

4 Typology of Learning Environments

4.1 Classification Schemata for Learning Software



4.2 Systems Oriented Towards Behaviorism

4.3 Systems Oriented Towards Cognitivism

4.4 Systems Oriented Towards Constructivism

4.5 Systems Supporting Social Learning

4.6 Learning Management Systems

Literatur:

Rolf Schulmeister: Grundlagen hypermedialer Lernsysteme: Theorie – Didaktik – Design. Oldenbourg 2007

Main Pitfalls of E-Learning

- High Dropout rates in E-Learning
 - 35 percent and above are common!
- Pitfall One (Clark/Mayer): **Loosing Sight of the Job**
 - "There is no one set of skills that support expertise across the diverse contemporary workforce."
 - *Do you see connections to Learning Theories, to HCI theory?*
- Pitfall Two (Clark/Mayer): **Media Abuse**
 - "Balance between technophile an technostic approaches"
 - See later
- *Do you see further problems with the concept of e-learning (or its current implementations)?*

Ruth Clark/Richard Mayer: e-Learning and the Science of Instruction, Pfeiffer, 2nd ed. 2011

Approaches to Classify Learning Environments

- By usage situation:
 - Remote learning / co-located learning
 - Isolated / connected learners
 - Usage modalities, including physical activities (embodied learning)
- By technology usage:
 - Local / networked
 - Web-supported / Web-enhanced / Web-based (Amy Wilson)
- By learning methodology:
 - Based on learning theories:
Behaviorism, Cognitivism, Constructivism, Social Learning
 - *Used here*

Our Classification Schema

- Characteristics
- Examples
- Sub-Categories
- Placement in a two-dimensional schema
 - Based on Bodendorf 1990
 - Dimension x: Learner Initiative
 - Dimension y: System Flexibility

