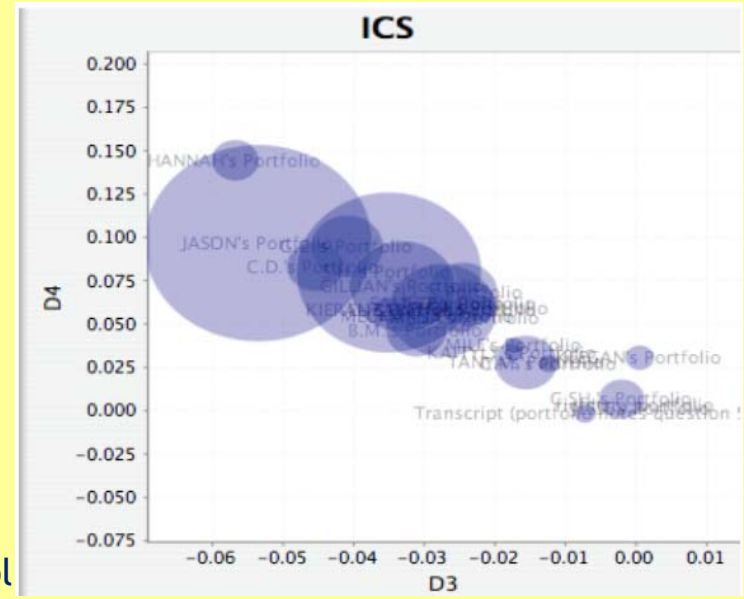
Example of IA Component: "Knowledge Forum" (Scardamalia et al.) that includes the "Analytic Tools" (for teachers) *CSCL2007 proceedings, p.720*



a) "Vocabulary growth tool

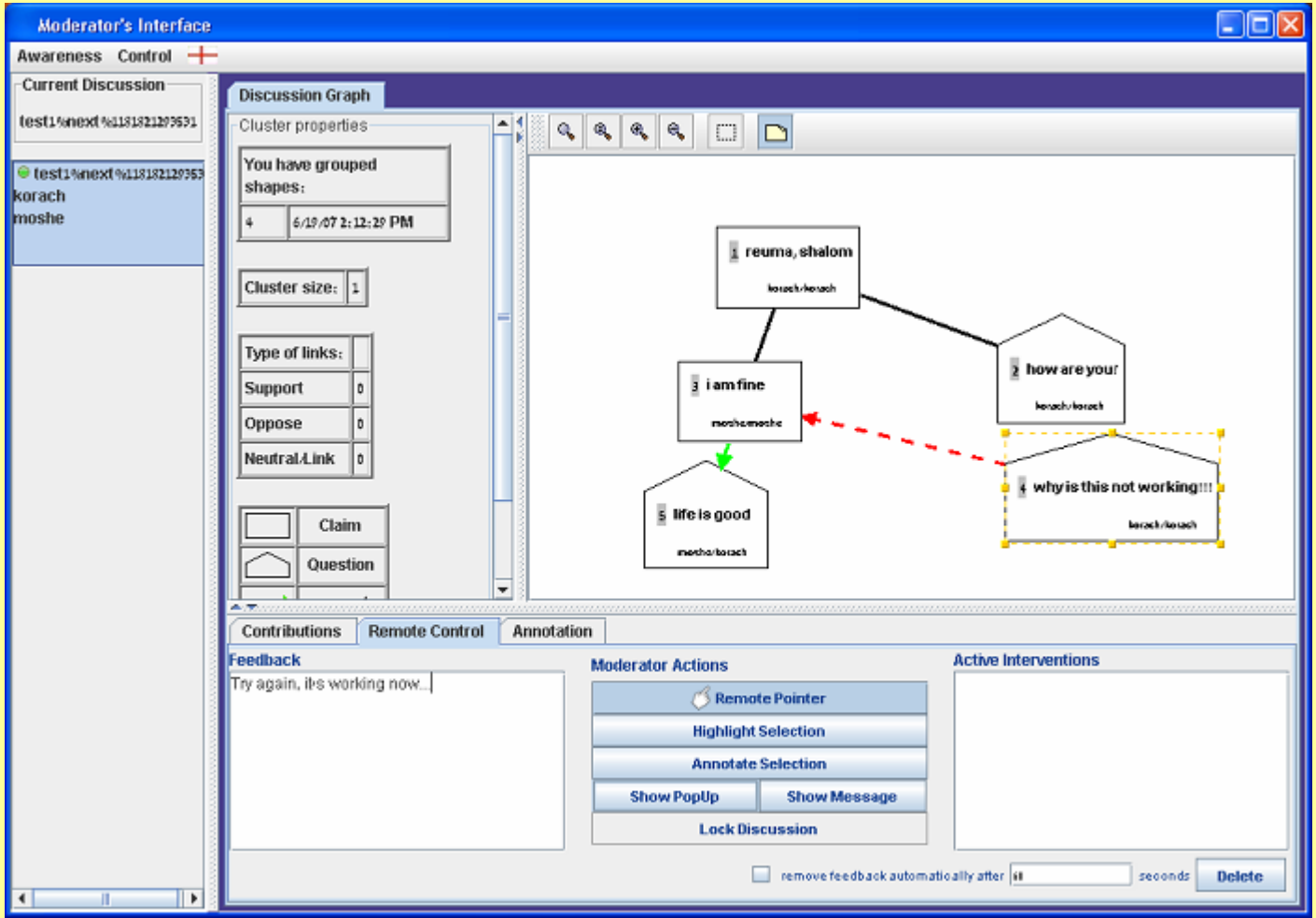


b) Semantic field vis. tool

IA ⇨ IA Tools state of the Art

(i) The status of the IA tool

Example of IA tool: "Argunaut" for Moderation by Teachers: Collide Group, de Groot et al.
CSCL2007 proceedings, p.165



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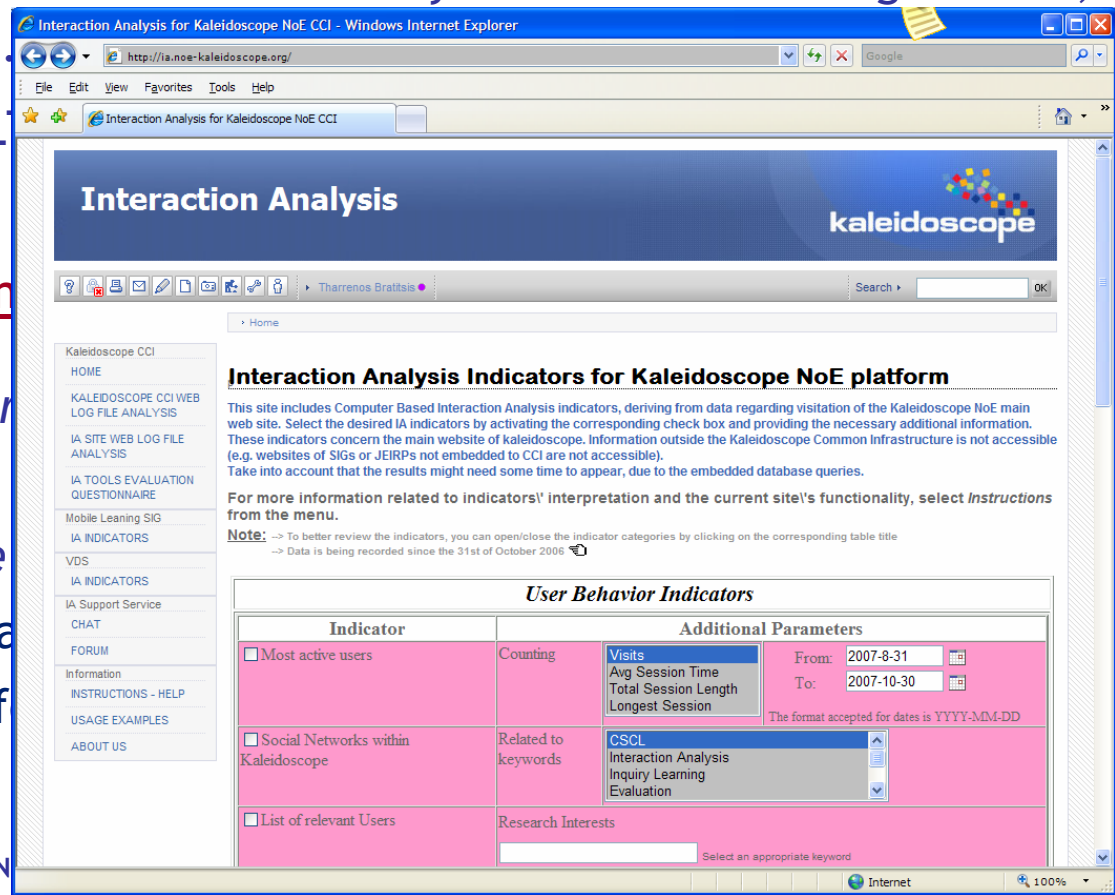
- Complete IA tool: DIAS, L

➢ IA tools current developmen

- Forums (*e.g. Aula IA suppor*
- File exchange- contribution
- Learning environments (*like*
- Web-based platforms (partia
- Scientific communities platf



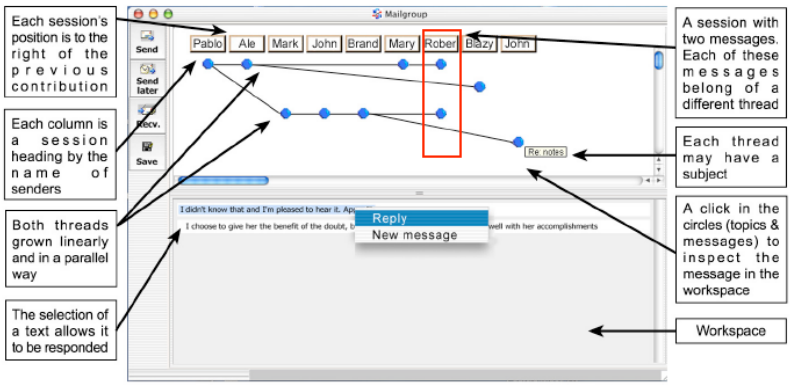
IA ⇨ IA Tools state of the Art

(ii) The visualisation space of IA Tool outputs

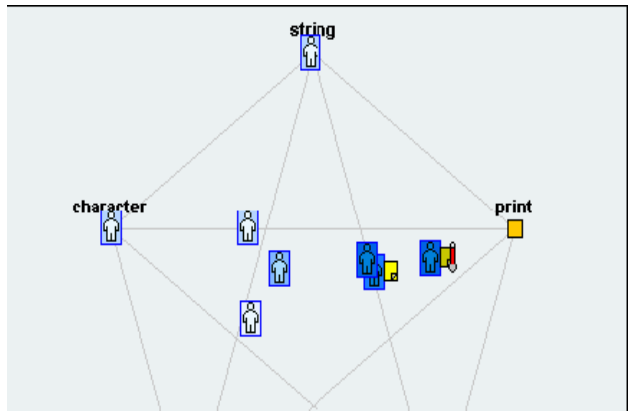
(a) Presented on the interface of the IA tool

e.g. i-bee; DIAS system; «Activity Analysis» of ModellingSpace.

(b) Presented on the interface of the learning environment



Rayes & Tchounikine, 2005



Social Navigation Support in VIBE, Ahn, Farzan, Brusilovsky 2006

IA ⇨ IA Tools state of the art

(iii) The IA tool output Interaction Model(s)

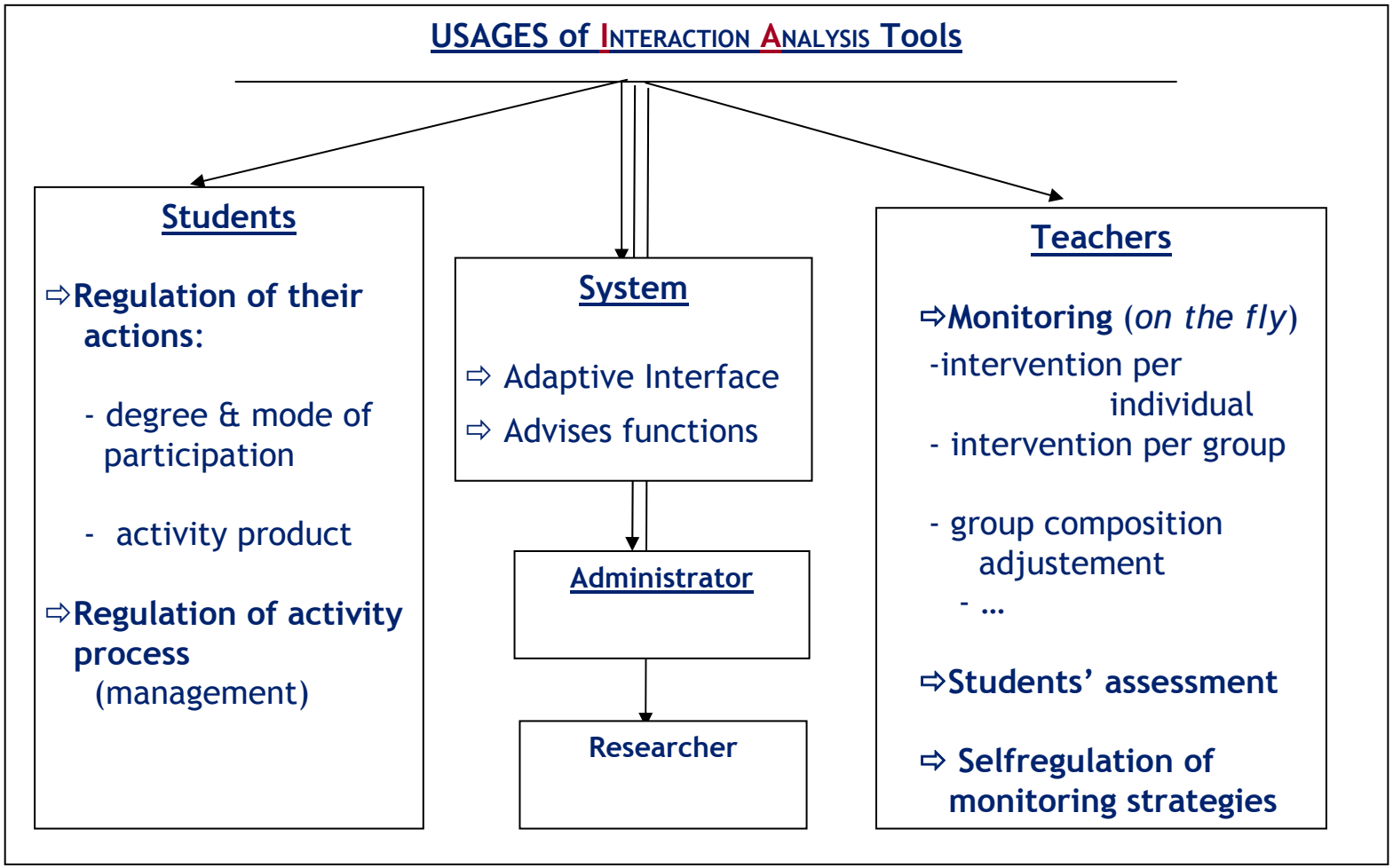
« *Expressiveness of Interaction Model of the IA tool* »

- Low level: a limited number of indicators
- Intermediary level: a coherent but partial set of indicators
- High level: coherent sets of indicators that represent a serie of complementary aspects of interaction and interactional product analysis (e.g. cognitive, social, affective aspects)

(iv) The intented Users of IA Tool

- **Students:** i-bee tool
- **Teachers:** Analytic Tool/Knowledge Forum; Argunaut
- **Multiple users** (students, teachers, researchers): DIAS tool; Activity Analysis/ModellingSpace// LTEE lab

IA ⇨ Overview: Current Usages of IA tools



IA ⇨ Case Studies of IA tools

I.

