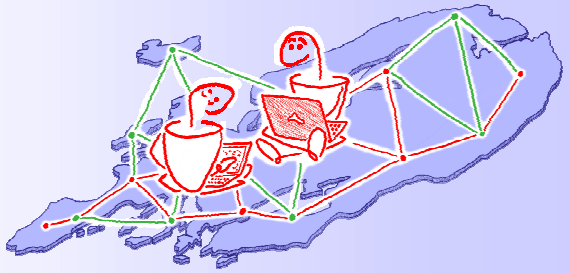


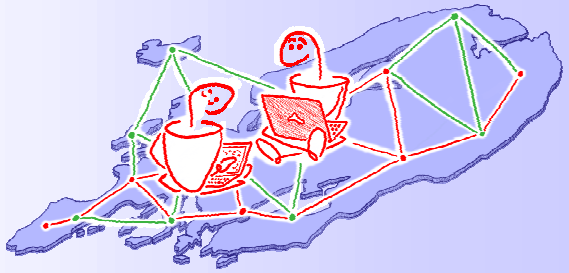
Concepts and Visions for Math and Science

OpenMath Thematic Network Meeting: Bremen 2003

Authors: Sabina Jeschke
Tilman Rassy

together with:

R. Keil-Slawik	Univ. Paderborn
R. Seiler	TU Berlin
C. Thomsen	TU Berlin
E. Zorn	TU Berlin

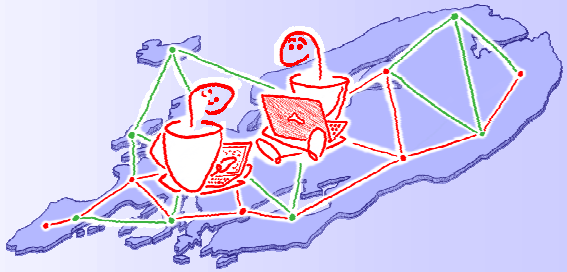


Aim of this Talk:

- give some insight on our projects and interests
- illustrate the necessity of semantic description of mathematics by eTeaching, eLearning & eResearch scenarios
- define (inplicitely) some demands & requirements on the semantic description of mathematics

by:
Sabina Jeschke & Tilman Rassy

Department of Mathematics
Berlin University of Technology

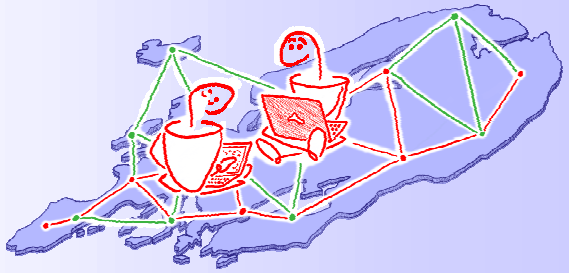


About this talk:

1. Introduction
2. Pedagogical Approach for Maths & Science
3. eLearning, eTeaching & eResearch Scenarios
4. Barriers, Problems & Answers...

by:
Sabina Jeschke & Tilman Rassy

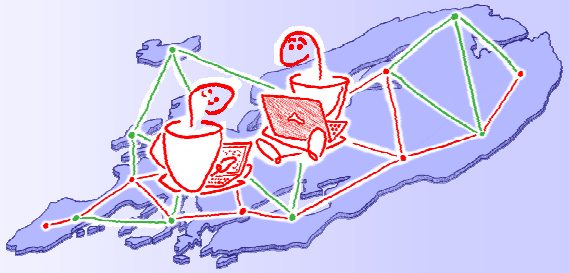
Department of Mathematics
Berlin University of Technology



Introduction

by:
Sabina Jeschke & Tilman Rassy

Department of Mathematics
Berlin University of Technology



Today:

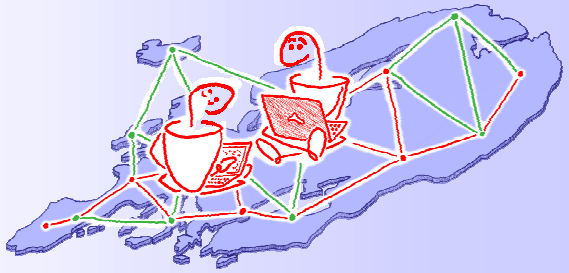
mainly:

- Organizational Scenarios: Distribution of Information
- Learning Scenarios: Distribution of (static) Documents
- Training Scenarios: Simple tests (multiple choice)
- Communication Scenarios: Chat, forum, mailing-lists
- Presentation Scenarios: Electronic Presentations (html, ppt, ...)

= 95% of "eLearning"

by:
Sabina Jeschke & Tilman Rassy

Department of Mathematics
Berlin University of Technology



Potential of electronic media

(particularly with regard to eLearning, eTeaching & eResearch)

- interactivity & experimental environment
- non-linearity
- adaptivity & personalization
- support of different learning styles & needs

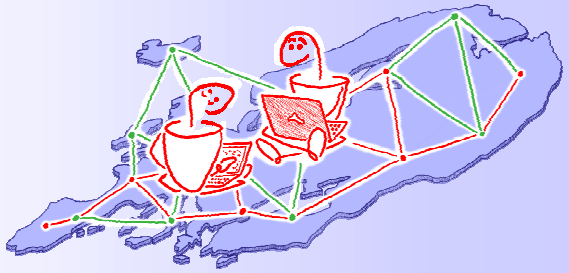
pedagogical & educational

- reusability & recomposition
- accessibility (anytime, everywhere, …)

organisational & political

by:
Sabina Jeschke & Tilman Rassy

Department of Mathematics
Berlin University of Technology



We have to face

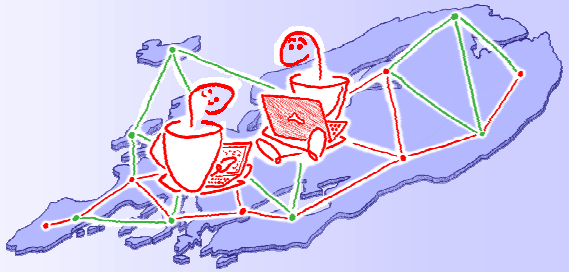
a huge divergence

between the potential

and the reality!