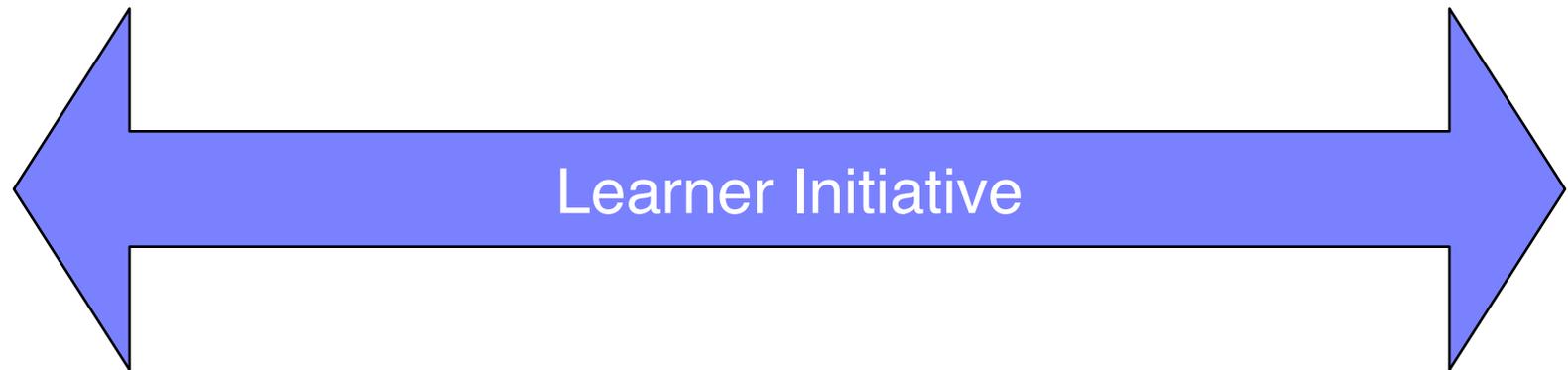
Behaviorism

Cognitivism

Constructivism

Social Learning

Learner Initiative



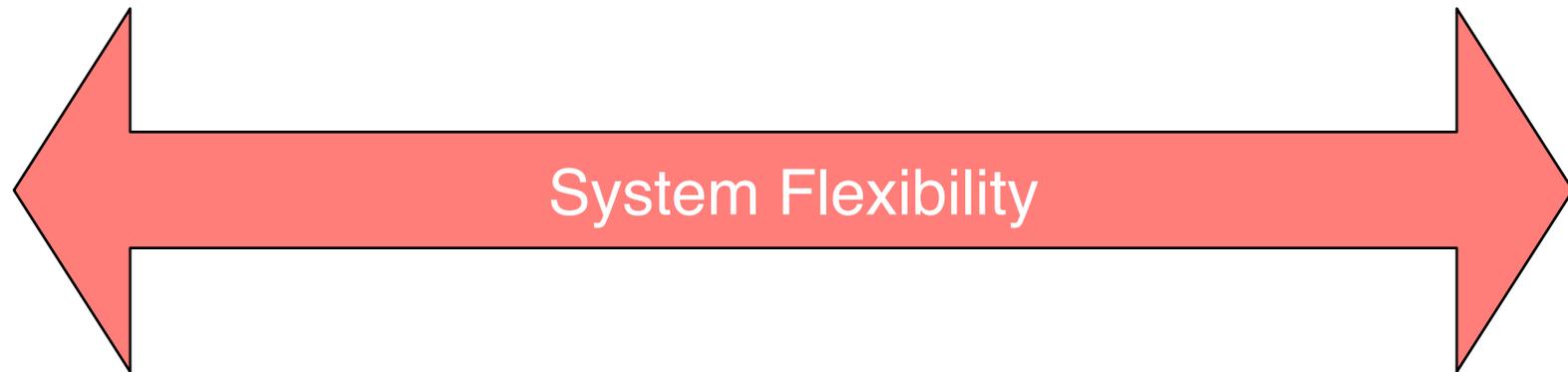
low

high

Exercises
Tests

Simulations
Cooperative systems

System Flexibility



low

Fixed sequences
Static structure

high

Multiple pathways
Adaptive/dynamic structure

Interaction Styles

Help

Learning by hints

Passive Tutor

Self-controlled learning

Training

Learning by practice

Active Tutor

Directed learning

Simulation

Explorative learning

Game

Entertained learning

Problem Solving

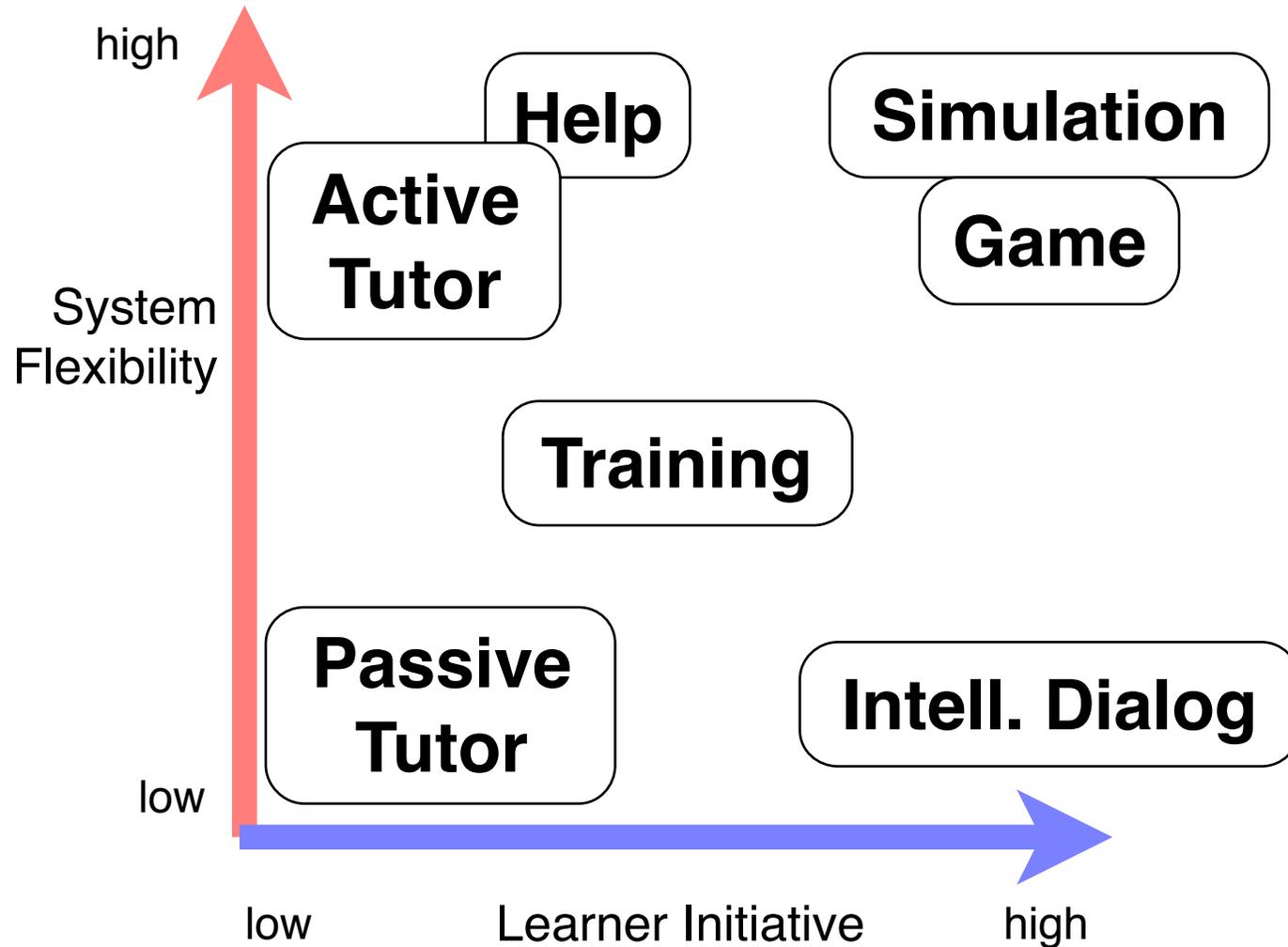
Learning-by-Doing

Intelligent Dialog

Socratic learning

Bodendorf
1993

Two-Dimensional Schema



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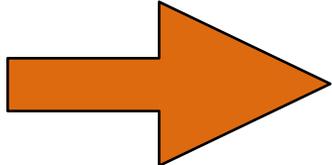
4.4 Systems Oriented Towards Constructivism

4.5 Systems Supporting Social Learning

4.6 Learning Management Systems

Behaviorism

Black Box

Stimulus  Response

Conditioning

Reinforcement

Programmed Instruction

- Content is broken down into *frames*
 - Frame contains statements and questions
- Learners read a frame at a time and immediately answer a question
 - Filling a blank
 - Selecting among alternatives
 - Solving a problem
- Learner receives immediate feedback

1. Words are divided into classes. We call the largest class nouns. Nouns are a class of _____.

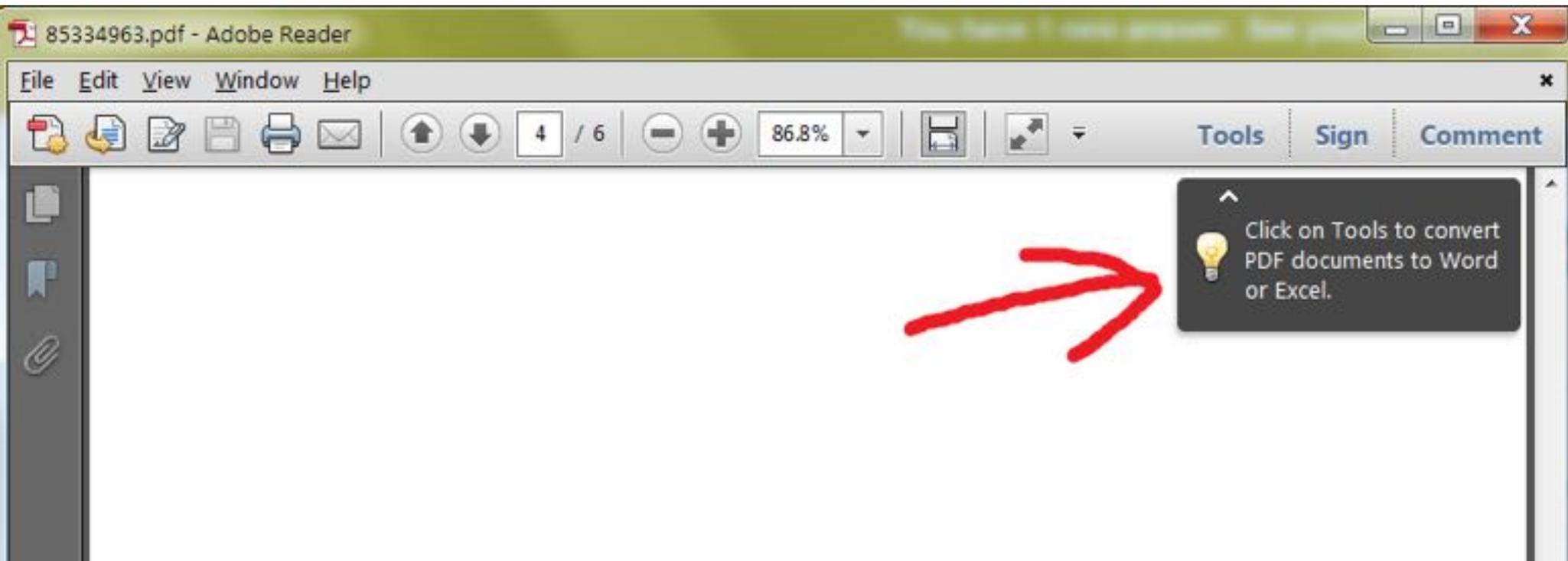
words

2. In English the class of words called nouns is larger than all the other _____ of words combined

classes

http://edutechwiki.unige.ch/en/Programmed_instruction

Example: Passive Tutoring



What is the degree of user initiative?
What is the degree of system flexibility?
Is this related to a learning theory?