Simple IA tool providing one representation- visualisation (Addressed to 'students' & 'teachers' so as to regulate their behaviour)

'SNA' of Community of learners (teachers in education), 2003

[*LTEE, Hlapanis PhD; Hlapanis & Dimitracopoulou JTPE,2007*]

II.

IA tools as Component linked to a Learning Environment (Addressed mainly to teachers so as to regulate their behaviour)

Interaction Analysis Tool for Teachers ("Activity Analysis" separate Component of a collaborative modeling env. 'MODELLINGSPACE') [2001]

[*LTEE, Petrou PhD, 2005, Petrou & Dimitracopoulou C&E, 2002, 2005*]

III.

Independent IA tool incorporating a variety of indicators (Addressed to teachers, students, researchers, etc.)

Independent Interaction Analysis Tool for Asynchronous Discussions ("DIAS" system), 2005

[*LTEE, Bratitsis PhD, 2007, Bratitsis & Dimitracopoulou 2006,2007*]

IA ⇨ Case Study I: Students' oriented

↳ Simple IA tool providing one representation- visualisation

Case: **Awareness and self/group assessment of 'e-mail messages' interactions, in the frame of an e-learning educational program, for in service education of teachers on ICTs**
[*LTEE, Hlapanis & Dimitracopoulou JTPE,2007***]**

Conditions:

- ⇨ **Hybride Distance Learning Program, ACL, LTEE, 2003-2004**
- ⇨ **Community of 80 persons 20 Univ. Professors' & 60 edu. teachers**
- ⇨ **Program of 15 courses (at least 2 courses in parallel).**
- ⇨ **A common platform for the courses [content, activities, forum, chat, etc].**

⇨ **Activity via e-mail: Preparation of synthesis or analysis topics**

IA ⇨ Case Study I: Students' oriented

Simple IA tool providing one representation- visualisation

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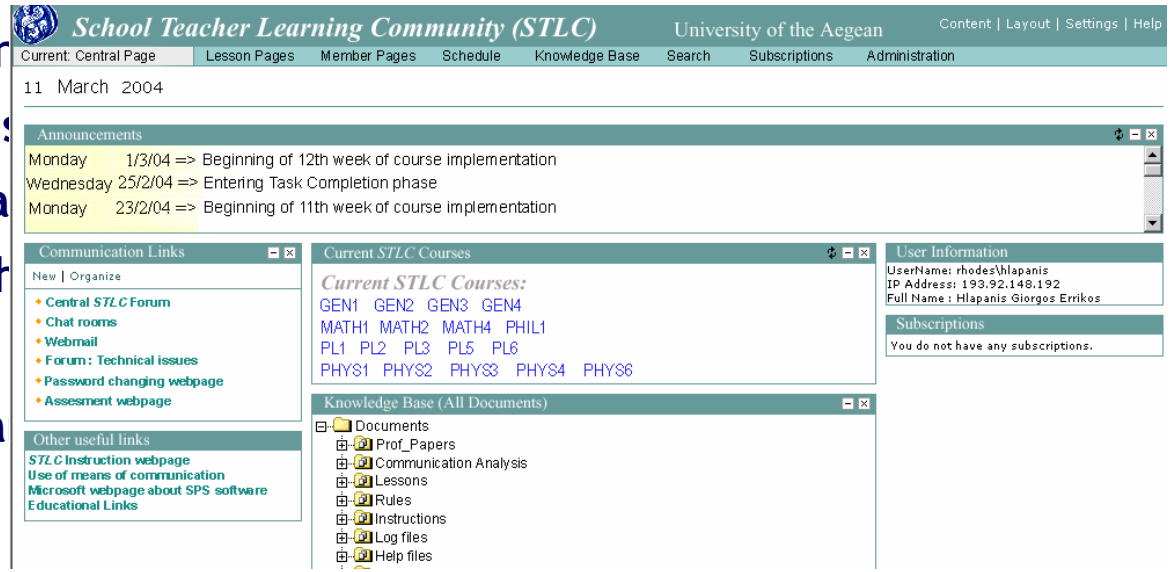


IA ⇨ Case Study I: Students' oriented

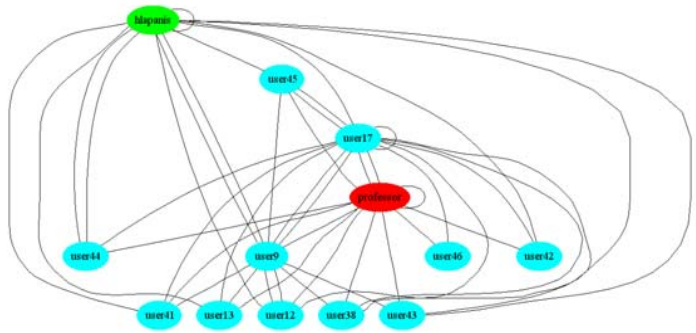
↯ *Simple IA tool providing one representation- visualisation*

⇨ **Activity: Preparation of a synthesis topic, by collaborating into small groups**

⇨ **Publication of visualisations of their e-mail exchanges in the frame of the community of the course participants**

⇨ **Periodicity: Every week**

⇨ **Codification of Persons (anonymity): Every 'student' is represented by a code (eg. User 13)**

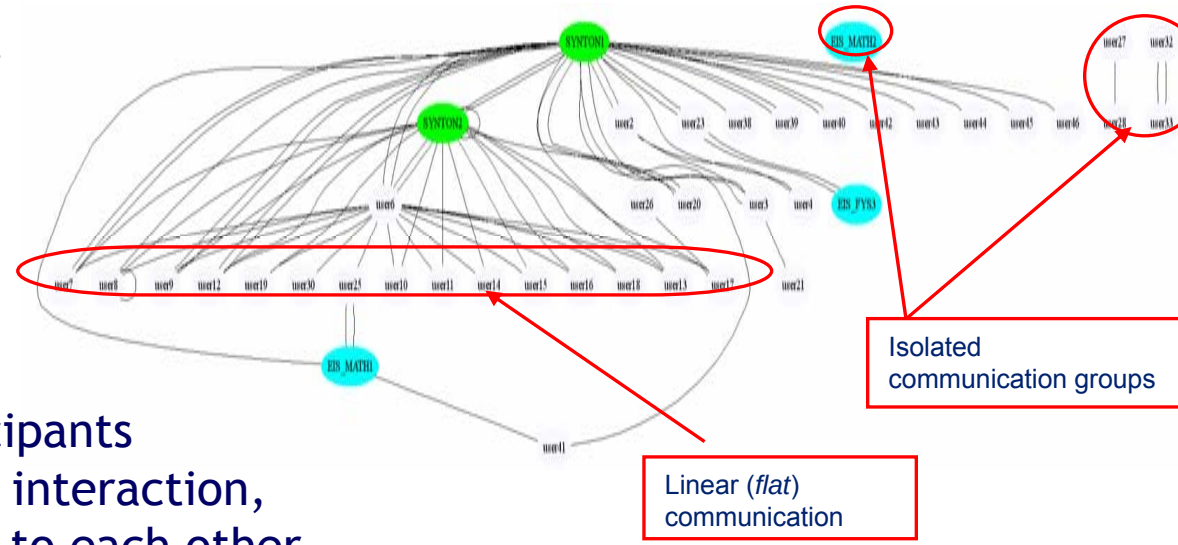


⇨ **Free choice access: Every member had to ask for its code so as to be able to decode the visualisation regarding his/her participation- contribution**

IA ⇨ Case Study I: Students' oriented

↯ *Simple IA tool providing one representation- visualisation*

⇨ **Social Network Analysis**



I. The Visualisation of SNA

Nodes: each participant
Links:
interactions among the participants
⇧ weight of a link: -> intense interaction,
the nodes are close to each other

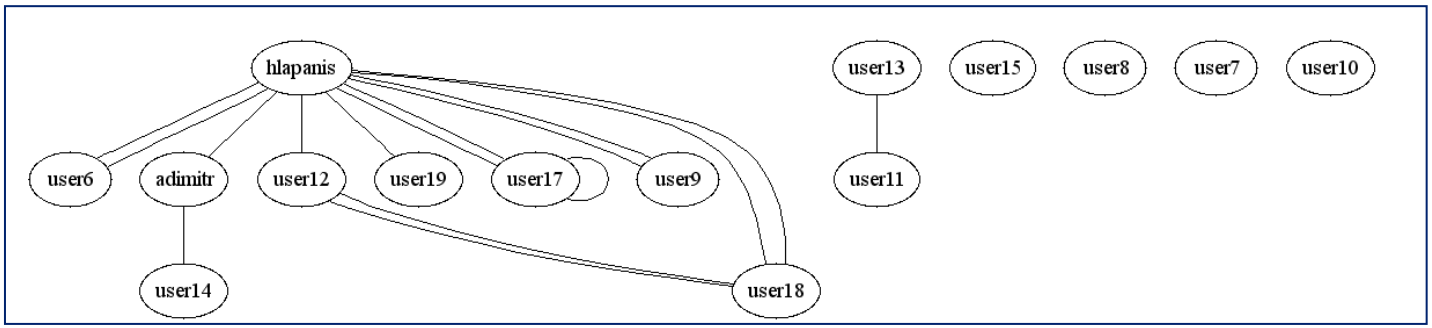
II. Interaction Analysis Indicators:

Density of network: *[registered interaction /the maximum of possible interactivity*
Concentration: [0 % = all communicate with all the others]
[100% =all communicate with only one person]

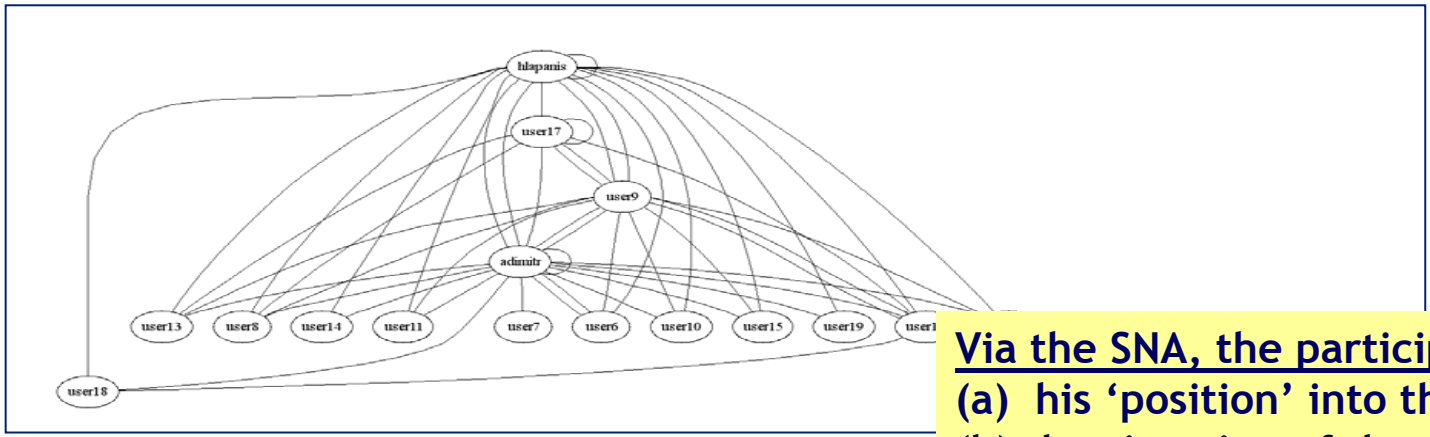
IA ⇨ Case Study I: Students' oriented

↯ *Simple IA tool providing one representation- visualisation*

⇨ **Social Network Analysis (SNA):**



2nd Week
Group Maths 1



4rth Week
Group Maths 1

Via the SNA, the participant can recognise:

(a) his 'position' into the group,

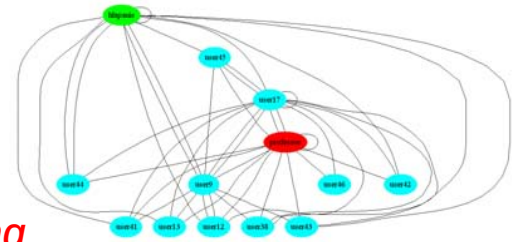
(b) the situation of the group as a whole

(without paying attention to the underlying indicators exact values)

IA ⇨ Case Study I: Students' oriented

↯ *Simple IA tool providing one representation- visualisation*

⇨ **Social Network Analysis (SNA):**



➢ *Research questions*

"To what extent does a learner community member's behavior change due to the presentation of reports analyzing and visualizing the communication within the community?"