by:
Sabina Jeschke & Tilman Rassy

Department of Mathematics
Berlin University of Technology



So far:

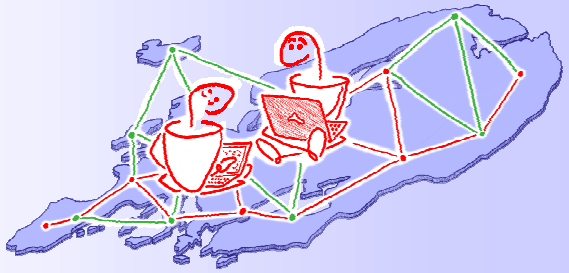
The Potential of

Electronic Media in Education

is Dramatically Wasted !

by:
Sabina Jeschke & Tilman Rassy

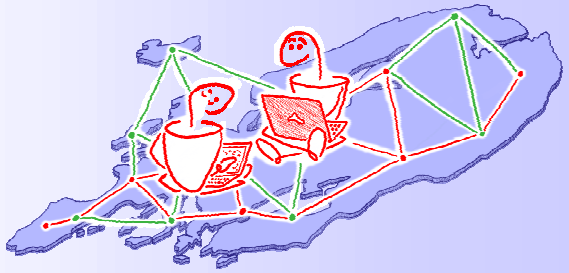
Department of Mathematics
Berlin University of Technology



Pedagogical Approach for Math & Science

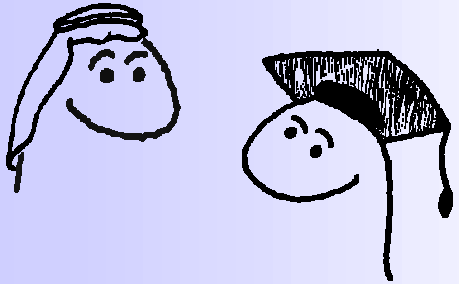
by:
Sabina Jeschke & Tilman Rassy

Department of Mathematics
Berlin University of Technology



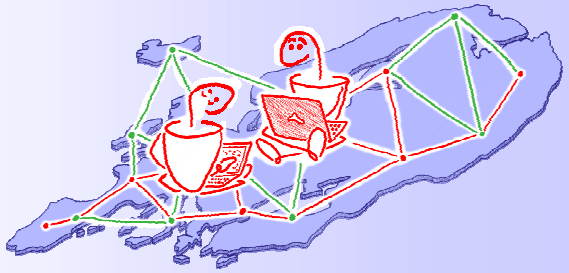
Qualitative Change in Mathematical Power leads to:

- ✓ Changes in Learning and Teaching
- ✓ Changes in Research
- ✓ Changes in Society



by:
Sabina Jeschke & Tilman Rassy

Department of Mathematics
Berlin University of Technology



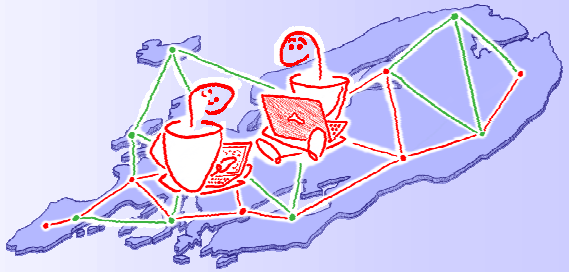
Changes in Pedagogical Approach...

- Awareness of the potential and power of mathematics
- Formulating, modelling and solving problems in context
- Mathematical reasoning
- Awareness of connectivities between mathematical ideas
- Handling mathematical symbols and formalism
- Communicating in, with and about mathematics
- Reflectively using mathematical tools & machinery
- Awareness of Mathematics for Society & Democracy

New view on mathematical competences

by:
Sabina Jeschke & Tilman Rassy

Department of Mathematics
Berlin University of Technology

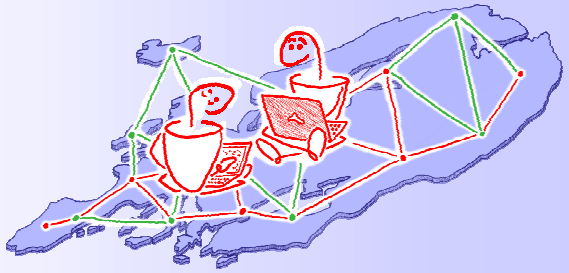


... requires:

- (Inter-)Active selfdirected mathematical exploration
- Intensive learning by intelligent tutoring
- Individualised & Competence oriented learning
- Non-linear learning
- Mathematics embedded in its context
- Active creation of new mathematical knowledge
- Communicate freely in mathematics
- Cooperative & collaborative learning in distributed environments

by:
Sabina Jeschke & Tilman Rassy

Department of Mathematics
Berlin University of Technology



Changes in Learning Process and Roles of Actors:

From a **Teacher led teaching** → To a more **Learner led learning**

Instructor:

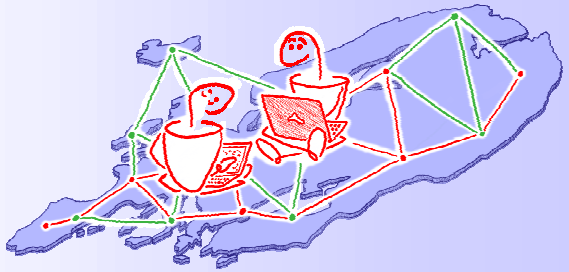
guide and facilitator
of independent learning

Student:

active and self-determined
part(ner) of education process

by:
Sabina Jeschke & Tilman Rassy

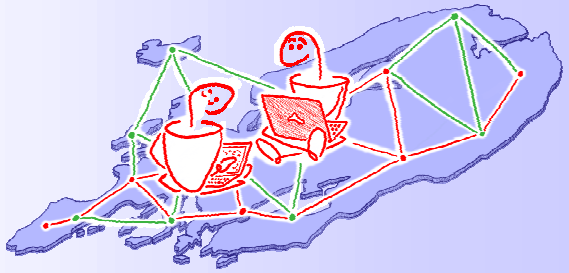
Department of Mathematics
Berlin University of Technology



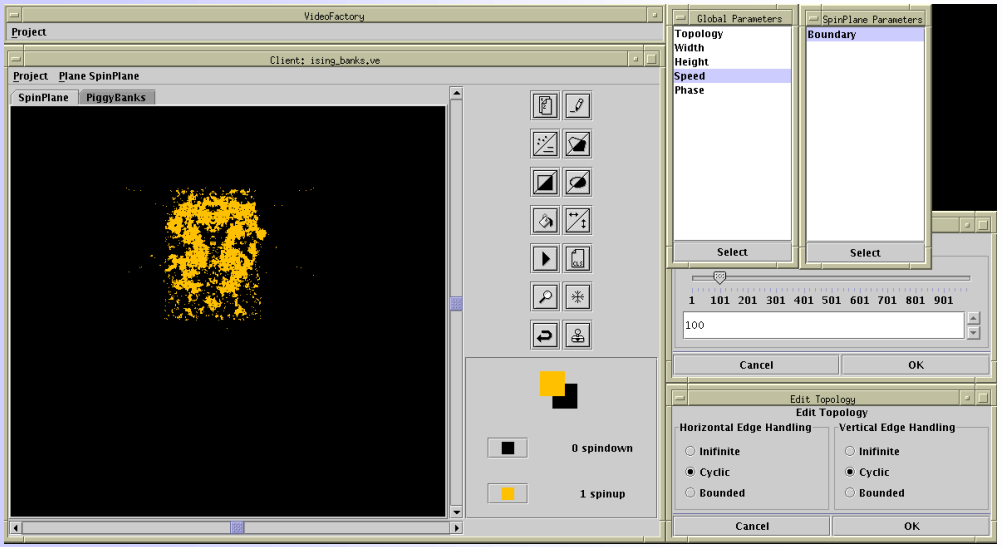
- eLearning
- eTeaching Scenarios
- eResearch

by:
Sabina Jeschke & Tilman Rassy

Department of Mathematics
Berlin University of Technology



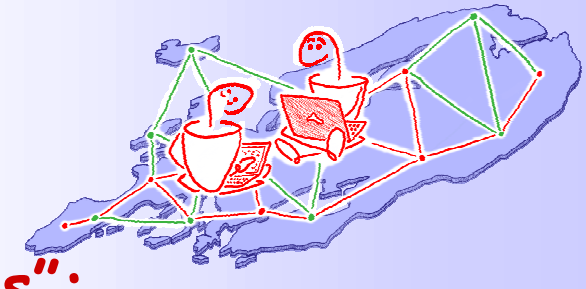
Scenario "Virtual Laboratories":



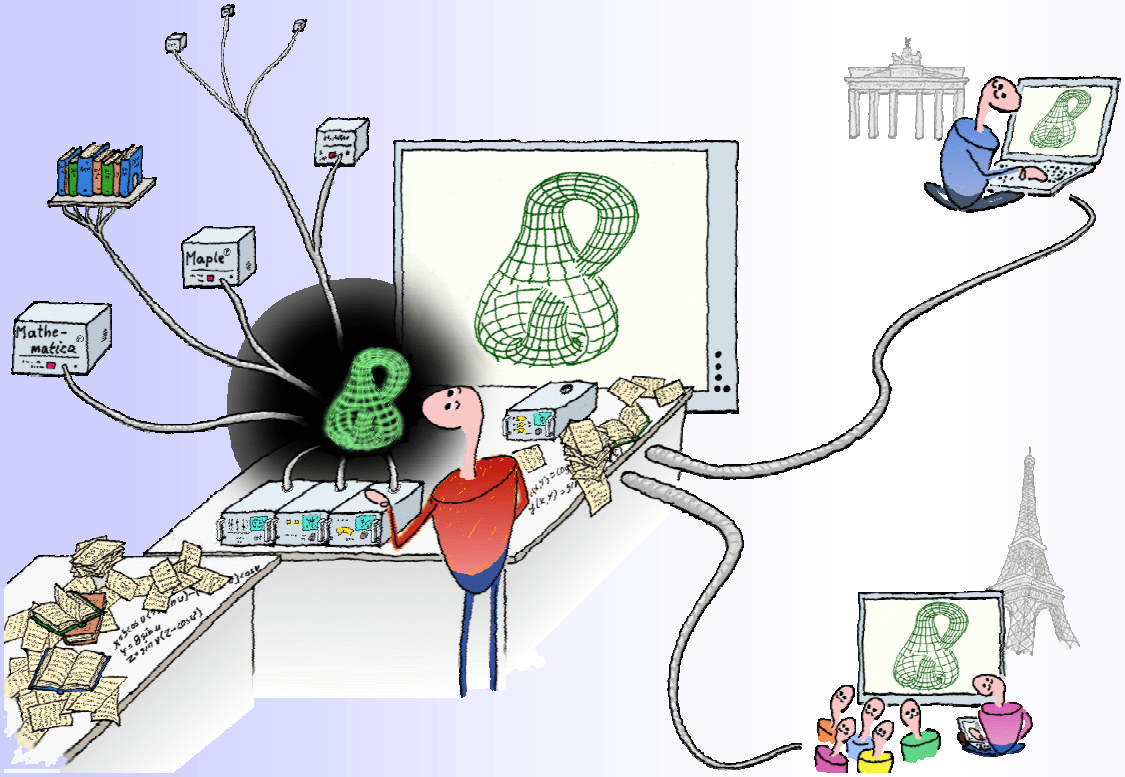
- virtual equivalence to "real lab"
- experimental learning scenarios
- highly interactive
- focus on self-directed discovering
- open for integration of other tools