Example: Training of Language Vocabulary (1)

The screenshot displays the VTrain Free software interface. The main window is titled "VTrain Free - PROJECT.b1" and features a menu bar (File, Edit, View, Compose, Review, List, Project, Statistics, Tools, Window, Help) and a toolbar. A sidebar on the left shows a "PROJECT" list with cards numbered 7, 10, 0, 0, and 0. The central area shows a review box titled "Box1 - Reviewing PROJECT.b1". Inside this box, the question "Question: the lion" is displayed above a photograph of a lion. A yellow callout box with an arrow pointing to the question contains the text: "The Review mode of VTrain appears, prompting us to answer a question." Below the image, there are three radio buttons: "Ask fronts" (selected), "Ask backs", and "Flip-flop". To the right of these buttons are two groups of controls: "Response" (with buttons for "?", "✓", "✗", a lightbulb, a key, and a refresh icon) and "Question" (with "Next" and "Previous" buttons). To the right of the "Question" group are "Solution" buttons (a "Play" button and a "Stop" button). At the bottom of the window, a status bar shows "Start reviewing in box 1 [right click -> context menu]", "0 cards reviewed, 0 right answers (0 min)", and a timer "00:01".

vtrain.net

Example: Training of Language Vocabulary (2)

The screenshot displays the VTrain Free software interface. The main window is titled "PROJECT.b1" and contains a menu bar (File, Edit, View, Compose, Review, List, Project, Statistics, Tools, Window, Help) and a toolbar. A sidebar on the left shows a "PROJECT" list with five items, the second of which is selected and labeled "10". The main content area features a window titled "Box1 - Reviewing PROJECT.b1". This window is divided into two panes: the left pane shows a "Question: the lion" with a photograph of a lion, and the right pane displays the message "Well... 1 word[s] are missing or wrong." Below the panes, the text "el leon" is visible. At the bottom of the window, there are three radio buttons: "Ask fronts" (selected), "Ask backs", and "Flip-flop". To the right of these are two groups of buttons: "Response" (containing icons for a question mark, checkmark, minus sign, lightbulb, key, and refresh) and "Question/Solution" (containing play and stop icons). The status bar at the bottom of the window shows "Press F1 for help" on the left and "0 cards reviewed, 0 right answers (0 min) 00:01" on the right.

vtrain.net

Example: Training of Language Vocabulary (3)

The screenshot displays the VTrain Free software interface. The main window is titled "Box1 - Reviewing PROJECT.b1" and contains a language training exercise. The exercise is titled "Question: the lion" and features a photograph of a lion. Below the photograph, the text "el león" is entered in a text field. A yellow tooltip message reads "We press Enter again." The interface includes a menu bar (File, Edit, View, Compose, Review, List, Project, Statistics, Tools, Window, Help) and a toolbar with various icons. On the left side, there is a vertical toolbar with icons for different levels (7, 10, 0, 0, 0). At the bottom of the window, there is a status bar that reads "Press F1 for help" on the left and "0 cards reviewed, 0 right answers (0 min) 00:01" on the right.

vtrain.net

Example: Training of Language Vocabulary (4)

The screenshot displays the VTrain Free software interface for a language training project. The main window, titled "Box1 - Reviewing PROJECT.b1", is divided into two panes. The left pane contains the text "Question: the island" above a photograph of a rocky island in the ocean. The right pane displays the feedback text: "Exactly, that's the right answer. Well done! The card was sent to the next box." Below the panes is a control panel with three radio buttons: "Ask fronts" (selected), "Ask backs", and "Flip-flop". To the right of these buttons are two groups of icons: "Response" (including a blue question mark, a green checkmark, a red minus sign, a lightbulb, a key, and a recycling symbol) and "Question" (including a play button and a square button). The status bar at the bottom indicates "1 cards reviewed, 1 right answers (0 min)" and "00:01".

vtrain.net

Example: Training in Electronics

The screenshot shows a software interface for training in electronics. At the top left, it says "WORKSHOP EDUCATION - Microsoft Internet Explorer". The main content area is titled "Serial/parallel resistance" and contains the following elements:

- Serial connection:** A diagram shows three resistors (R1, R2, R3) connected in series. Below it is the formula: $R_{tot} = R1 + R2 + R3$.
- Parallel connection:** A diagram shows three resistors (R1, R2, R3) connected in parallel. Below it is the formula: $\frac{1}{R_{tot}} = \frac{1}{R1} + \frac{1}{R2} + \frac{1}{R3}$.
- Input fields:** Three input boxes for resistor values: R1: Ω, R2: 0 Ω, R3: 0 Ω.
- Output fields:** Two output fields: "Serial resistance: 0" and "Parallel resistance: 0".
- Text:** "Fill in the values for the resistors R1 to R3 and read the results for the different connections:" and "The value 0 is handled like an interruption at parallel connections."

At the bottom of the interface, there is a navigation bar with a progress indicator showing "1-1. Components / Resistors" and a slide counter "4/10".

<http://www.v-techuk.com/>

E-Reinforcers

- ***Do you remember the definition of reinforcement?***
- How to reinforce in an e-learning situation?
 - Historical solution: Sweet dispenser...
- Known types of reinforcement:
 - Experience reinforcement
 - Self-esteem reinforcement
 - External reinforcement
- ***Which reinforcers have you met in real life, and to which category do they belong?***

Example: Drill-And-Practice

Significant Figures

Here you will be presented questions regarding significant figures. When you hit "New Number", a question will appear to the right of the table. Enter the number of significant figures in the answer cell and press "Check Answer". The results appear in the second table.

- If you miss a problem three times, pressing "Show Answer" will display the complete solution and you will no longer be able submit an answer for that problem.

New Problem

4 Enter your answer here

Check Answer

Show Answer

Results	Total Done	Total Correct
correct	17	10

Determine the number of significant figures in $4.000 \cdot 10^{+2}$

<http://science.widener.edu/svb/tutorial/>

Example: Test (Quiz)

Plagiarism Quiz

★★★★☆ ♀ ♂ 10 Questions - Developed by: Julio - The quiz is developed on: 2013-07-01 - 2.101

3/10

I have a class this quarter that is similar to a class I had at Mt. SAC last year. It's not plagiarism if I submit the paper I wrote for that class for my class this year.

True

False

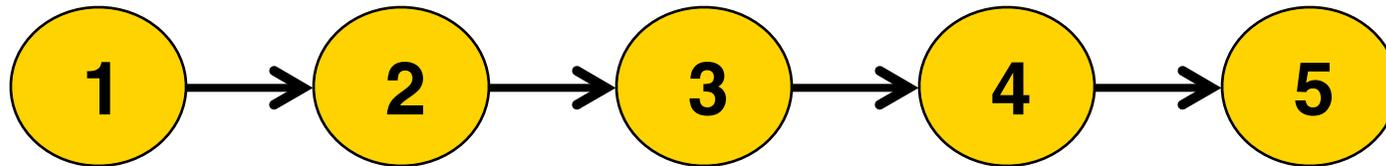
<http://www.allthetests.com/knowledge-tests-trivia-Copyright-and-plagiarism.php?katb=070C>