Data: **Comparison of changes in participants behavior, questionnaire(s), interviews at the end of the program**

Hlapanis & Dimitracopoulou, 2007

Main conclusions:

⇨ **Correlation between the students having accessed "activity reports" and an increase in their e-mail exchanges / ⌦ Less low moderation actions applied by the moderator**

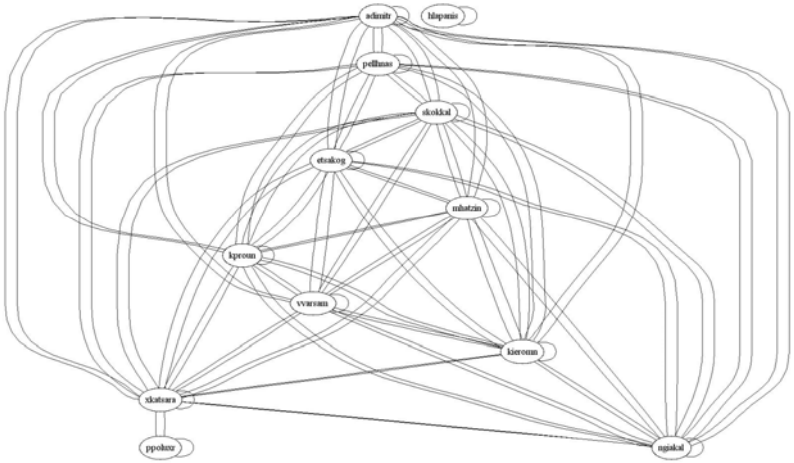
⇨ **Men were more interested in SNAs than women (more competitive behavior ?) (correlations):**

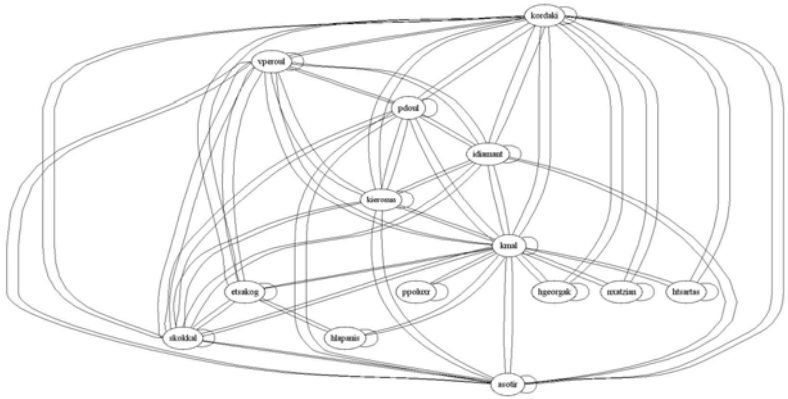
['*I prefer to be at least in a middle situation regarding the other persons' actions* **U5/C1]**

IA ⇨ Case Study I: Students' oriented

Simple IA tool providing one representation- visualisation

⇨ **SNA for Forum Moderators**





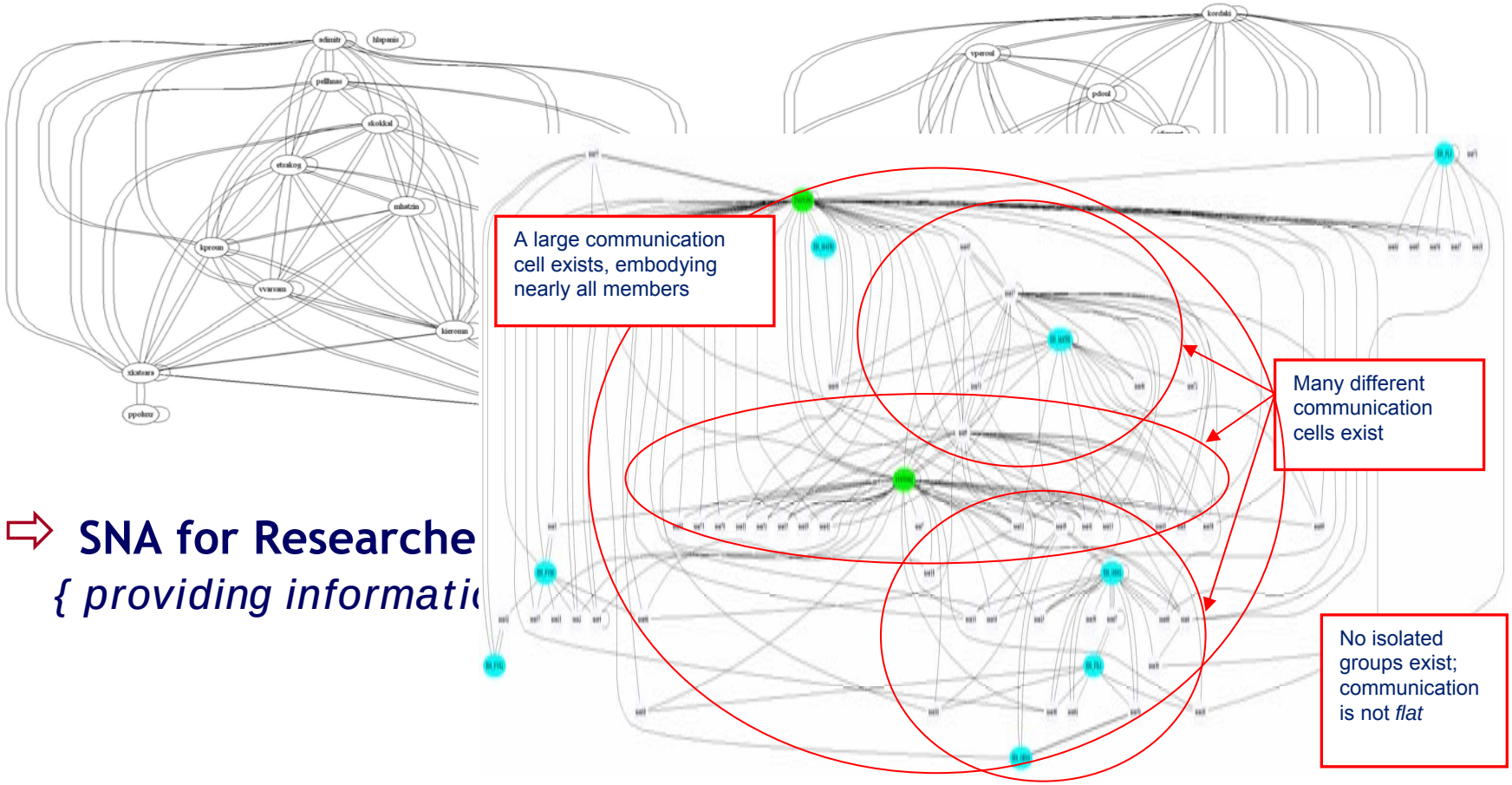
⇨ **SNA for Researcher (Community main Coordinator)**

{ providing information on when a community is created}

IA ⇨ Case Study I: Students' oriented

↯ *Simple IA tool providing one representation- visualisation*

⇨ **SNA for Forum Moderators**



⇨ **SNA for Researche**

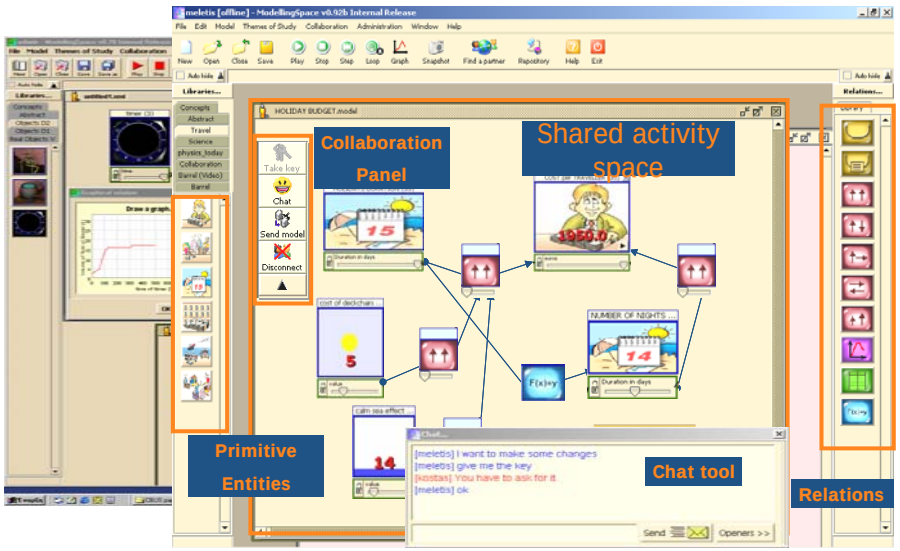
{ providing informati

IA ⇨ Case Study II: Teachers' oriented

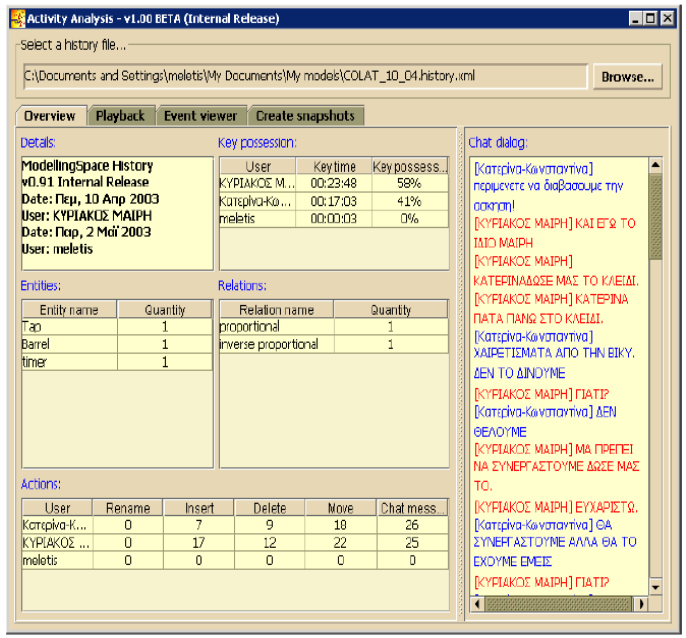
↳ *IA tool as Component linked to a Learning Environment*

Case: **Secondary Education Teachers use the IA tools, on the fly and afterwards synchronous collaborative modelling activities [2001]**

- LTEE, Petrou, Fessakis, Dimitracopoulou, 2004
- Petrou PhD, 2005



MODELLINGSPACE



'Activity Analysis' of MODELLINGSPACE

IA ⇨ Case Study II: Teachers' oriented

IA tool as Component linked to a Learning Environment

- **Participants**
  - ✓Four teachers (without any specialty on collaborative learning)
  - ✓Four classes of students (15, 16, 17 years) of three public schools

  Class Conditions
  - ✓ Students collaborate between them via different PCs in the same class
  - ✓ On the fly, each teacher choose one-two group of students to supervise using the corresponding IA tool,
  - ✓ Afterwards, (after the end of the session) teachers study the available IA tool

  Technological environments
  - ✓**MODELLINGSPACE, learning environment**
  - ✓**Activity Analysis (IA Tool of ModelingSpace)**

    Four tools: Quantitative Overview, Annotated Video of Interaction Process, Tool of Process Reproduction [*COPRET*], CAF.

- **Learning Activity**
  - ✓4 Activities around [y=ax+b], working on a serie of problems related to the cost of mobile phones companies' programs

IA ⇨ Case Study II: Teachers' oriented

IA tool as Component linked to a Learning Environment

Participants

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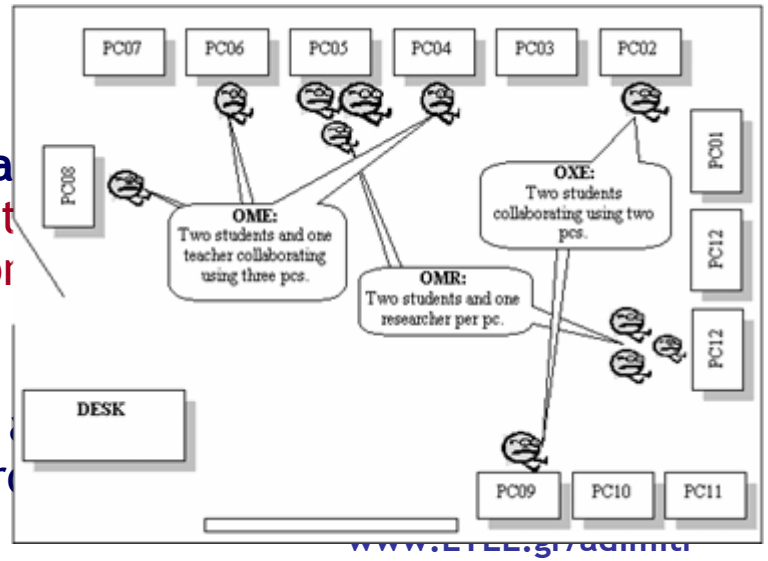


Learning Activity

- ✓4 Activities around [y=ax+b], working on
the cost of mobile phones companies' pr

IA ⇨ Case Study II: Teachers' oriented

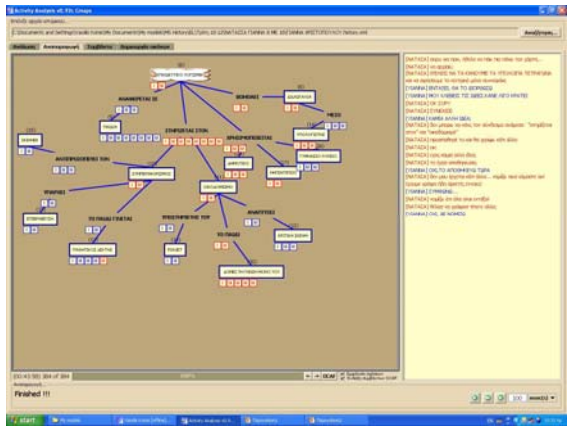
↳ *IA tool as Component linked to a Learning Environment*

COLLOCATED STUDENTS SYNCHRONOUS COLLABORATION SCRIPT	
Phase 1	INITIAL INDIVIDUAL PROBLEM UNDERSTANDING. Students solve individually specific instances of the problem using paper and pencil [via students printed activity'sheets]. ⇨ Individual, with paper & pencil
Phase 2	SYNCHRONOUS COMPUTER MEDIATED COLLABORATION ⇨ collocated synchronous computer supported collaborative activity [students that are collocated in the same classroom, working on different PCstations, not near each other] ⇨ with possible supervision, by teacher (computer mediated or not)
Phase 3	GROUP ACTIVITY REPORT Students have to edit a report in order to present the process and the results of their collaborative activity process During this phase, students must be supported, by using interactions analysis tools, that provides a readable 'history' of their collaborative activity process. ⇨ side-by side synchronous collaboration in front of the same PC ⇨ without supervision of the teacher
Phase 4	REPORT PRESENTATION IN THE CLASSROOM. During the next lesson, some group of students present their activity report in the classroom and answer other students' and teacher questions. ⇨ collective activity in the social level of the class, moderated by the teacher. Teacher Role: Additionally, teacher intervenes to the whole class, or to specific groups after having study the 'history of collaborative process' of each group (using and studying information provided by interaction analysis tools).