by:
Sabina Jeschke & Tilman Rassy

Department of Mathematics
Berlin University of Technology



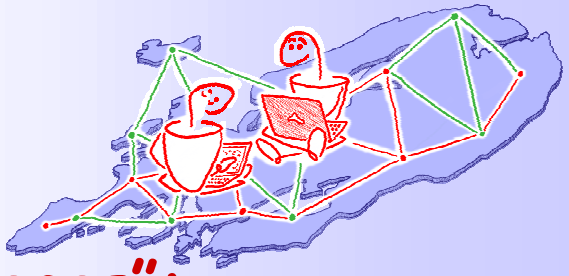
Scenario "Cooperation in Virtual Spaces":



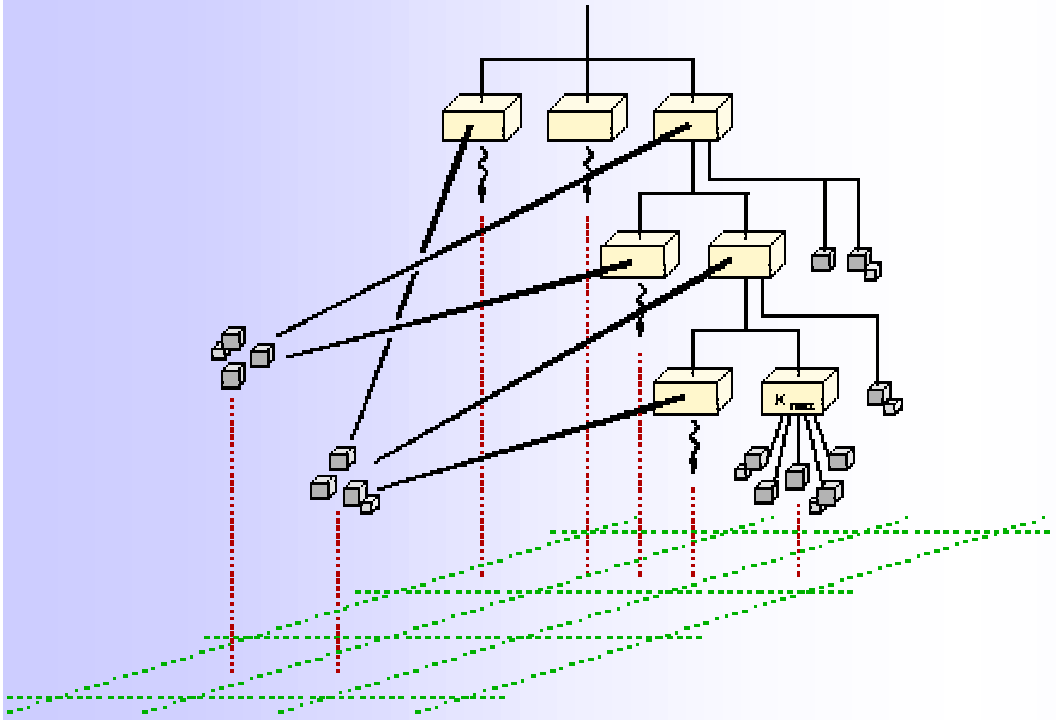
- cooperative studies
- in virtual laboratories
- given a geographically separated situation

by:
Sabina Jeschke & Tilman Rassy

Department of Mathematics
Berlin University of Technology



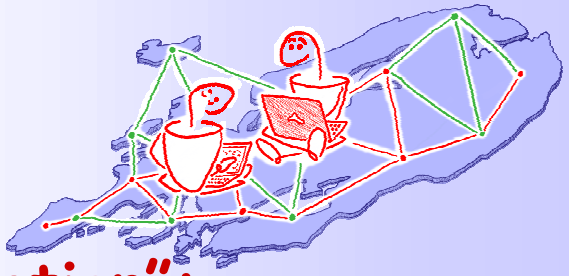
Scenario "Granular interactive Math-Pieces":