Design Decisions

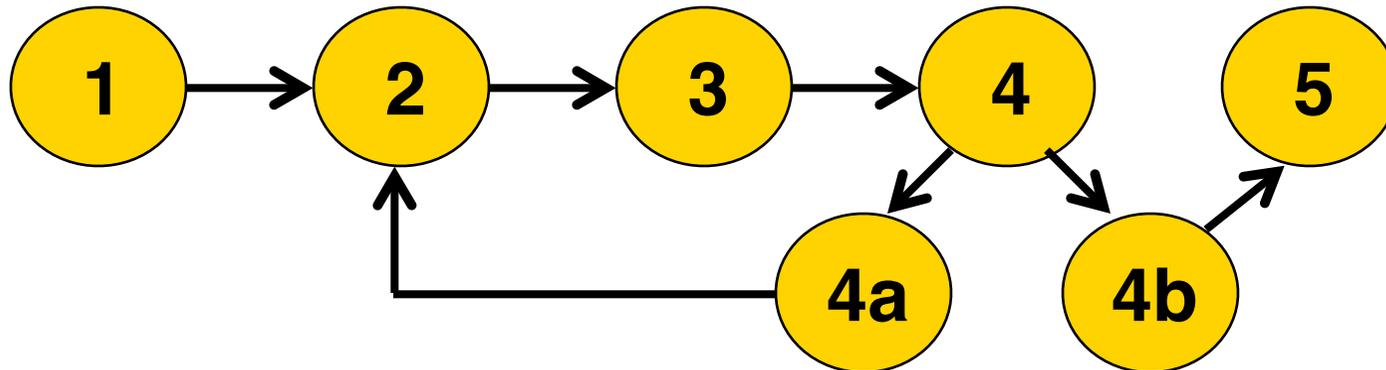
- User guidance
 - Degree of learner control
- Dealing with wrong answers
 - No reaction (no reinforcement)
 - Feedback that answer is wrong
 - Show the right answer
 - » Show the right answer after a certain number of attempts
 - Give additional explanations?
 - Branching sequences (see next slide)
- Dealing with correct answers
 - Give additional explanations?

Linear and Branching Programming

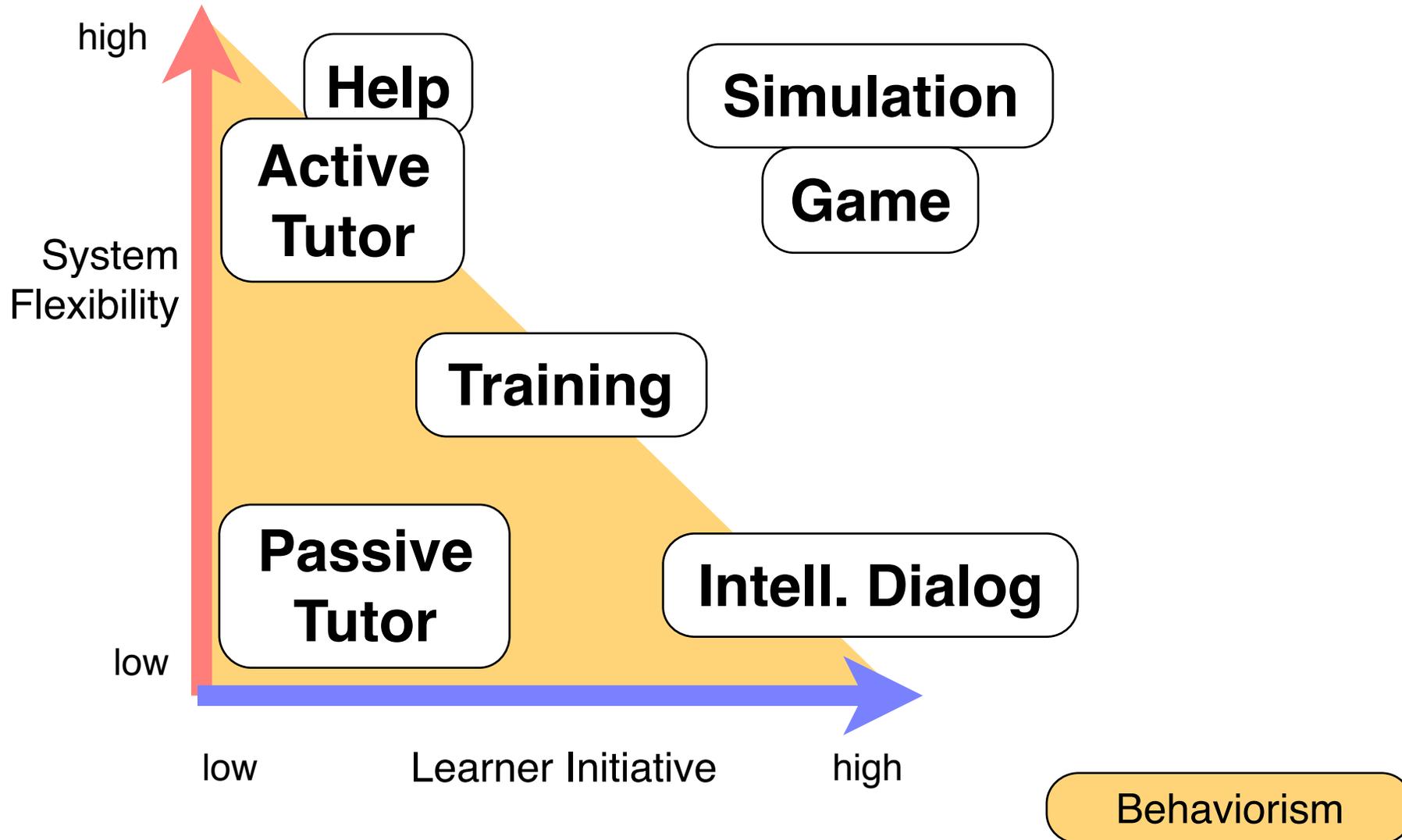
- Reaction-centered approach (Skinner/Holland):
 - Feedback only for correct answers
 - Strictly linear



- Stimulus-centered approach (Norman Crowder):
 - Feedback also on negative answers
 - Feedback control loops to enable repetition of sub-sequences



Behaviorism-Oriented Systems



Learning Algebra with Ms. Lindquist

MsLindquist

Advance section Show Progress Email a Progress Report Give us feedback

Problem
Debbie has two jobs over the summer. At one job she bags groceries at Giant Eagle and gets paid 5 dollars an hour. At the other job she delivers newspapers and gets paid 7 dollars an hour. She works a total of 30 hours a week. She works "g" hours bagging groceries. Write an expression for the total amount she earns a week.

History
Student: $g \cdot 7 + (30 - g) \cdot 5$
Tutor: Hmm. No. We will come back to the total pay per week. Let me try to break this down for you. What is the hours delivering newspapers?
Student: $30 - g$
Tutor: Correct. If "B" was the hours delivering newspapers then what would be the pay from the newspaper?

Student Input: Send

<http://www.algebratutor.org/>

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Intelligent Tutoring Systems (ITS)

- Combining Artificial Intelligence (AI) and education methods
 - Ideas from the 1960s, implementation in the 1980s
- Key characteristics:
 - Representation of domain knowledge, modeling of student + adaptation
 - Mixed initiative: Student can ask questions
- Typical interaction techniques:
 - Socratic dialogue: System guides learner by (adaptive) questions
 - Coaching: Assistance function in background until requested
 - Learning by doing: System closely guides learner through activities
 - Learning while doing: System passively observes learner and gives occasional hints
- Knowledge representation:
 - E.g. Semantic network
 - E.g. Collection of rules (expert system)