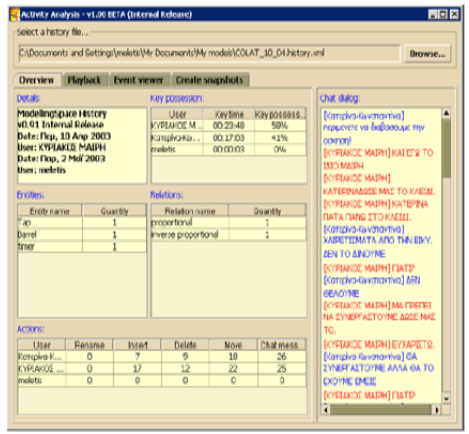
IA ⇨ Case Study II: Teachers' oriented

IA tool as Component linked to a Learning Environment

"Annotated Playback"



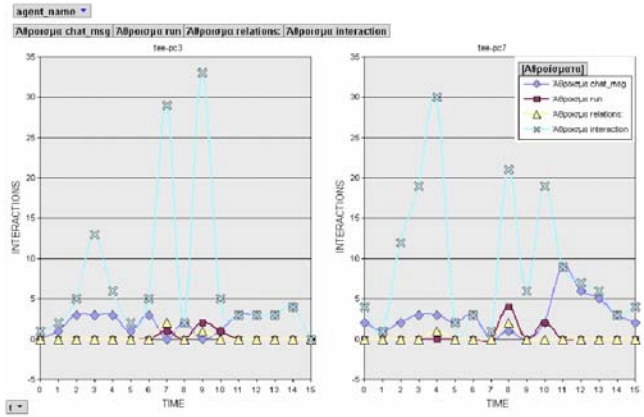
"Quantitative overview"



"COPRET"

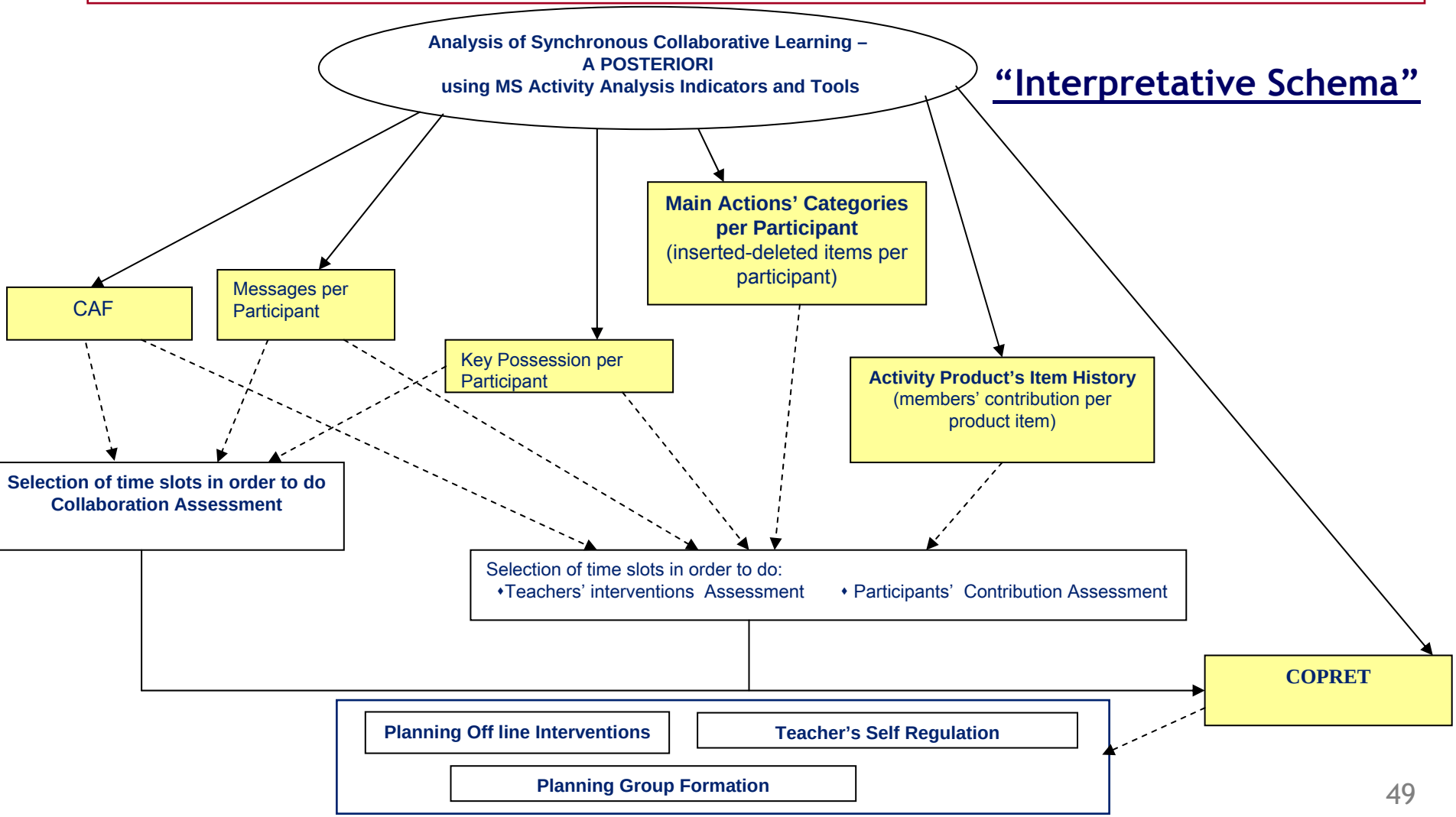
[00:04:53][Kyriakos] You must go to page 8 and do what it says.
[00:06:23][Kyriakos] What's going on? Why you are doing nothing?
[00:07:18][Rodoula] I can't put the relationship, I whould like some guidance. If you want ask for the key and do it.
[00:07:26][Kyriakos]ok
[KYRIAKOS TOOK THE KEY].
[00:07:38][Teacher] Kyriako please, don't press Rodoula!

"CAF: Collaborative Activity Function"



IA ⇨ Case Study II: Teachers' oriented

↳ *IA tool as Component linked to a Learning Environment*



IA ⇨ Case Study II: Teachers' oriented

IA tool as Component linked to a Learning Environment

- **Case Study Duration**
  - ✓ Each class work during 8 sessions (2x45 minutes)

- **Data**
  - ✓ ♦ Log files, ♦ collaborative product (models & final reports),
    ♦ students' worksheets, ♦ video & audio from students' and classes
    ♦ questionnaires of students and teachers, ♦ interviews
    ♦ Thinking aloud protocol (applied to teachers)

- **General Conditions of IA tools usage**

On the fly: Each teacher choose one or two groups of students to supervise, using: The CAF, the images of the shared working space

Afterwards:

- ✓ At the end of each session, he/she collected the data
- ✓ Study the IA tools outputs
- ✓ During the next session, apply self-regulated actions /interventions

IA ⇨ Case Study II: Teachers' oriented

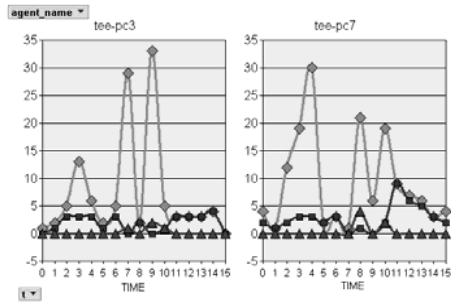
IA tool as Component linked to a Learning Environment

Research questions

- ⇨ What information teachers decode and how they interpret this information?
- ⇨ How teachers regulate their own teaching strategies based on the decoded information?
- ⇨ What is teachers' opinion about the tools' appropriateness, the way of use, the restrictions and the improvements?
- ⇨ What are the effects of their self-regulating actions

IA ⇨ Case Study II: Teachers' oriented

↳ *IA tool as Component linked to a Learning Environment*



(A) CAF. Teachers' global point of view points out mainly:

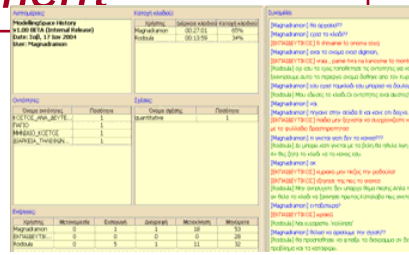
(1) *Its usefulness:* considering it as a tool, allowing supervision of many groups at the same time: "*CAF gives me an overview of the collaboration between students*" T-ELSA, *"CAF is giving you a general idea about the collaboration"* T-SAV.

(2) *Its justification*: selection of time points for teachers' intervention or more detailed observation, "*I'm able to find out in time that a group face problems and is doing nothing, or that a student monopolize the work and is not giving the key to other participants*" T-MITS,

(3) *Its disadvantage:* since teachers need practice in order to fully exploit its potentials, "*Of course, in order for the teacher to be able to make worth of all the functionalities he needs practice"* T-DIM.

IA ⇨ Case Study II: Teachers' oriented

↳ *IA tool as Component linked to a Learning Environment*



(B) QUANTITATIVE OVERVIEW

Teachers' global point of view points out mainly:

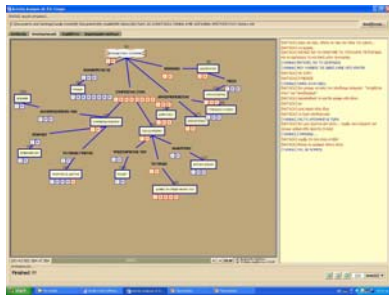
(1) *Its usefulness*: considering it as tool presenting key's possession percentages and number of exchanged messages: *"Statistics give general information about collaboration, like percentage of key's possession, number of messages per participant"* T-ELSA

(2) *Its justification:* since teachers can do estimation of learners' collaboration: who was acting more at the shared workspace, who sent more messages, or reflect on their own interventions in terms of intervention's frequency and duration, "*Micelle possessed the key more than Mary*", T-DIM, *"You see, the collaboration seems good, students possessed the key equally"* T-SAV, *"Most of the time I had the key. Next time I will try to sent more messages".* T-ELSA.

(3) *Its limitation*: "*But can't come to safe conclusions about the collaboration unless you have access to other analysis tools"* T-ELSA, "*Statistics are not sufficient in any case"* T-SAV.

IA ⇨ Case Study II: Teachers' oriented

↳ *IA tool as Component linked to a Learning Environment*



(C) PLAYBACK. Teachers' global point of view points out mainly:

(1) its usefulness considering it as a tool presenting details of students' problem solving process, *"Using Playback you can follow students' problem-solving process"* T-MITS.

(2) *Its justification:* since teachers can localize students' mistakes and do demonstration for further discussion, "*Here they did it all wrong, you see, Kyriakos put the relationship wrong, Rodoula continue….*", T-DIM, *"They don't know how to do a graph?"*, T-SAV; *"I 'm curious what they will say when they will see it next time"*, T-ELSA.

(3) *Its disadvantage:* since it is very time consuming, "*The problem is that it is time consuming and if you must do it for lets say ten groups then you need much more time"* T-DIM.

IA ⇨ Case Study II: Teachers' oriented

↳ *IA tool as Component linked to a Learning Environment*

(D) COPRET. Teachers' global point of view points out mainly:

(1) *Its usefulness:* considering it as a tool presenting details from dialogues and actions during collaborative problem-solving, *"I would use this tool again because it was the most useful collaboration's analysis tool because it allows dialogues' and action's analysis"* T-MITS,
"*Using this tool you can follow actions and dialogues that take place simultaneously"* T-ELSA.

(2) *Its justification:* since teachers can localize students' weak points and detect misconceptions, studying students' behavior and contribution, criticize theirs interventions and analyzing interventions' results,
"*In this way we can find our weak points without time pressure, unlike during the collaboration where our decisions are under a lot of pressure"* T-DIM,
Mainly through dialogue study and actions analysis I concluded each member's participation during problem-solving and their weak points concerning the subject matter that was taught" T-MITS,
"*I use this tool for studying and analyzing participants' behavior, including myself"* T-ELSA,

IA ⇨ Case Study II: Teachers' oriented

↳ *IA tool as Component linked to a Learning Environment*

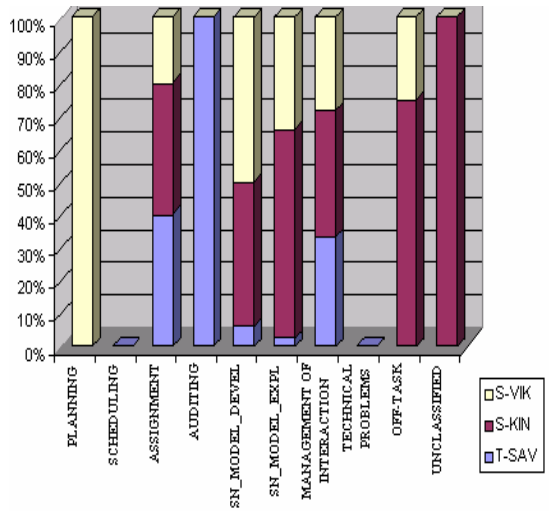
TOOLS	DECODED DATA	HOW TEACHERS INTERPRETED THE DECODED DATA	REGULATION OF TEACHERS' STRATEGIES
CAF	•Participation	•Assessing collaboration •Assessing contribution •Choosing the right time for intervention •Choosing points that need focus, a more detailed analysis •Assessing their own interventions	•Self-regulation •Planning a new group formation
STATISTICS	•Number of messages per participant •Percentages of key possession	•Assessing collaboration •Assessing their own interventions	•Self-regulation
PLAYBACK	•Activity solving process	•Diagnose cognitive difficulties •Diagnose difficulties with the software	•Demonstration
COPRET	•Dialogues between the participants & Actions at the shared workspace	•Assessing collaboration •Diagnose cognitive difficulties •Diagnose difficulties with the software •Assessing their own interventions	•Self-regulation •Planning a new group formation

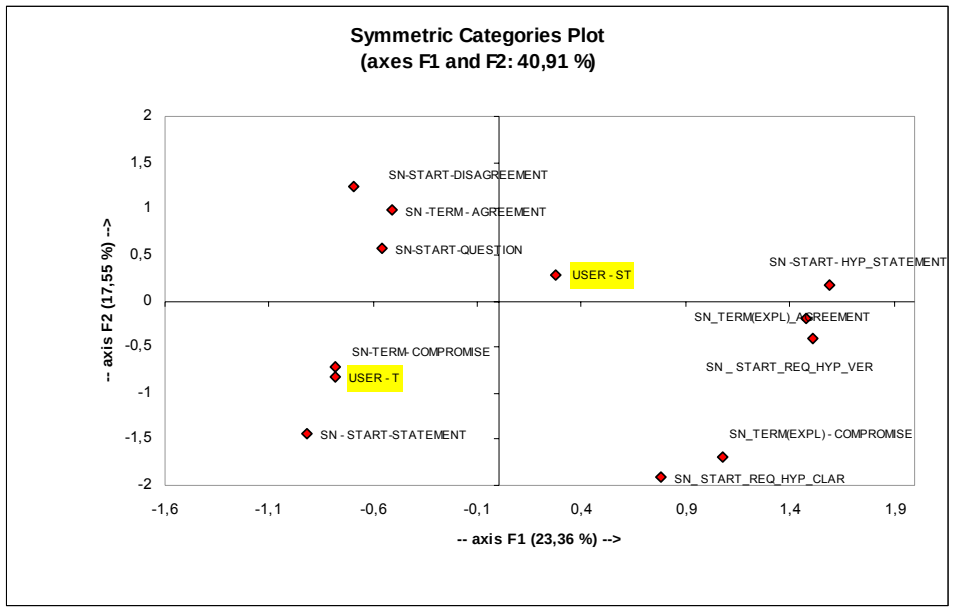
IA ⇨ Case Study II: Teachers' oriented

↳ *IA tool as Component linked to a Learning Environment*

Study of the effects of teachers interventions (after using the IA tools)…

PhD A. Petrou, LTEE lab; Petrou & Dimitracopoulou 2007





IA ⇨ Case Study II: Teachers' oriented

↳ *IA tool as Component linked to a Learning Environment*

IA Tools like "Activity Analysis" of 'MODELLINGSPACE':