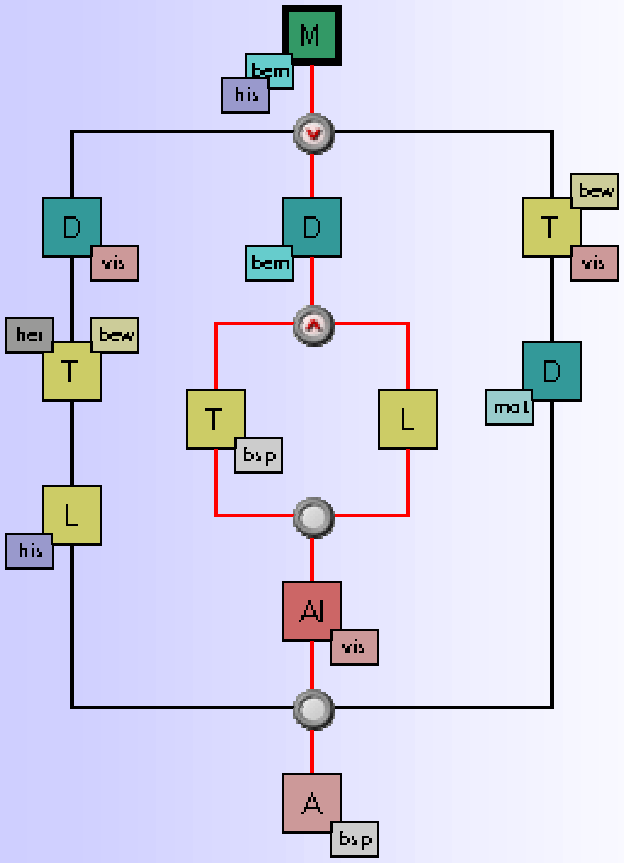
- fine-granular knowledge content
- for recomposition
- for flexible usage
- interactive & multimedial
- arranged by its interior logical structure

by:
Sabina Jeschke & Tilman Rassy

Department of Mathematics
Berlin University of Technology



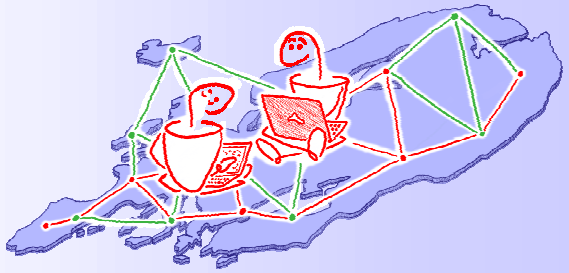
Scenario "Non-linear Course Representation":



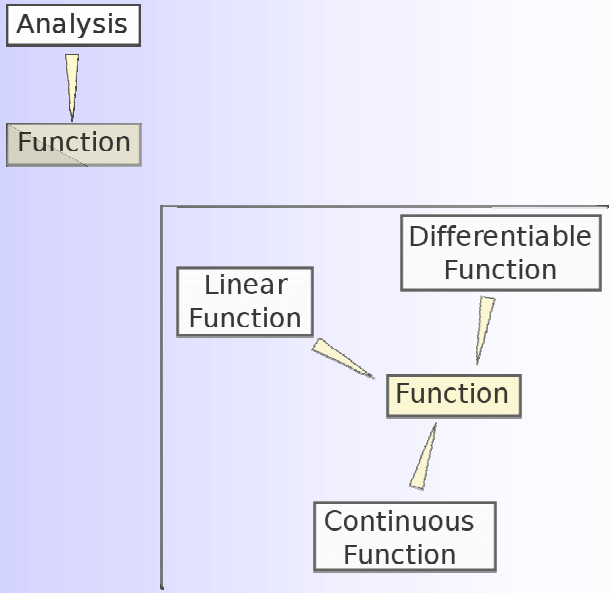
- multidimensional arrangement of content
- non-linear navigation structure
- visualization of different connections

by:
Sabina Jeschke & Tilman Rassy

Department of Mathematics
Berlin University of Technology



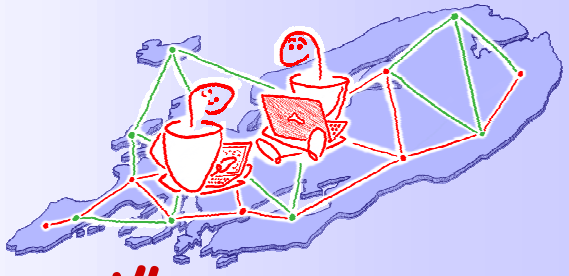
Scenario "Knowledge-Nets":



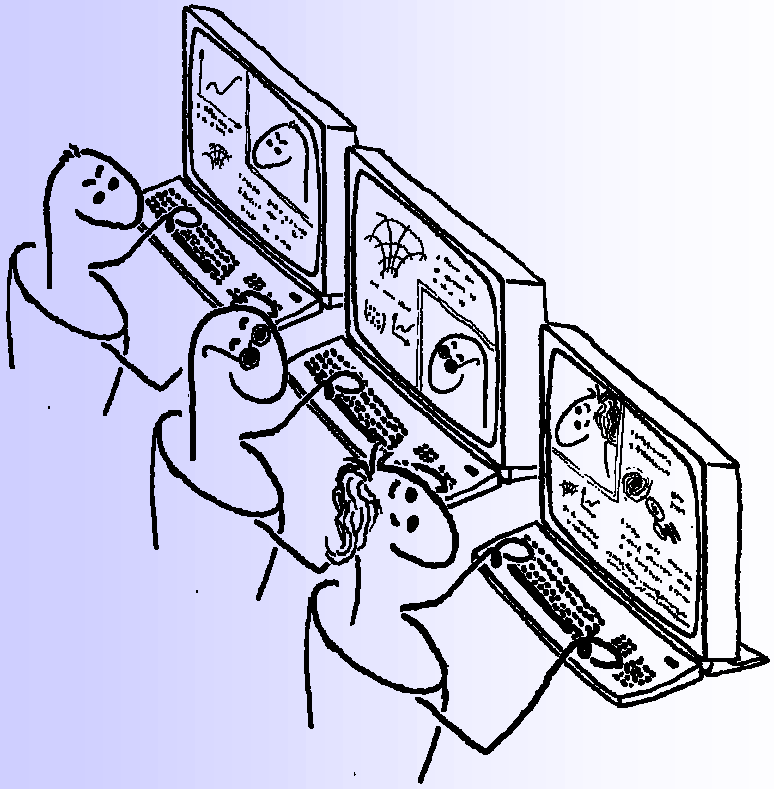
- dynamical knowledge nets
- representing knowledge connections
- answering individual inquiries
- open for integration of new content
- self-organized, increasing