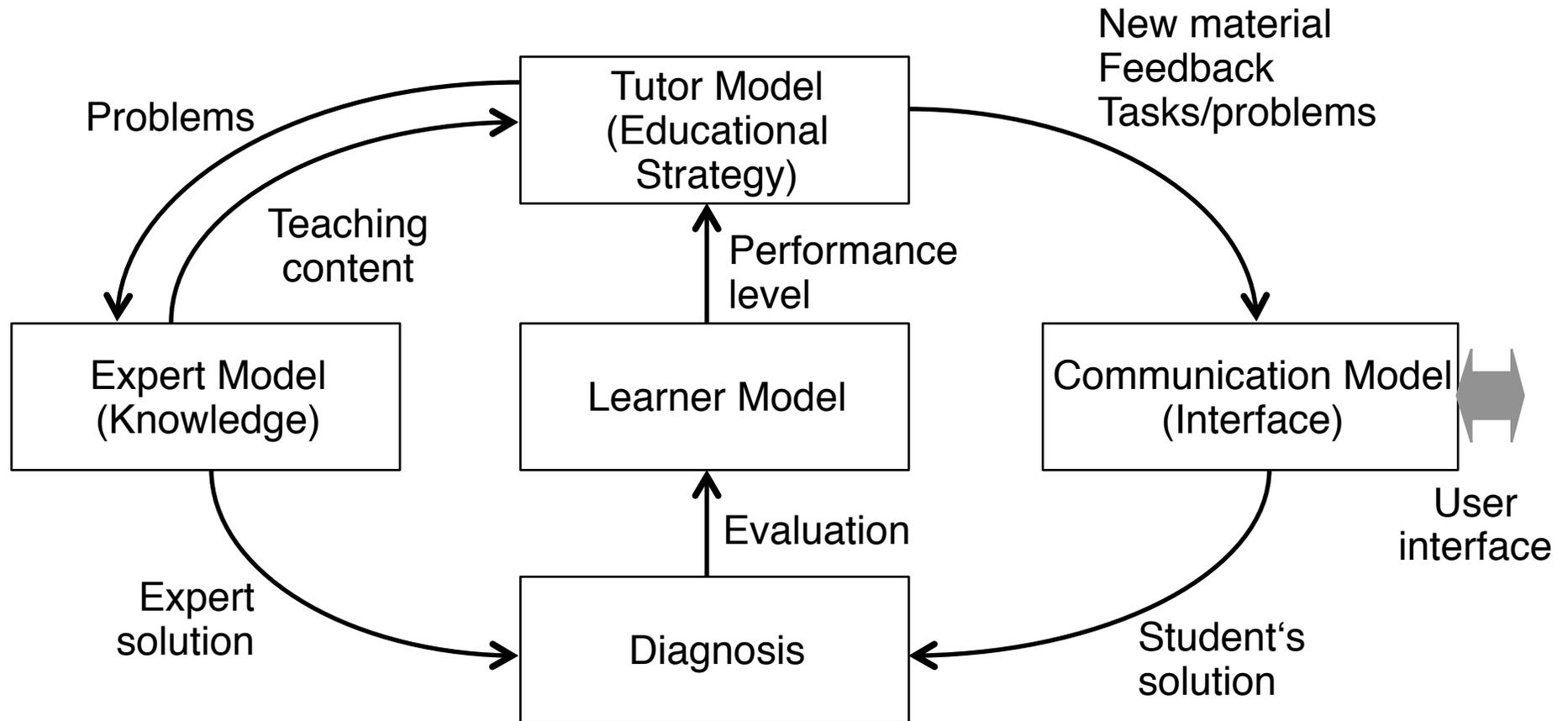
Cognitivism

Schemata

Assimilation & Accommodation

Processing Information
to Knowledge

Architecture of an ITS



Learner Models

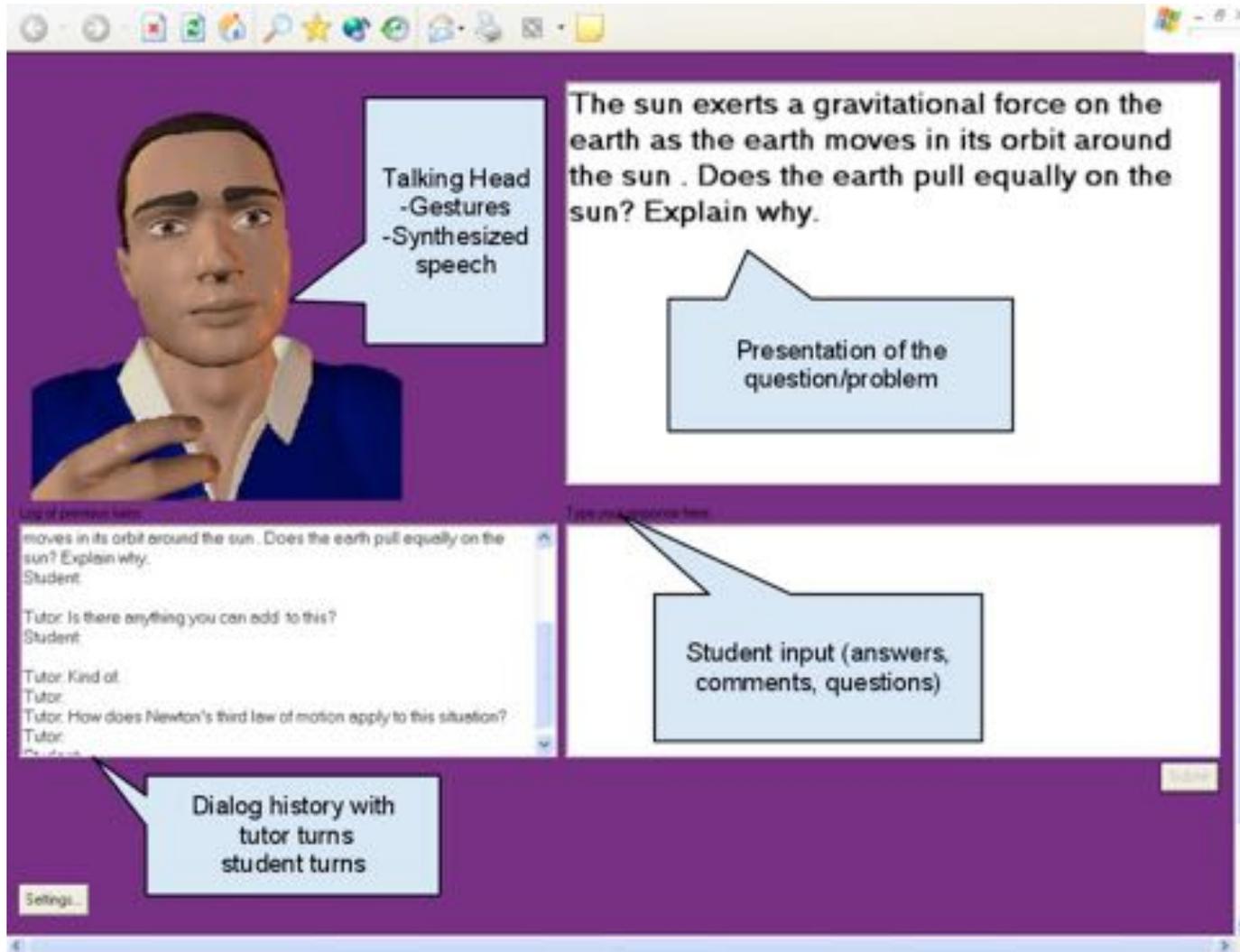
- Main approaches:
 - Subset model (or overlay model):
Which subset of the expert knowledge has been mastered?
 - Difference model:
Which are the differences between expert solution and learner solution?
- Functions of learner models (according to Self 1988)
 - Corrective function
 - Elaborative function
 - Strategic function
 - Diagnostic function
 - Predictive function
 - Evaluative function

Diagnosis: Finding the Reason for Errors

- Ideally, the tutorial system can find the “wrong schema” which causes a wrong answer
 - Problem: All possible “mal-rules” are clearly intractable
- Examples for error diagnosis by tutorial system:
 - “Proust” tutor for Pascal programming (Johnson 1986)
 - » Context: Line 12 in student’s program: `NEW = NEW + 1;`
 - » Tutor: It appears you were trying to use line 12 to read the next input value. Incrementing NEW will not cause the next value to be read in. You need to use a READ statement here.
 - The Algebra Tutor (Anderson et al 1990)
 - » Student rewrites the equation “ $15 - 3x = -x$ ” as “ $15 = -4x$ ”.
 - » Tutor: “ $15 = -4x$ ” is wrong because you added $-3x$ instead of its inverse to $-x$. Try again.