⇨ *IA tools that do not provide well defined indicators, nor high level ones*

⇨ *They do not include calibrated indicators*

⇨ *Far away from indicators sets forming interpretative students' models*

⇨ *However, they constitute tools useful for the teachers in a class*

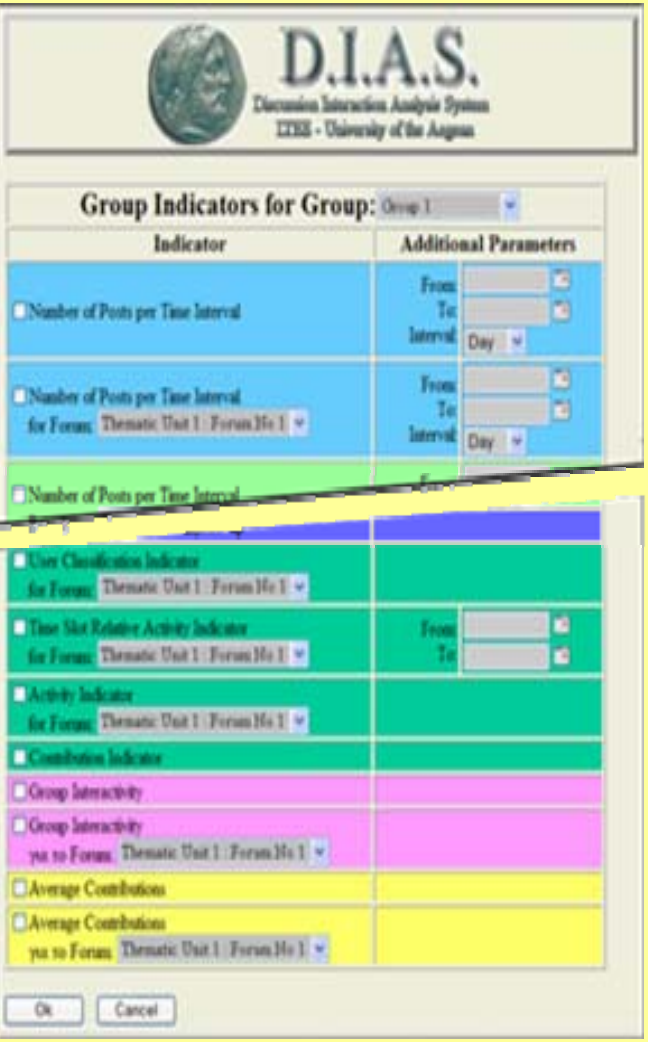
IA ⇨ Case Study III: Flexible IA tools for all

↳Independent IA tool incorporating a variety of indicators

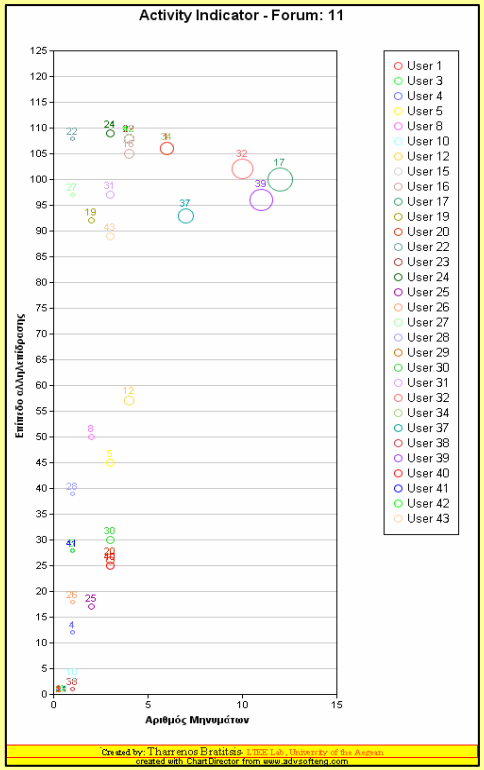
DIAS system – (Discussion Interaction Analysis System):
for asynchronous discussion forum)

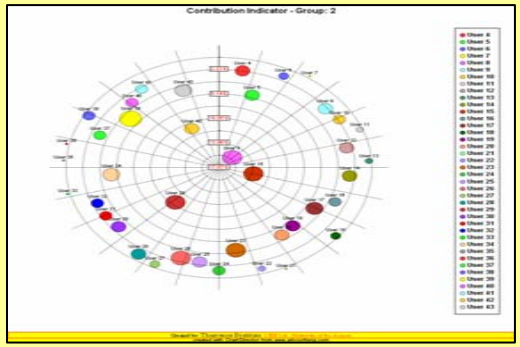
IA ⇨ Case Study III: Flexible IA tools for all

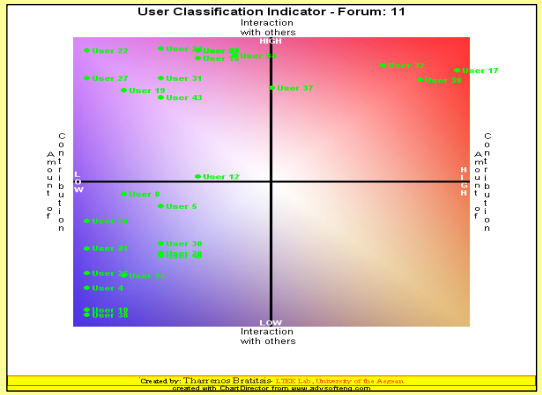
Independent IA tool incorporating a variety of indicators

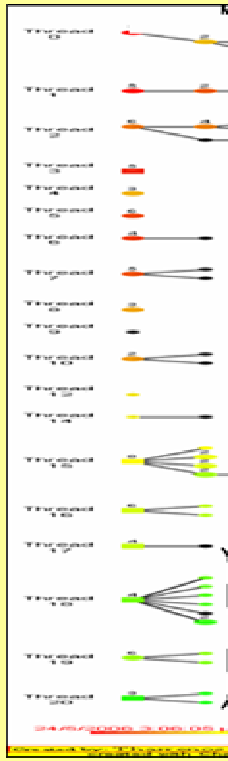


Indicators selection interface (*group IA I*)









DIAS IA tool user: can select set of indicators :

(~ 65 indicators): ➢ for individual students, grou

➢ for teachers

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↳*Independent IA tool incorporating a variety of indicators*

DIAS IA tool; Bratitsis, 2007, LTEE lab

DIAS produce a wide range of Interaction Analysis Indicators:

- 65 visualised indicators (including variations) [varying from simple statistical awareness indicators to more complex one].

that could be appropriate for:

- all participants and IA tool users and the roles they overtake in the context of a discourse learning activity
- the distinct phases during a discourse learning activity
- the teaching strategies, which can be applied in asynchronous discussion activities

when they form:

- Different sets of indicators for students as IA tools users and other sets for teachers
- **Interpretation schemas** per IA tool user profile,
- Indicators Sets and interpretation schemas **for various discussion strategies and usage scenarios.**

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↳*Independent IA tool incorporating a variety of indicators*

DIAS IA tool: Design Principles

Central design principles:

- *Take into account the totality of the members that are involved in a 'learning activity', as well as their cognitive systems that may form*, **students as individuals (in various roles),** but also as members of one or more groups or even communities, teachers in different roles according to the category of learning activity, etc.
- *Provide a rich range of interaction analysis indicators*: The analysis of interactions, in terms of indicators, seems to be an appropriate framework that offers different points of view of the learning activity process, its quality, as well as its product. Different indicators may be more appropriate during different time periods of the learning, for different learning task, as well as for different profiles of forum participants.
- *Create a flexible, customizable and interoperable system*: Forums are tools that can be used in a number of contexts, and for a variety of discussion based learning activity categories. Furthermore, forum participants take various roles and they have different needs according to their discussions subjects, the available time, etc. Thus, it is significant to create customizable, flexible and interoperable systems.

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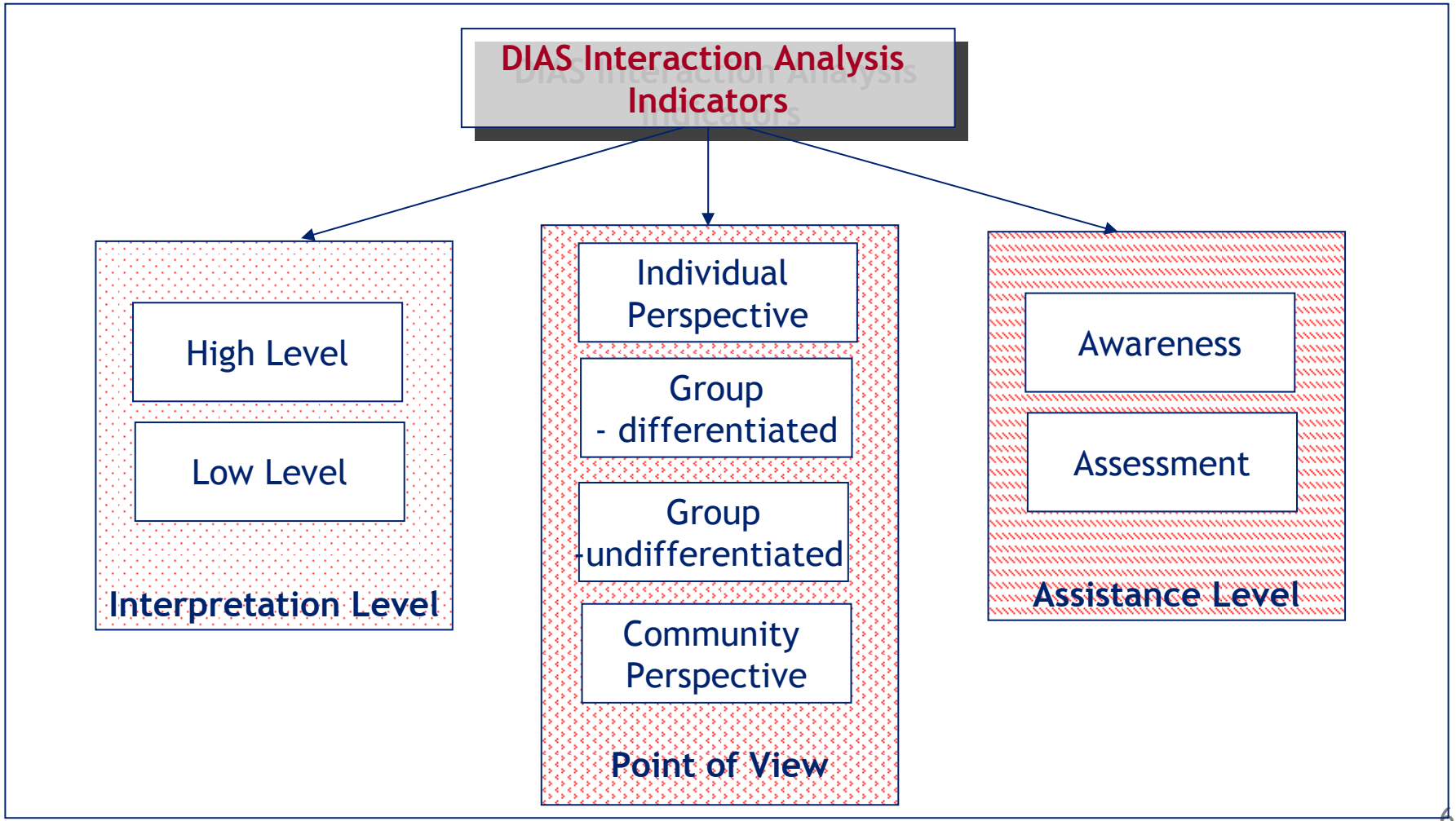
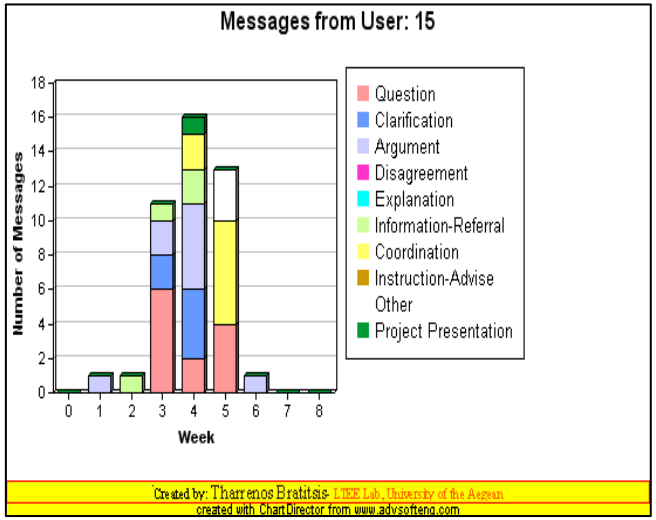
Independent IA tool incorporating a variety of indicators



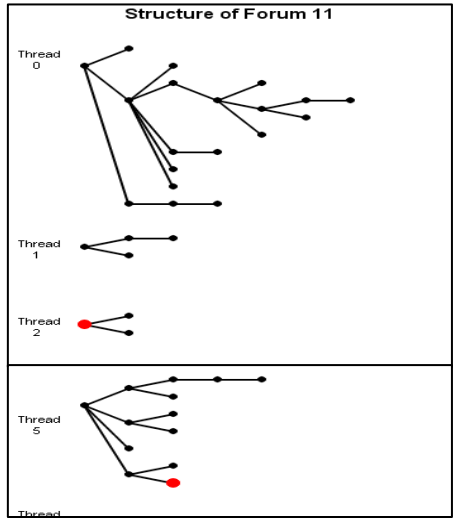
IA ⇨ Case Study III: Flexible IA tools for all

↳Independent IA tool incorporating a variety of indicators

A. Indicators addressed to individuals

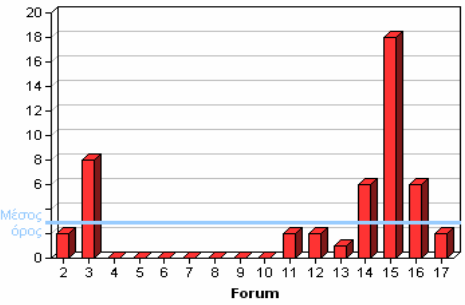


(a) User Type Messages per week



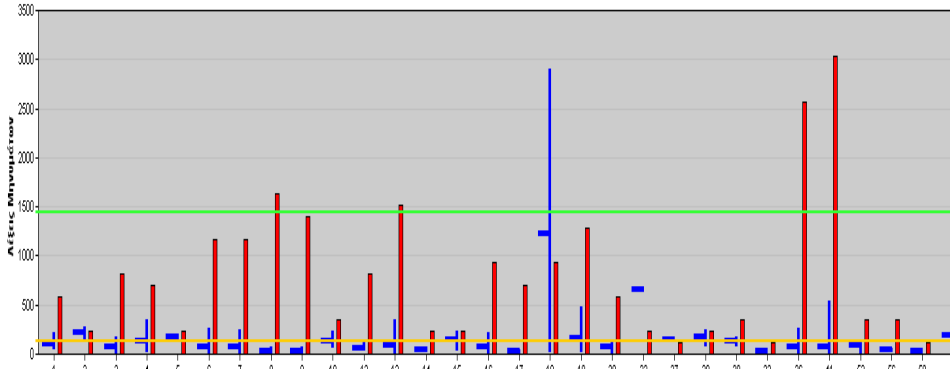
(b) Tree Structure

c) Messages posted by user in community



2: 1st thematic discussion
3: Working group 1
4: Working group 2
5: Working group 3
6: Working group 4
7: Working group 5
8: Working group 6
9: Working group 7
10: Working group 8
11: ICTs in pre-primary education
12: PC labs spaces
13: Technical management
14: School models
15: Innovation initiatives in schools