by:
Sabina Jeschke & Tilman Rassy

Department of Mathematics
Berlin University of Technology



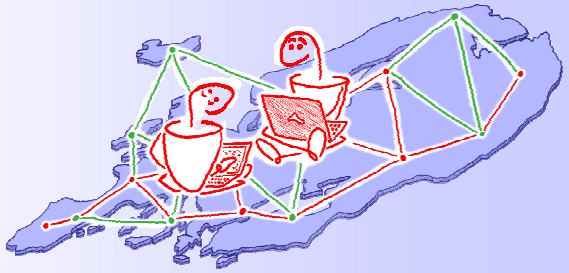
Scenario "Intelligent Training Environment":



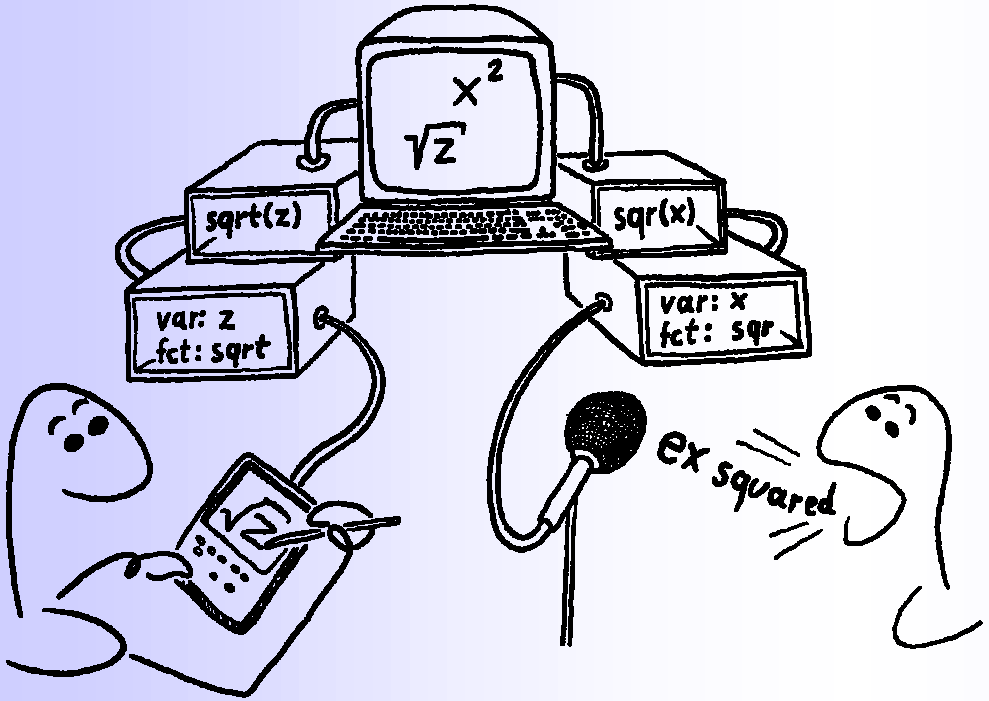
- adaptive to different learning styles
- adaptive to different precognition levels
- adaptive to different learning targets
- intelligent check mechanisms

by:
Sabina Jeschke & Tilman Rassy

Department of Mathematics
Berlin University of Technology



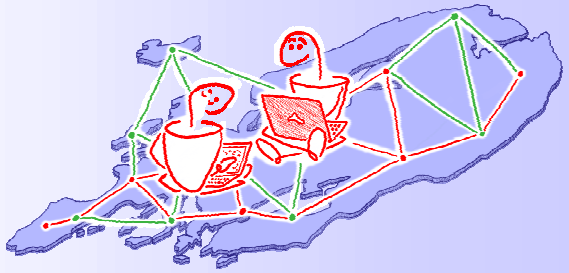
Scenario "Natural formula recognition":



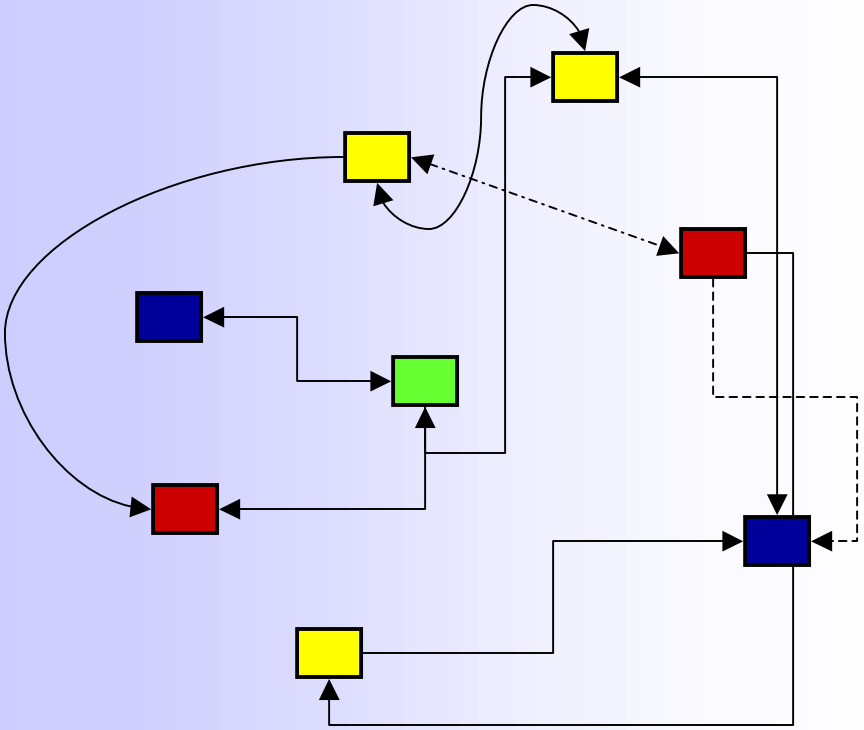
- handwritten formula recognition
- speech-based formula recognition
- with semantic interpretation