Example source: Merrill et al 1992

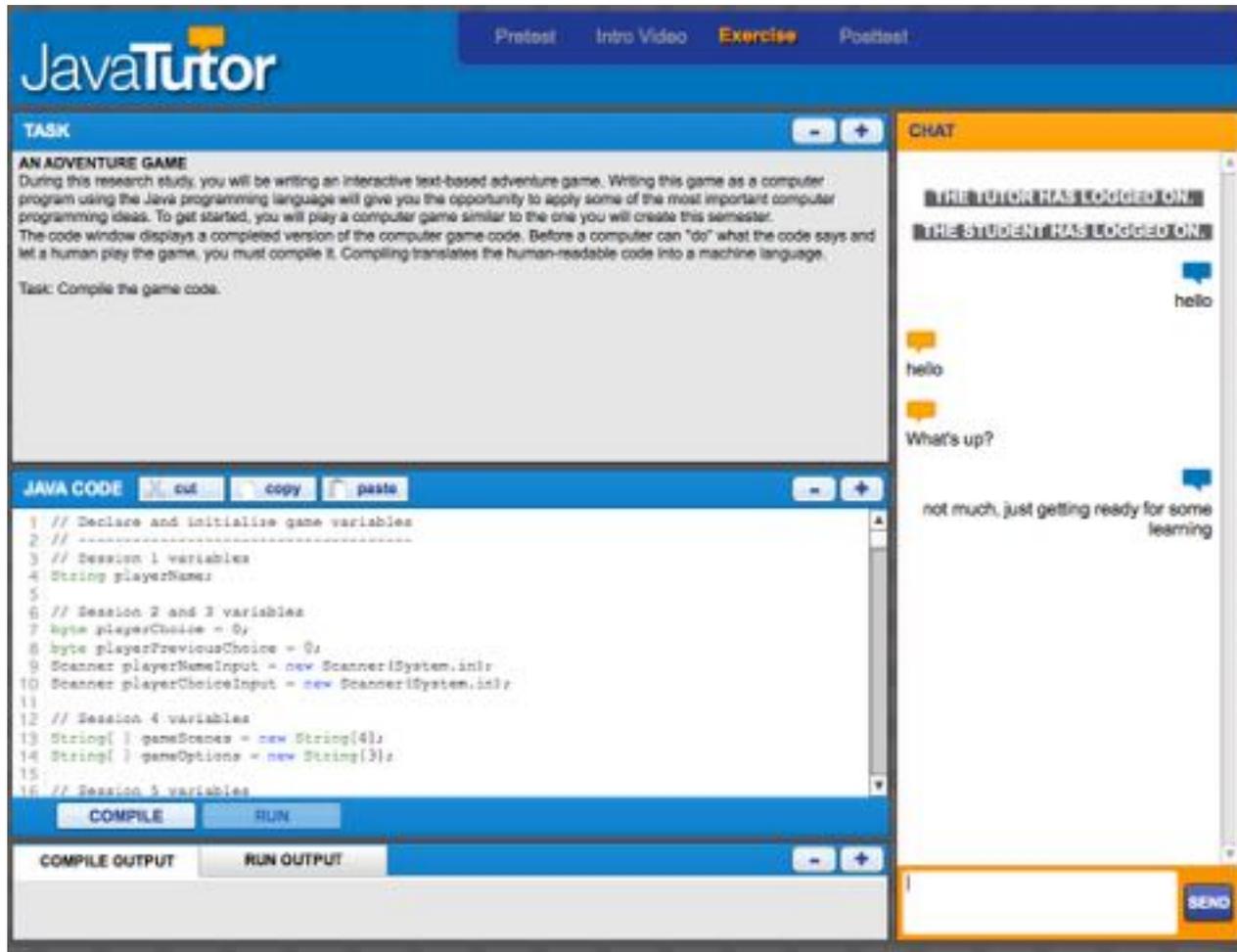
Example: AutoTutor



Picture:
V. Catete,
ncsu.edu

Art Graesser, University of Memphis

Example: JavaTutor



The screenshot displays the JavaTutor interface. At the top, there are navigation links: Prefest, Intro Video, **Exercise**, and Posttest. The main interface is divided into several sections:

- TASK:** Contains the title "AN ADVENTURE GAME" and a detailed description of the task, which involves writing an interactive text-based adventure game in Java. It also includes a specific instruction: "Task: Compile the game code."
- JAVA CODE:** A code editor window showing Java code for game initialization. The code includes comments for sessions 1 through 5 and declares variables for player names, choices, and game scenes/options. Below the code editor are buttons for "COMPILE" and "RUN".
- CHAT:** A chat window on the right side of the interface. It shows a conversation between a tutor and a student. The tutor's messages are in blue speech bubbles, and the student's messages are in yellow speech bubbles. The chat history includes:
 - Tutor: "HELLO! YOU'VE LOGGED ON!"
 - Student: "HELLO"
 - Tutor: "HELLO"
 - Student: "What's up?"
 - Tutor: "not much, just getting ready for some learning"At the bottom of the chat window is a text input field and a "SEND" button.

Investigating
human-human(!)
tutoring language

Kristy Boyer, NCSU, 2010

Example: EarthTutor, 2005 (1)

EarthTutor - Oceanography

Go to Card Tools

Lab 1: Intro to Image Processing using Sea Surface Temperature

Why Study Sea Surface Temperature

Earth's [climate](#) has remained essentially unchanged for centuries. This is because the sources of heat and water that enter the atmosphere have been approximately equal to the amounts of heat and water that are removed from the atmosphere. Today, anthropogenic, or human-caused, emissions of [greenhouse gases](#) into the atmosphere may be changing atmospheric temperature conditions such that the balance between heat gained and heat lost is shifting. This trend, referred to as climate change, has many scientists worried.



You might be thinking, what do the oceans have to do with climate? The oceans and the atmosphere are closely linked and form a "dynamic duo" in global climate. Oceans, which cover over 70% of the Earth's surface, absorb and release massive amounts of heat. Scientists believe that climate is related to the way the oceans store and transport heat. One way scientists study oceanic heat transport is by looking at temperature measurements of the ocean surface, also known as Sea Surface Temperatures (SST).

In this lab you will learn the basics of image processing and interpretation of satellite images using SST data. Specifically, you will

- Use ImageJ to open and view an SST image.
- Understand the parts of an SST image.
- Become familiar with ImageJ tools to explore SST data.

< Previous Next >

EarthTutor - Oceanography

Go to Card Tools

Lab 1: Intro to Image Processing using Sea Surface Temperature

Daily vs Monthly Images

The *temporal resolution* of a remote sensing system refers to how often it records imagery of a particular area. You begin the lab by observing a monthly-averaged image of SST for February 2003, in which the SSTs of the single month were averaged into one composite image. One of these images exists for each month in the [Reynold's Optimally Interpolated SST dataset](#). In the last card, you examined the SST reading for a single day (missing data and all).