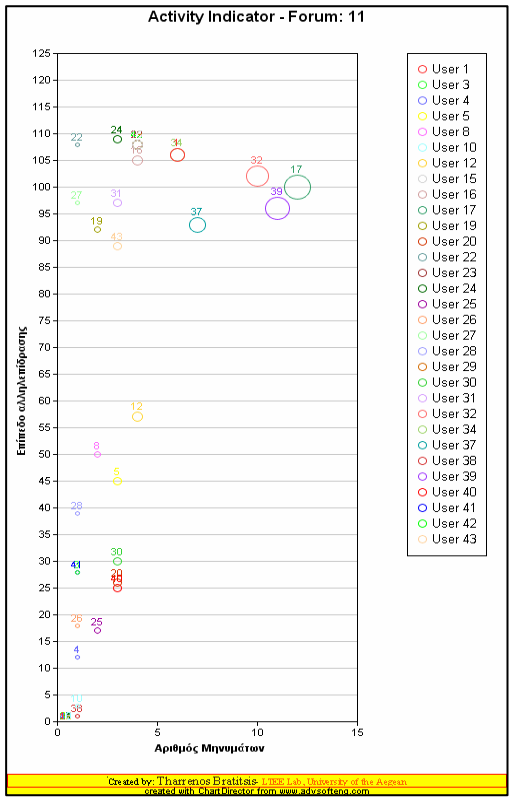
(d) Messages Length per user



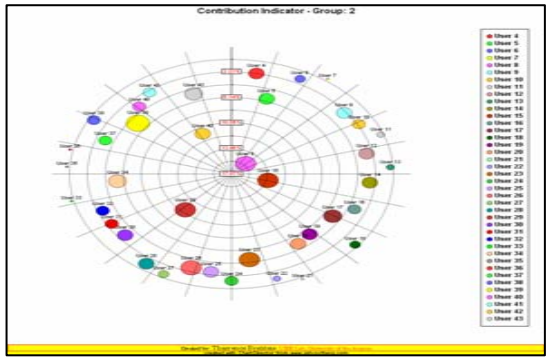
IA ⇨ Case Study III: Flexible IA tools for all

Independent IA tool incorporating a variety of indicators

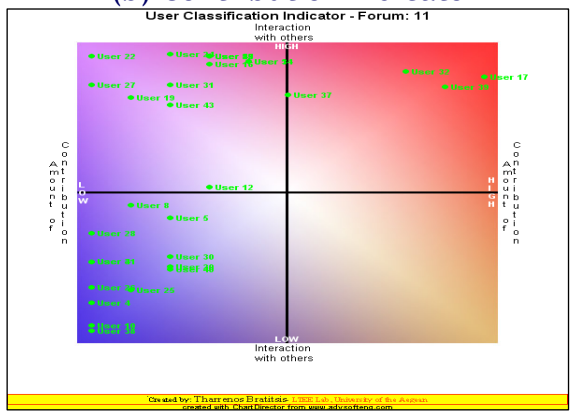
B. Indicators addressed to participants groups



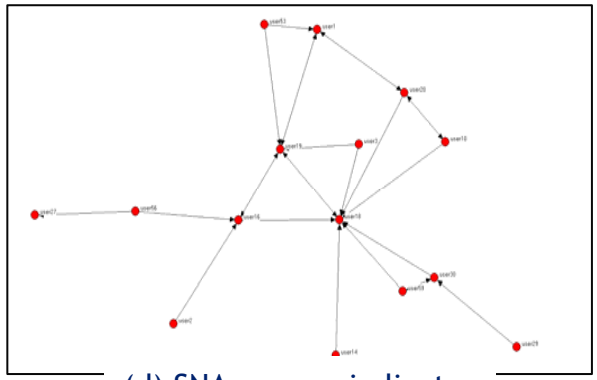
(a) Activity Indicator



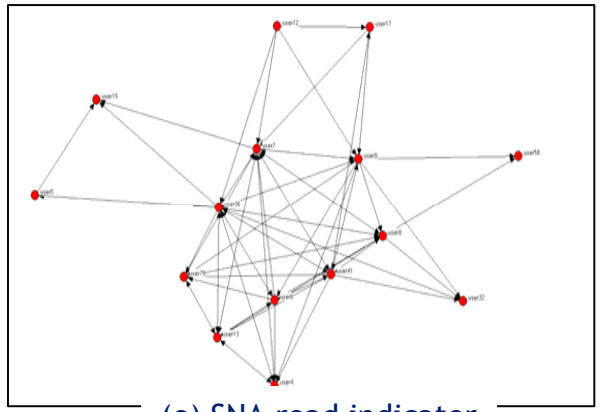
(b) Contribution Indicator



(c) Classification Indicator



(d) SNA answer indicator

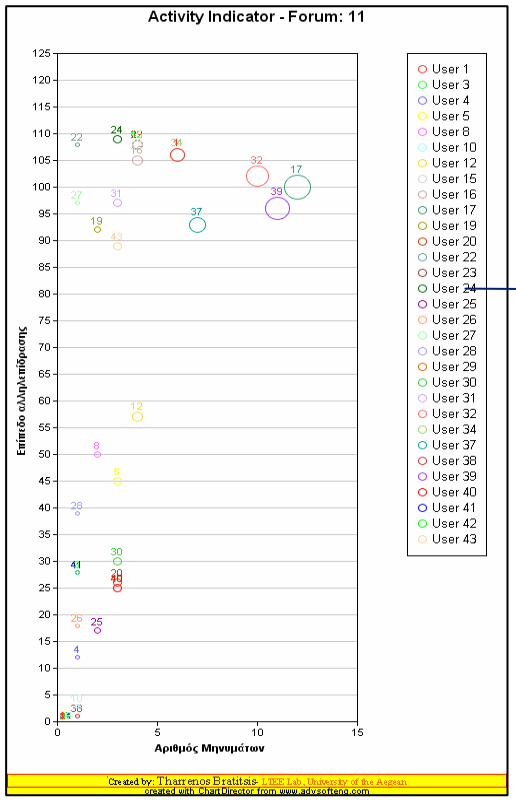


(e) SNA read indicator

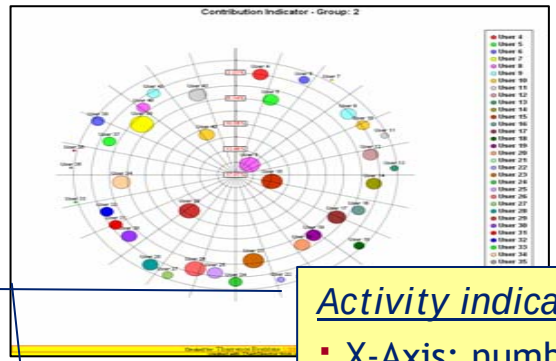
IA ⇨ Case Study III: Flexible IA tools for all

Independent IA tool incorporating a variety of indicators

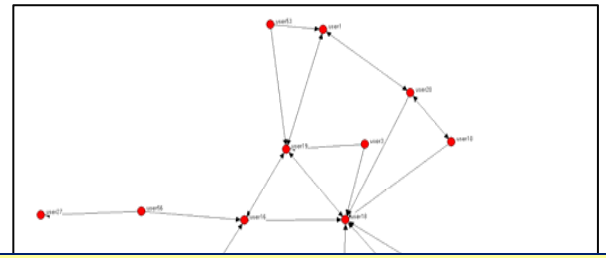
B. Indicators addressed to participants groups

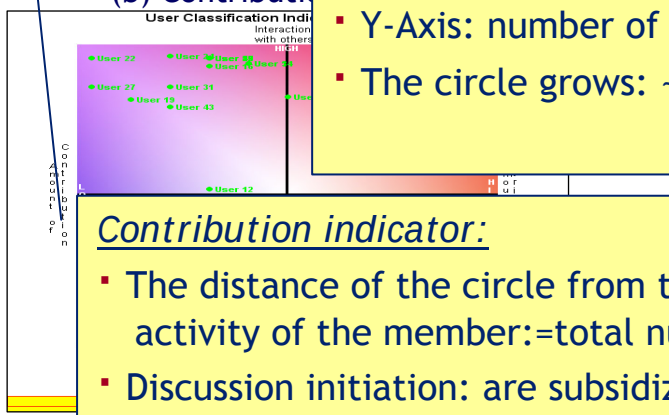


(a) Activity Indicator



(b) Contributi





Activity indicator:

- X-Axis: number of messages written by a member
- Y-Axis: number of messages read by this member
- The circle grows: ~number of types of messages

Contribution indicator:

- The distance of the circle from the circumference: ~to the activity of the member:=total number of messages
- Discussion initiation: are subsidized
- The circle sizes: ~number of types of messages

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Independent IA tool incorporating a variety of indicators

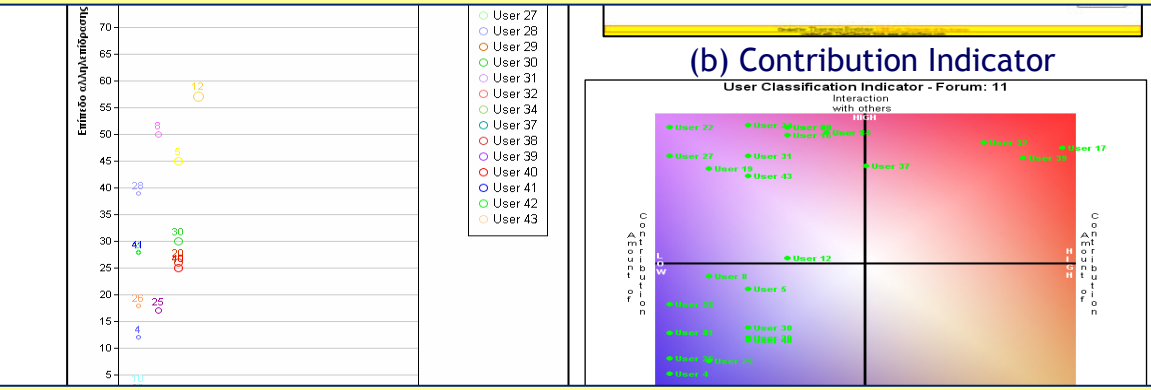
B. Indicators addressed to participants groups

SNA Answer Indicator:

- messages written by user B, that user A has answered

SNA Reads Indicator:

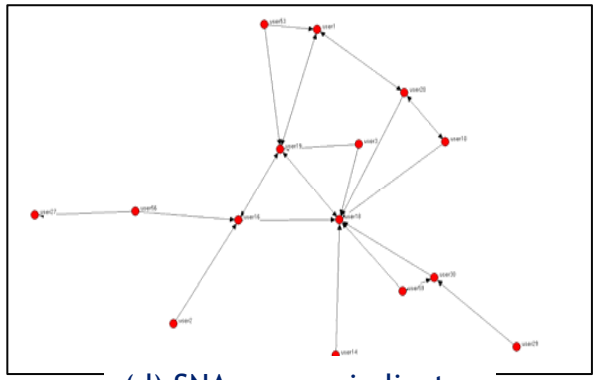
- messages written by user B, that user A has read (dissemination of messages)



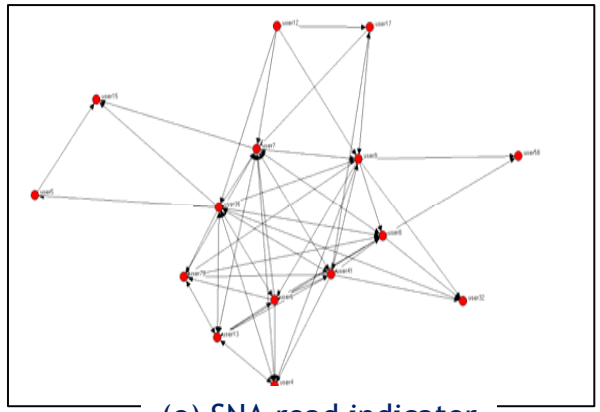
(b) Contribution Indicator

Classification indicator:

- X-axis: It represents the amount of contribution (messages written as percentage of the total number of messages)
- Y-Axis: the amount of interaction: messages read as percentage of the available number of messages



(d) SNA answer indicator



(e) SNA read indicator

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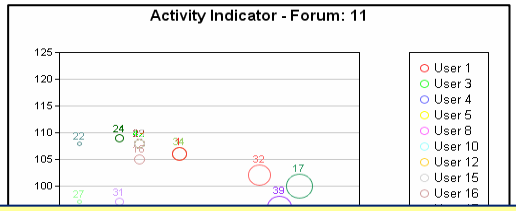
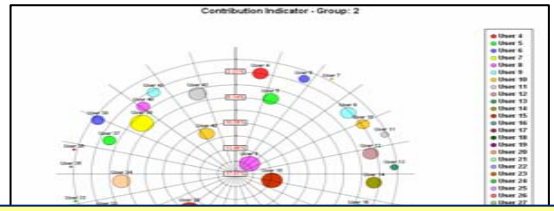


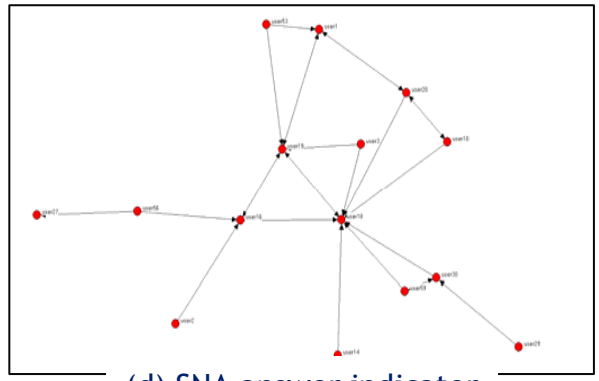


Example: By inspecting:

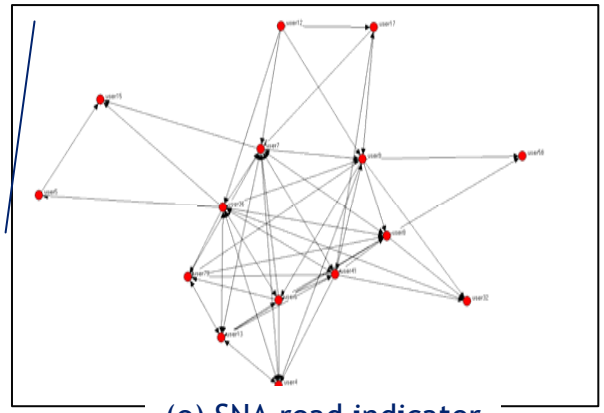
- the Classification Indicator the moderator may see how active member X is: => whether X has extreme of balanced behavior [Arrogant member: write many messages, but not read other messages. Passive member: read many messages, but not write enough]
- the SNA Answers Indicator: whether X is isolated or holds a central position. > If X seems active in message writing (*classification indicator*), SNA shows if X interact with others or not, by posting answers and receives answers :=>

If not : low argumentative value of his messages, off topic writing, arrogant behaviour, lack of knowledge regarding topic, etc

- *the SNA Reads Indicator*: if he holds a central position but appears to be isolated in *SNA Answers*, then he writes messages which are read by many others but not answered to:=> X could be a discussion coordinator or face participation problems.