by:
Sabina Jeschke & Tilman Rassy

Department of Mathematics
Berlin University of Technology



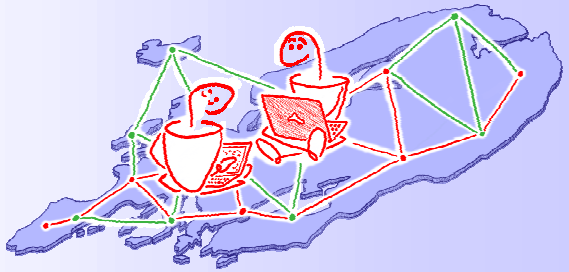
Scenario "Flexible Tool Composition":



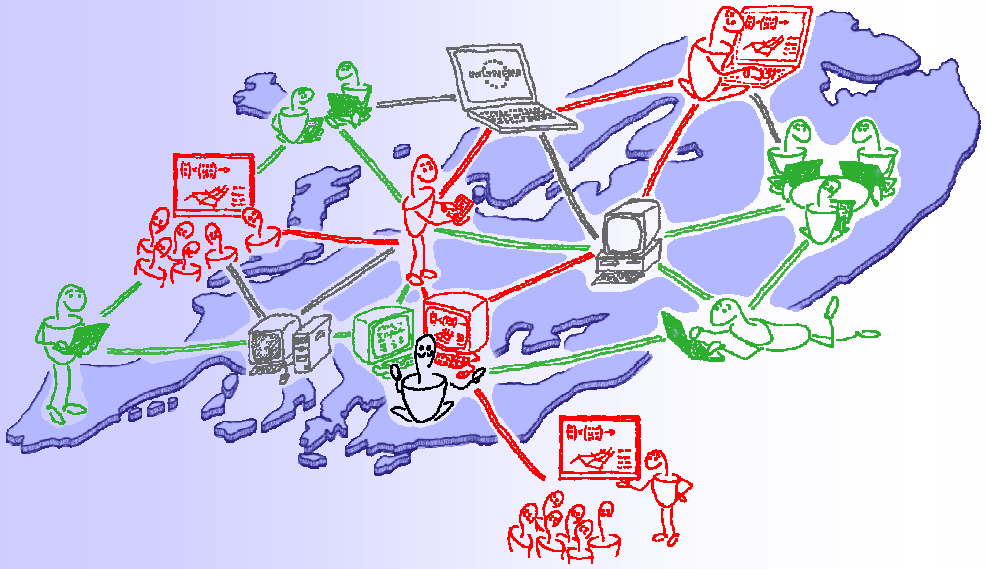
- integration of different specific software
- crosslinking & interconnectedness
- interface defined by open standards

by:
Sabina Jeschke & Tilman Rassy

Department of Mathematics
Berlin University of Technology



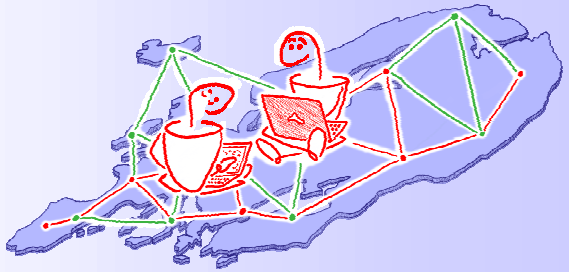
Scenario "Single Sign On":



- open framework structure
- standard-based
- networked
- integration of heterogeneous partners

by:
Sabina Jeschke & Tilman Rassy

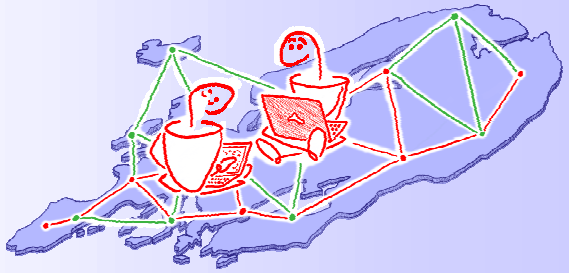
Department of Mathematics
Berlin University of Technology



Barriers, Problems, Answers

by:
Sabina Jeschke & Tilman Rassy

Department of Mathematics
Berlin University of Technology

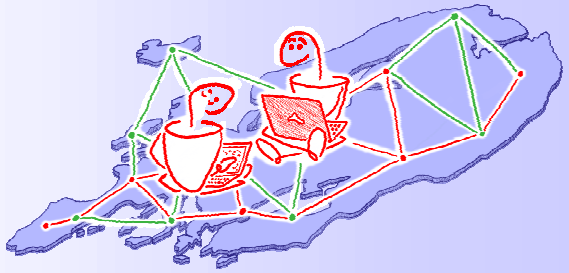


All problems are basically caused by:

- monolithic design of the majority of all eLearning software
- missing granularity and missing ontological structure of content
- usage of static typographical objects

by:
Sabina Jeschke & Tilman Rassy

Department of Mathematics
Berlin University of Technology

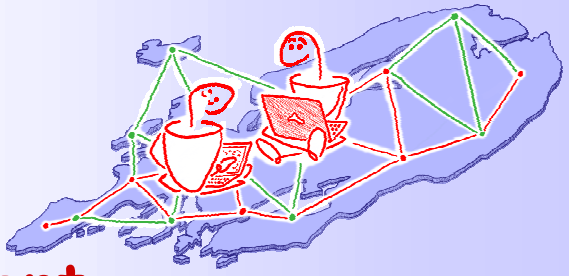


… and answered by:

- open heterogenous platform-independent portal solutions
- analysis and synthesis of self-immanent structures of knowledge fields
- usage of active executable processes with semantic description

by:
Sabina Jeschke & Tilman Rassy

Department of Mathematics
Berlin University of Technology



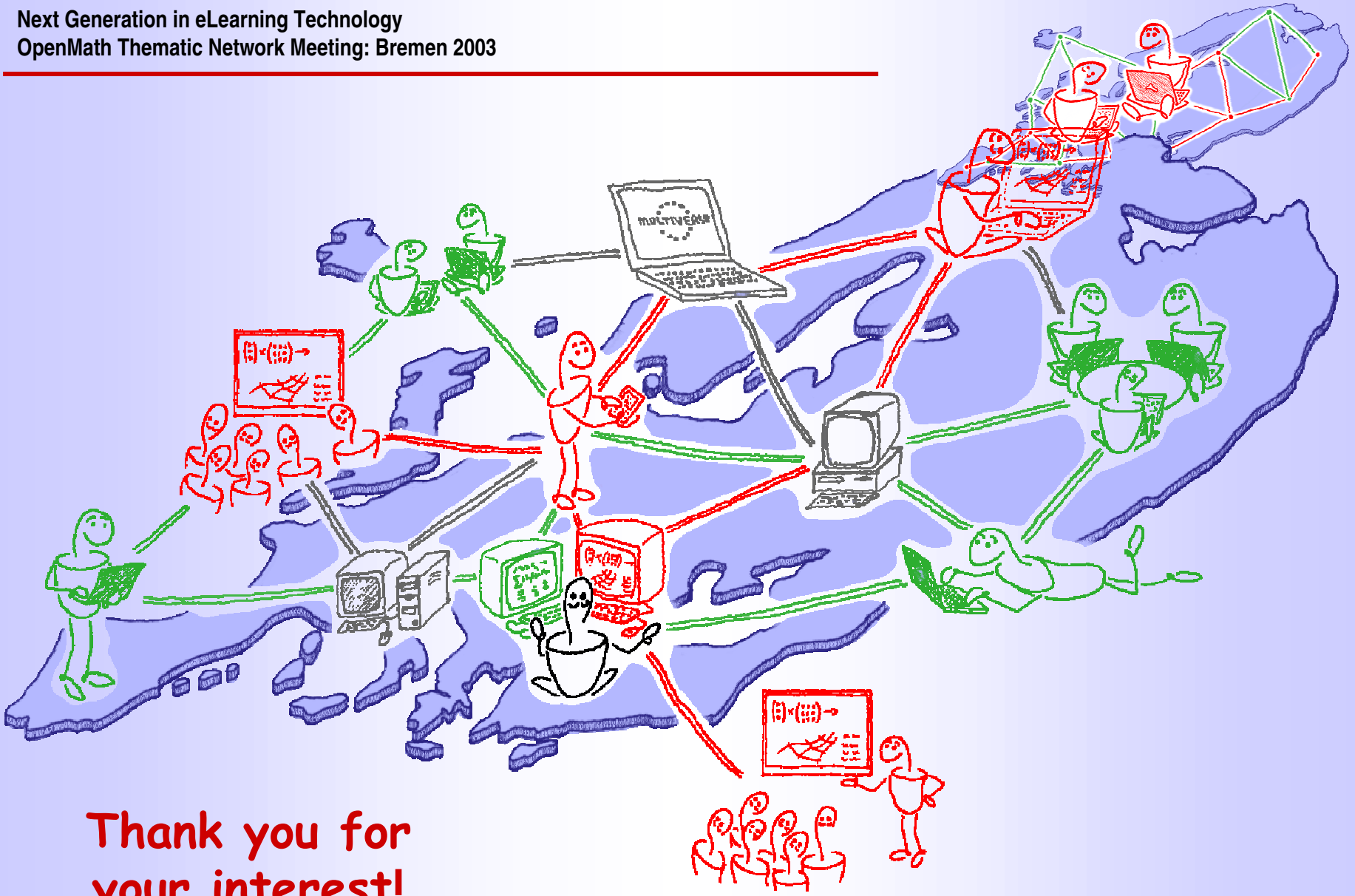
Next Generation of eLearning Environment has to overcome these barriers!

We have the arguments -
We have the vision -
We have the concept -
We have the power -
We have the technology -

… and we have to apply them to use the potential of multimedia for the learning, teaching and research in Math!

by:
Sabina Jeschke & Tilman Rassy

Department of Mathematics
Berlin University of Technology



Thank you for your interest!

by:
Sabina Jeschke & Tilman Rassy

Department of Mathematics
Berlin University of Technology