Question 17.1

Think about temporal resolution for a minute. What kinds of oceanographic phenomena would you not be able to observe using monthly-averaged images?

Please select an answer below.

- Geographic differences in SST
- Seasonal changes in SST
- Yearly changes in SST
- Hurricane-induced SST changes
- None of the above

Answer Skip

Question 17.2

Please discuss the benefits and drawbacks of monitoring the ocean temperature using daily images versus using monthly images.

[Get me a hint.](#)

Activity 17.3

< Previous Report Card >

Earth science (remote sensing), in particular usage of image processing software from NASA and NIH

Report Card for Lab

Report Card

Student: Jane Doe

Lab: [The Biological Response to Upwelling](#)

Time started (last session only): 1:29 PM

Time finished (last session only): 2:15 PM

Overall:

- 88% cards complete
- 100% questions correct

This report only includes questions that the student has attempted.

Student's Essays:

- Card 3. Summer California Seasonal Chlorophyll Patterns
 - Question 4.3 How does the do the June chlorophyll concentrations along the shore and offshore compare to the concentrations in January?
much higher concentrations in June
- Card 5. Chlorophyll Patterns
 - Question 6.5 In the last lab you measured a SST chirps in the same region to extend roughly 500 km

Example: EarthTutor, 2005 (2)

EarthTutor - Oceanography
Go to Card Tools
Lab 1: Intro to Image Processing using Sea Surface Temperature

Calibrated Values

Now when you move your mouse around in the image, the value is now the calibrated SST with the pixel value in parentheses.

Image J
File Edit Image Process Analy
x=370, y=193, v=25.98 (57)

The number to the left is the temperature in degrees Celsius (e.g. 25.98), while the number to the right is the original pixel value (57).

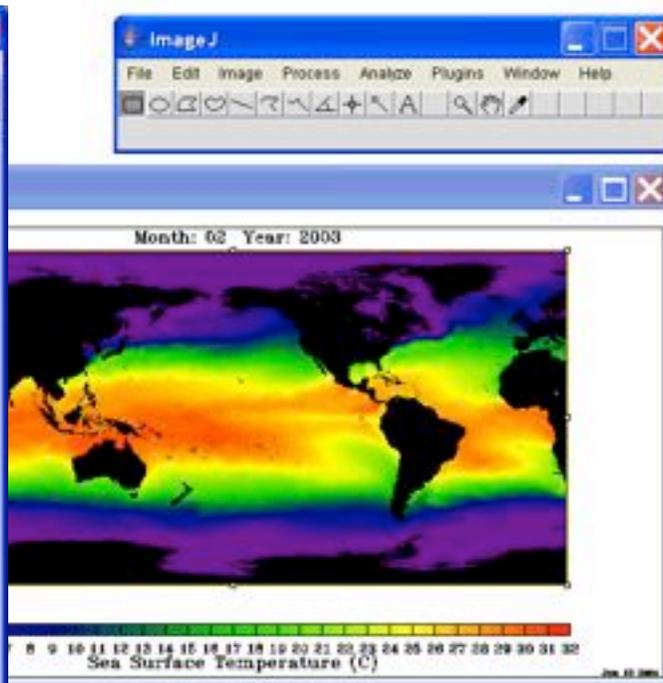
Activity 12.1
[Click here to skip this activity \(Teacher's Edition only\).](#)

- 1 Select the **Crosshair Tool** on the toolbar.
Look at the color legend. Which colors are the warmest?
- 2 Click on an area of the image with the warmest pixel values.
Sorry, you did not click a correct point. Try me a bit.

Question 12.2
In February 2003, approximately what temperature is the warmest SST?
 degrees C

Activity 12.3
1 Select the **Crosshair Tool** on the toolbar.
2 Click on an area of the image with the coolest pixel values.

Question 12.4
< Previous Next >



EarthTutor - Oceanography
Go to Card Tools
Lab 1: Intro to Image Processing using Sea Surface Temperature

Making a Measurement

You can use ImageJ's tools to perform quantitative measurements on the image data. Here you will calculate the max SST for the entire image.

Activity 13.1

- 1 Select the **Rectangle tool** from the toolbar.
- 2 Draw a selection rectangle around the main world image.

Activity 13.2
[Click here to skip this activity \(Teacher's Edition only\).](#)

- 1 From the **Analyze** menu, select **Set Measurements...**
- 2 Make sure the following measurement(s) are checked:
 - Min & Max Gray Value
- 3 From the **Analyze** menu, select **Measure...**

Question 13.3
Look at the results table that just opened. What is the Max temperature for the image?
 degrees C

Activity 13.4
1 Please close Results window. You don't need to save the measurements.

< Previous Next >

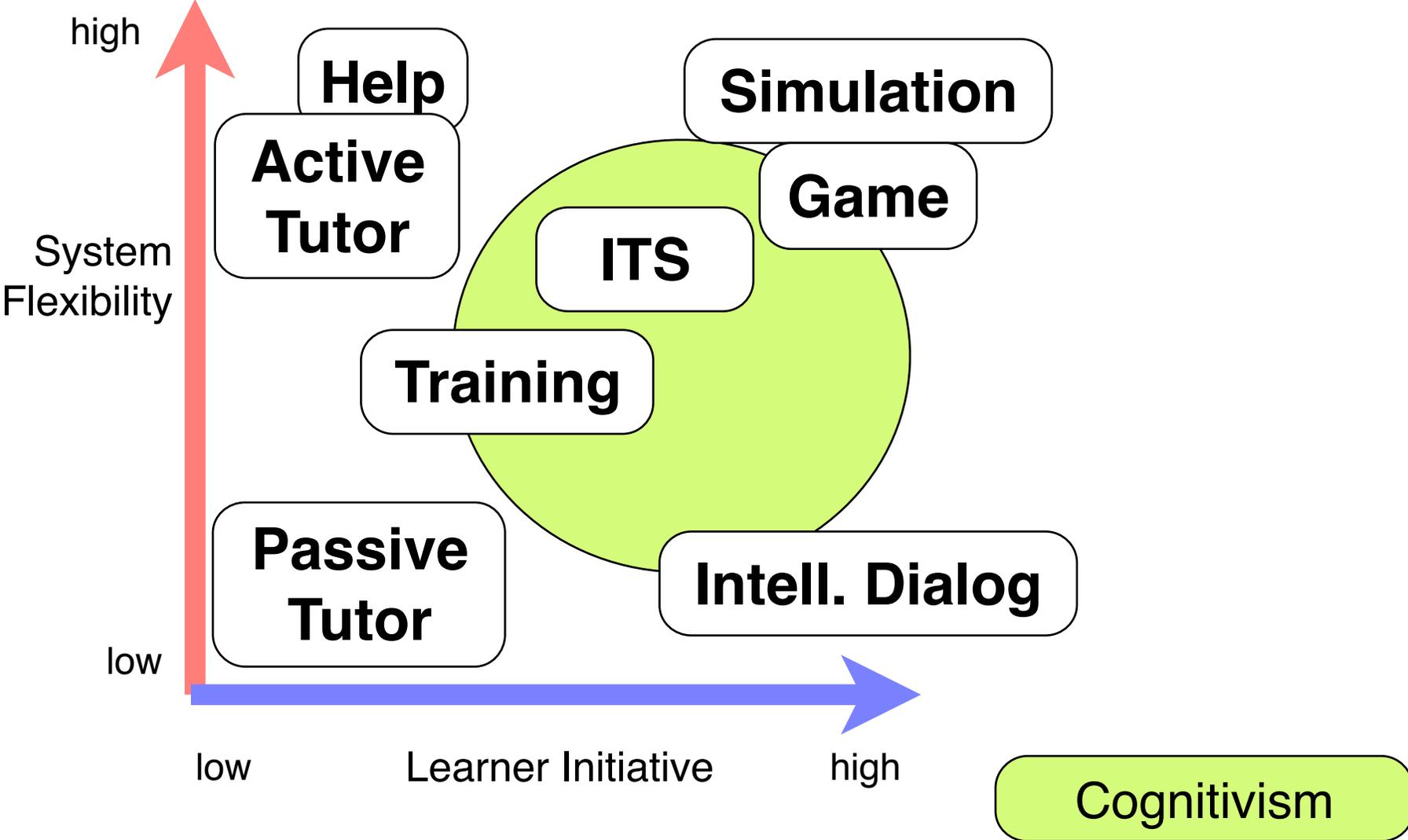
<http://www.stottlerhenke.com/earthtutor/>