(d) SNA answer indicator



(e) SNA read indicator

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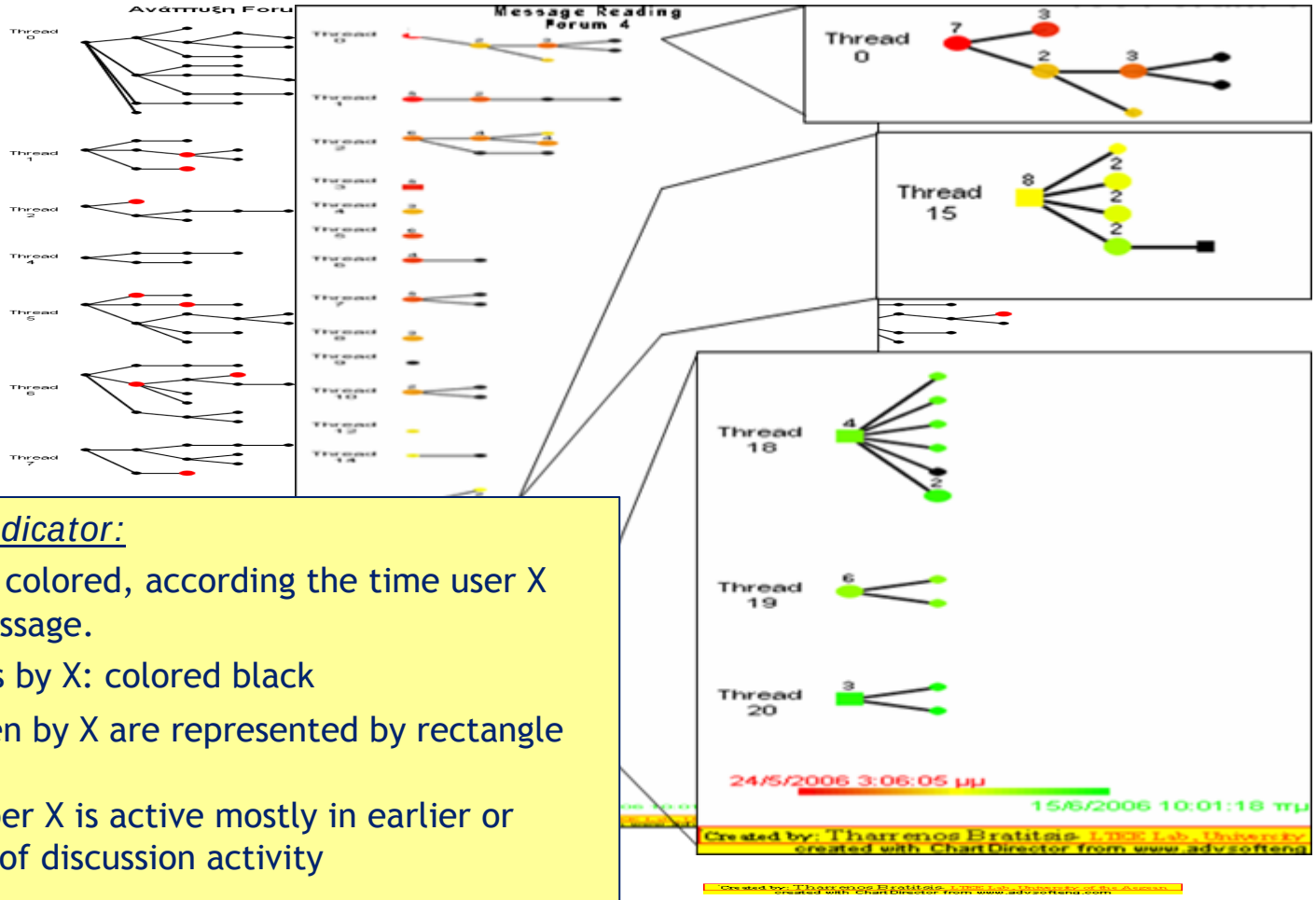
↳*Independent IA tool incorporating a variety of indicators*

(f) User Time Read I



User Time Read indicator:

- The vortices are colored, according the time user X has read the message.
- unread messages by X: colored black
- messages written by X are represented by rectangle

=> Whether member X is active mostly in earlier or later phases of discussion activity

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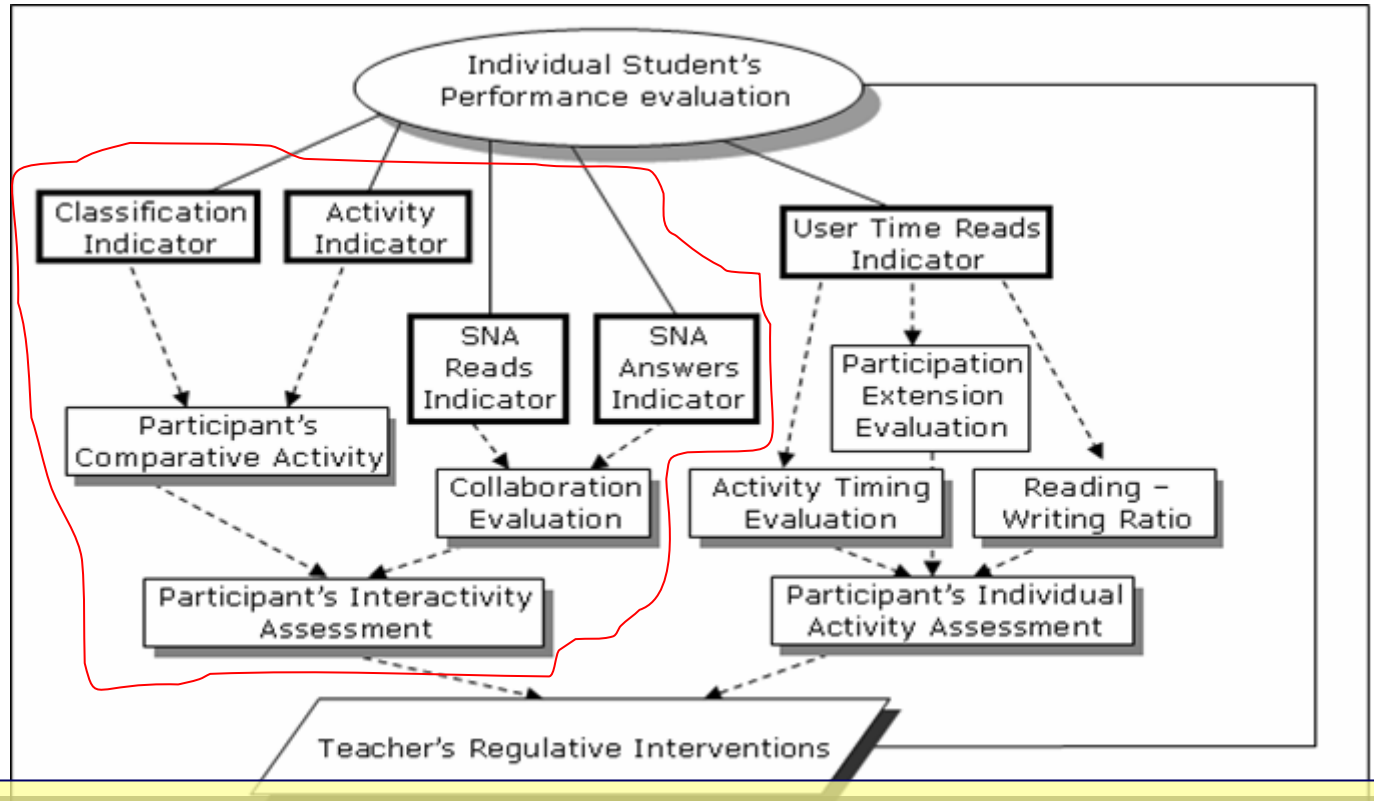
Interpretation Schema: Example of Individual Student's Evaluation of participation quality, applied by Teachers



An *Interpretation Schema* is a set of instructions, explaining the manner and order of combining information from different IA indicators, in order to extract additional, qualitative information, with a meaning.

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Case study 1	40 postgraduate students 1 group	6 weeks	Non-restricted discussion
Case study 2	14 postgraduate students 2 groups (exper. –control)	7 weeks	3 discussion subjects one coordinator summarizes and presents discussion
Case study 3	14 postgraduate students 2 groups (exper. –control)	6 weeks	6 phase discussion. Assignments, discussion and summarization per phase
Case study 4	30 undergraduate students 2 groups (exper. –control)	7 weeks	2 problem solutions → 2 groups (ph 1). Each group builds arguments (ph 2). Debate - common ground (ph 3).

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Research Questions (*selection*)

- *Detect the most/least popular indicators*,
- *Distinguish users' information preference* (individual or group data, personal or related to others' actions?).

- *Identify the interest in reviewing the indicators*
- *Detect and explain user behavior alterations due to the indicators' presence (indicators effects to the users)*

- *Study Indicators transparency*
- *Study Indicators usages and needs*

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↳*Independent IA tool incorporating a variety of indicators*

Research Questions (*selection*)

- *Dete*
- *Dist*
  pe

"kind of information students are interested in":
- 70% of them preferred comparative information, in order to assess their actions as compared to those of their collaborators.
- Individual indicators were less preferred (50% of the users), (mostly for confirming their impression of their personal activity).

- *Identify the interest in reviewing the indicators*
- *Detect and explain user behavior alterations due to the indicators' presence (indicators*

Frequency of reviewing:
- almost 60% have a look at them every time they connected and 80% at least 2-3 times per week.

- *Study Indicators transp*
- *Study Indicators usages and needs*

Indicators Visualisation transparency and diagrams explanatory schemas

(i) Using simple diagrams, (bar-charts, XY-charts,scattered charts) facilitates understanding,
(ii) Users understood the main concept of a complex diagram, but were unable to "read between the lines", detecting more refined information.
(iii) Need to provide some *Interpretative Schemas* (combining info from indicators)

IA ⇨ Case Study III: Flexible IA tools for all

↳*Independent IA tool incorporating a variety of indicators*

Research Questions (*selection*)

- *Detect the most/least popular indicators*,
- *Distinguish users' information preference* (individual or group data,

"Indicators preferences and appropriateness"
Some indicators were more preferable than others, regardless of the teaching settings, whereas some of them are better utilized under specific context and activity settings.
[E.g. SNA diagrams seem more appropriate
when heavy interaction among smaller groups is pursued,
Activity Indicators seem more appropriate in cases of open ended discussions with a large number of participants.]

- *Study indicators transparency*

"*How the indicators affect the IA tools users (students)*

⇨ Different indicators affect users behavior in a different way
E.g. *SNA effect*: postgraduate students who understood SNA diagrams were tighter connected with their collaborators, than just reading and writing more messages
Tree structure indicator effect: Students reviewing this indicator participated in more threads than those who didn't.

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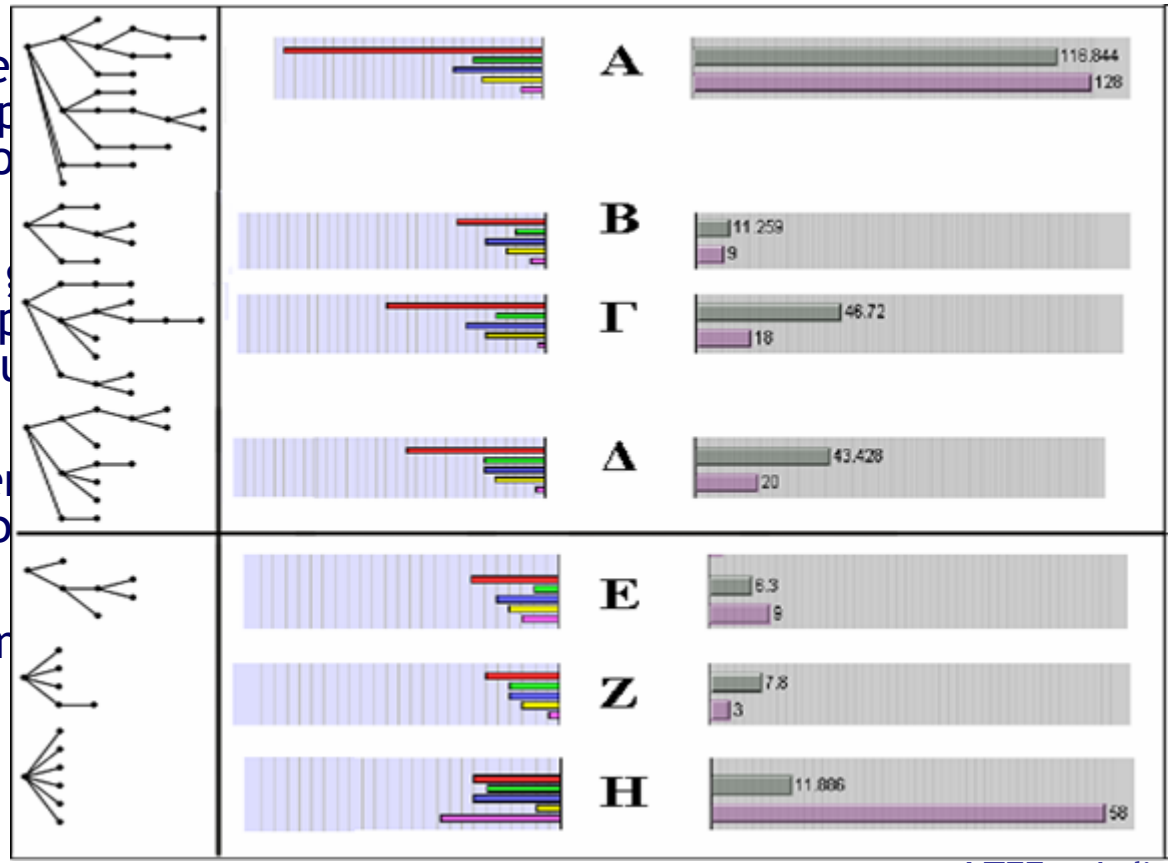
Independent IA tool incorporating a variety of indicators

Research results: Indicators significance

- Simple quantitative
  evaluate quality asp
  erroneous conclusio
- Some indicators (e.
  combine several asp
  producing safer resu
- Connection betwee
  the indicators has b
- The indicators are r
  discussions



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Independent IA tool incorporating a variety of indicators

Research Results related to Students as users of DIAS tool

Interaction Analysis Indicators improves students' collaboration:

- by acting as a strong, additional participation motive
- by assisting students understanding and assessing the discussions' general goals
- by promoting self-confidence
- by assisting the students to reflect upon the overall activity, thus self-regulating their actions

Evaluative and assessing potentiality of the indicators and their combinations, confirming the power of visualizing information.

… more in Bratitsis T. & Dimitracopoulou A. (2007b).

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↳Independent IA tool incorporating a variety of indicators

Research results related to Teachers/Moderators as users of DIAS tool

⇨A moderator selecting the indicators to present during a learning activity, can decrease his/her work load by transferring a portion of the regulative task to the students

A moderator can:

⇨ Assess the evolution of the group

⇨ Assess the participation quality of individuals

⇨ Identify instances where there is need to examine in a more profound way (e.g. reading the content of messages) the contributions of particular individuals.

… more in Bratitsis T. & Dimitracopoulou A. (2007a).

IA ⇨ Research State of the Art

Research Dimensions

- ⇨ **Design of interaction Analysis tools/components & functions**
  - ⇨ Interaction Analysis Indicators (produced vs suitable)
  - ⇨ Values presentation form
  - ⇨ Calibrated Values of IA indicators in specific conditions/contexts
  - ⇨ Design Principes

- ⇨ **Development**
  - ⇨ Data processing methods
  - ⇨ Representation formalisms

- ⇨ **Research with IA tools users**
  - ⇨ Empirical Results
  - ⇨ Methods for teachers / students' needs & requirements

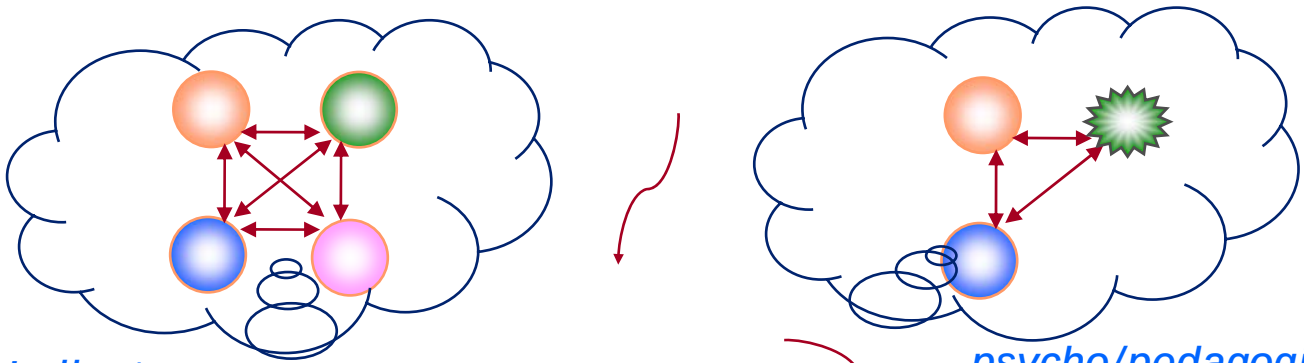
IA ⇨ Research State of the Art

I. Design

- Focus & **work, in a profound way on IA 'indicators':**

  There are differences or even gaps among:

  - the indicators that we 'process'
  - these having a psychological/pedagogical significance
  - those that can activate a metacognitive process to users



Processed Indicators

psycho/pedagogical Indicators
-researchers-

***'meta-cognitive'** indicators*
-users-

IA ⇨ Research State of the Art

I. Design

- Focus & **work, in a profound way on IA 'indicators':**

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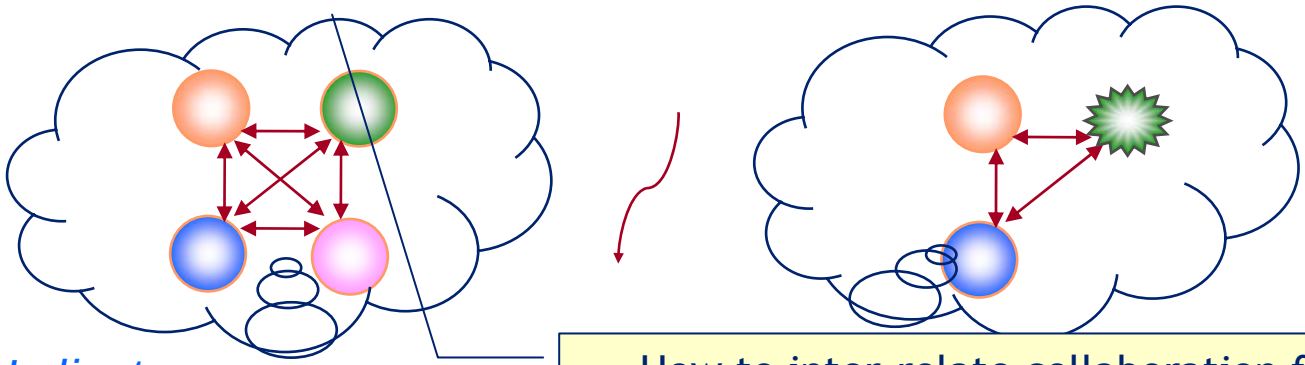


Processed Indicators

- How to inter-relate collaboration features with collaborative activity content and process?
- How to go beyond simple quantitative indicators to more sophisticated ones?
- How to provide a rich variety of analysis output (*see Indicator Nature dimensions*) to really assist participants ?

IA ⇨ Research State of the Art

III. Research

⌦ **Knowing better the IA tool User:**

Different **Indicators** and/or different visualisations :

taking into account:

- ⇨ the profiles and the roles of users
- ⇨ the type of the activity
- ⇨ the context

Tailoring IA indicators for different types of users »

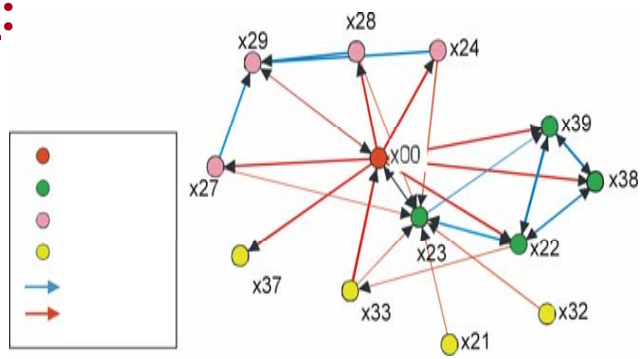
⌦ **Does it work? More research is needed so as to study the effects of IA Indicators -> the IA tools users:**

Study the significance: of these 'tools'

- *What is the 'meaning' of the IAI concept?*
- *How they do decode the visualisations?*

Study the effects of these 'metacognitive tools'

- *Do they affect the learning process?*
- *Do they help users to develop their own regulation competences?*



IA ⇨ Research State of the Art

III. Research

First design Prototype

Aspects to Study

I) ↳ Try to identify users' needs: - Students; - Teachers
⇨ in the various usage categories

(II) ↳ Get data on how they appreciate the available tools, and how they decode the provided visualised information

(III) ↳ Try to understand how and when they use the IA tools

(IV) ↳ Try to capture and study the effects on IA tools usages

(V) ↳ Conceive "interpretation schemas" connecting IA indicators sets

&

↳ **Apply appropriate Research Design**

IA ⇨ Research State of the Art

III. Research

First design Prototype

Aspects to Study

I) ↳ Try to identify users' needs: - Students; - Teachers
⇨ in the various usage categories

(II) ↳ Get data on how they appreciate the available tools, and how they decode the provided visualised information

⌦ Apply an Appropriate Research Design so as:
- Experimenting in situ
- Take into account and study the context of use and its dominant culture
(get detailed human interaction data also around computer)

&

↳ **Apply appropriate Research Design**

IA ⇨ Perspectives: Research Road Map

…a new research field to work on

⌦ *Design of interaction Analysis tools/components & functions*

- ⇨ More profound IA indicators and more complete IA models
- ⇨ Define interpretative schema, for specific conditions/contexts
- ⇨ Tailored indicators as well as indicators sets (models) for various actors profiles and roles.

⌦ *Development*

- ⇨ Development of IA tools for a wider variety of learning environments
- ⇨ Independent interoperable tools and customisable components

⌦ *Research on IA tools users (users' requirements, tools' effects)*

- ⇨ Empirical Results on IA tools effects to users:
  [(i) users' requirements, (ii) tools usages,
  (iii) IA I significance for the users, (iv) tools' effects]
- ⇨ Research with appropriate Design
- ⇨ Emphasis on "ethical" aspects and 'community' social rules

IA ⇨ Perspectives: Research Road Map

…a new research field to work on

⌦ *Design of interaction Analysis tools/components & functions*

- ⇨ More profound IA indicators and more complete IA models
- ⇨ Defi
- ⇨ Tail

↳ In order to make the field progress, and cover the actual needs : develop interoperable IA tools, independent of specific learning environments

⌦ *Development*

- ⇨ Development of IA tools for a wider variety of learning environments
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⌦ *Research on IA tools users (users' requirements, tools' effects)*

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IA ⇨ Perspective: Position

- The IA for self-regulation field is still in an early phase of development, presenting an impressively intensive growth
- Its potential is attributed to the fact that even simple tools could be effective
- *Position:*

> *The Design of a technology based Learning Environment do not concern only the components and the functions on how to act,*
> *but also on how to manage the actions and the interactions, thus, how to empower Learning Environment Participants to control, regulate and self-regulate their own activity.*

IA ⇨ Perspective

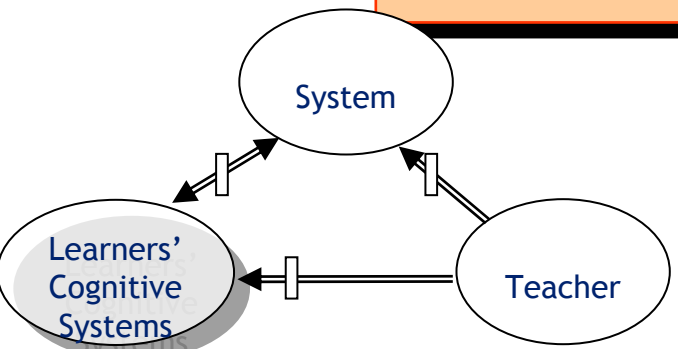
↳ *General Design Aim*:
Every LE to include/be linked with an IA component/tool

Perspective: *Exploit the complementarities between the existing approaches applying computer based IA*

Create enriched and/or adaptive interfaces

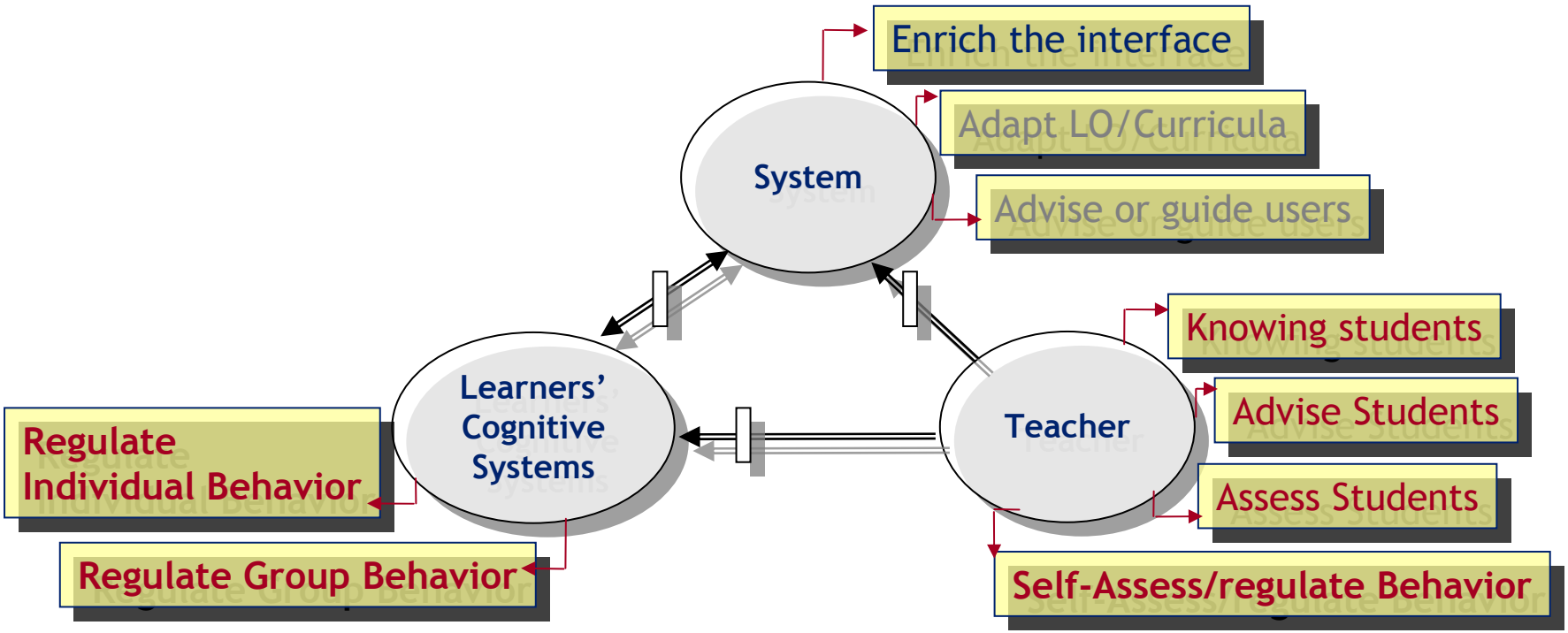
Provide IA tools' outputs for selregulation

Intelligent systems advising students or even teachers



IA ⇨ Perspective

⌦ *Perspective: Apply complementary approaches based on CS IA*



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…a new research field to take into account

- ⇨ http://telearn.noe-kaleidoscope.org/ *{open archive on TEL}*

List of active labs worldwide, on cb IA for self-regulation

- ⇨ LTEE lab, Aegean Univ., GR, [www.ltee.gr/adimitr]
- ⇨ CoCo Lab (P. Reimann) [http://coco.edfac.usyd.edu.au/]
- ⇨ Collide, Lab, Univ. of Duisburg, [www.collide.info]
- ⇨ GSIC, Univ. Valladolid, [http://gsic.tel.uva.es/]
- ⇨ EPFL/CRAFT, (P. Jermann),[http://craft.epfl.ch/]

- ⇨ Beatriz Barros, F.Verdejo, http://ltcs.uned.es/
- ⇨ Amy Soller, [http://www.cscl-research.com/]
- ⇨ Julita Vassileva, [http://julita.usask.ca/]
- ⇨ AGILeViZ Visualisation/students' assessment (CSCL2007- AIED2007)

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