Criticism on ITS Principles

- Mark Elsom-Cook 1993:
 - “takes no account of the rich range of learning styles and capabilities for which there is psychological evidence”
- Ohlson/Langlely 1988:
 - “there are disappointingly few psychological principles that can be used for [evaluating the psychological plausibility of a solution or mistake]”
- Bredo 1993:
 - “the assumption of a given task and given expertise puts students in a passive role with respect to finding their own problems and developing their own expertise”

Quotations based on talk by Martin Homik,
published on slideshare.net

Cognitivism-Oriented Systems



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Constructivism

It's All Invented!

Active Learners

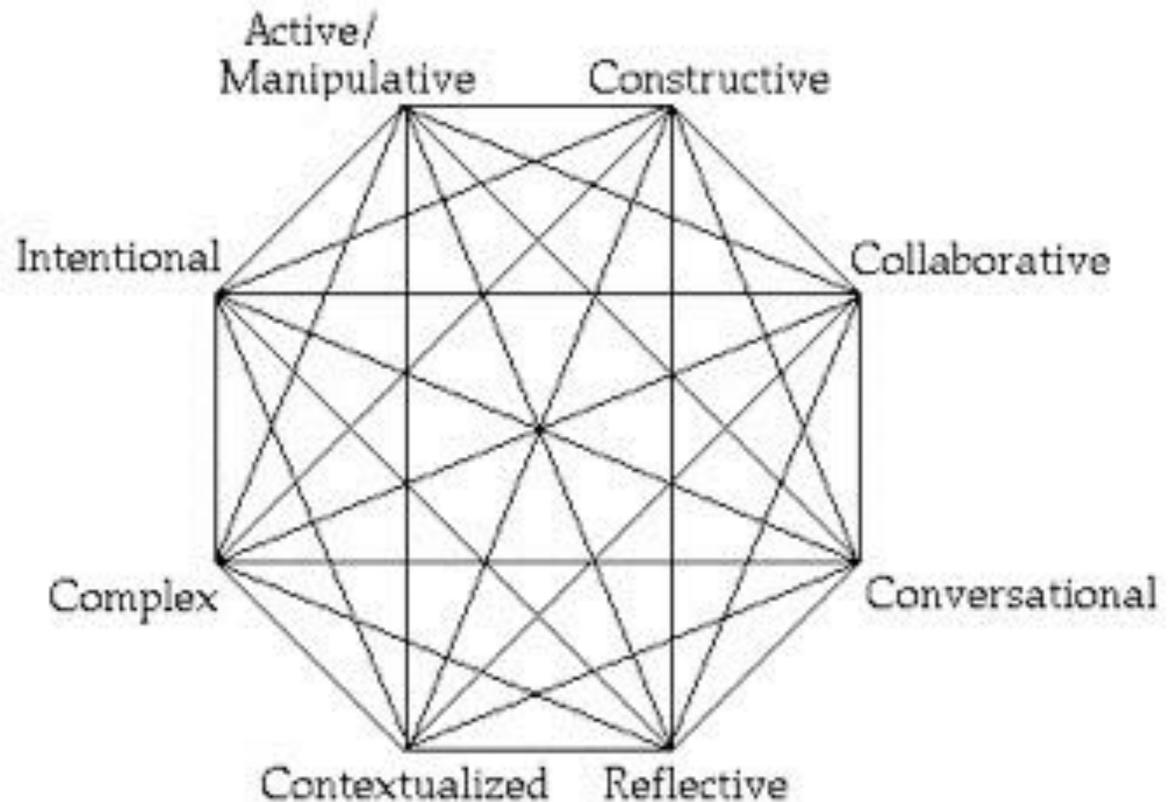
Construction by
sense-making activities

Individual Differences

Properties of Constructivist Learning Environments

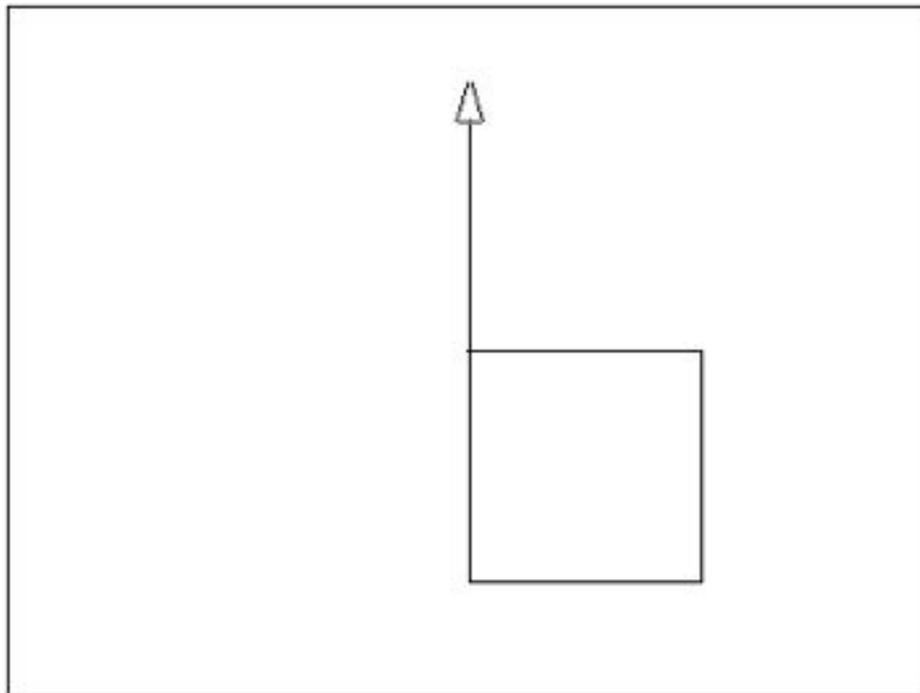
“Web of Constructivism” according to D. Jonassen 1994

D. Jonassen, Thinking technology: towards a constructivist design model, *Educational Technology* 34(4), 1994



Example for a MicroWorld: Logo

- Seymour Papert
- Programming by moving a turtle through commands
- Learning concepts by abstraction from experience

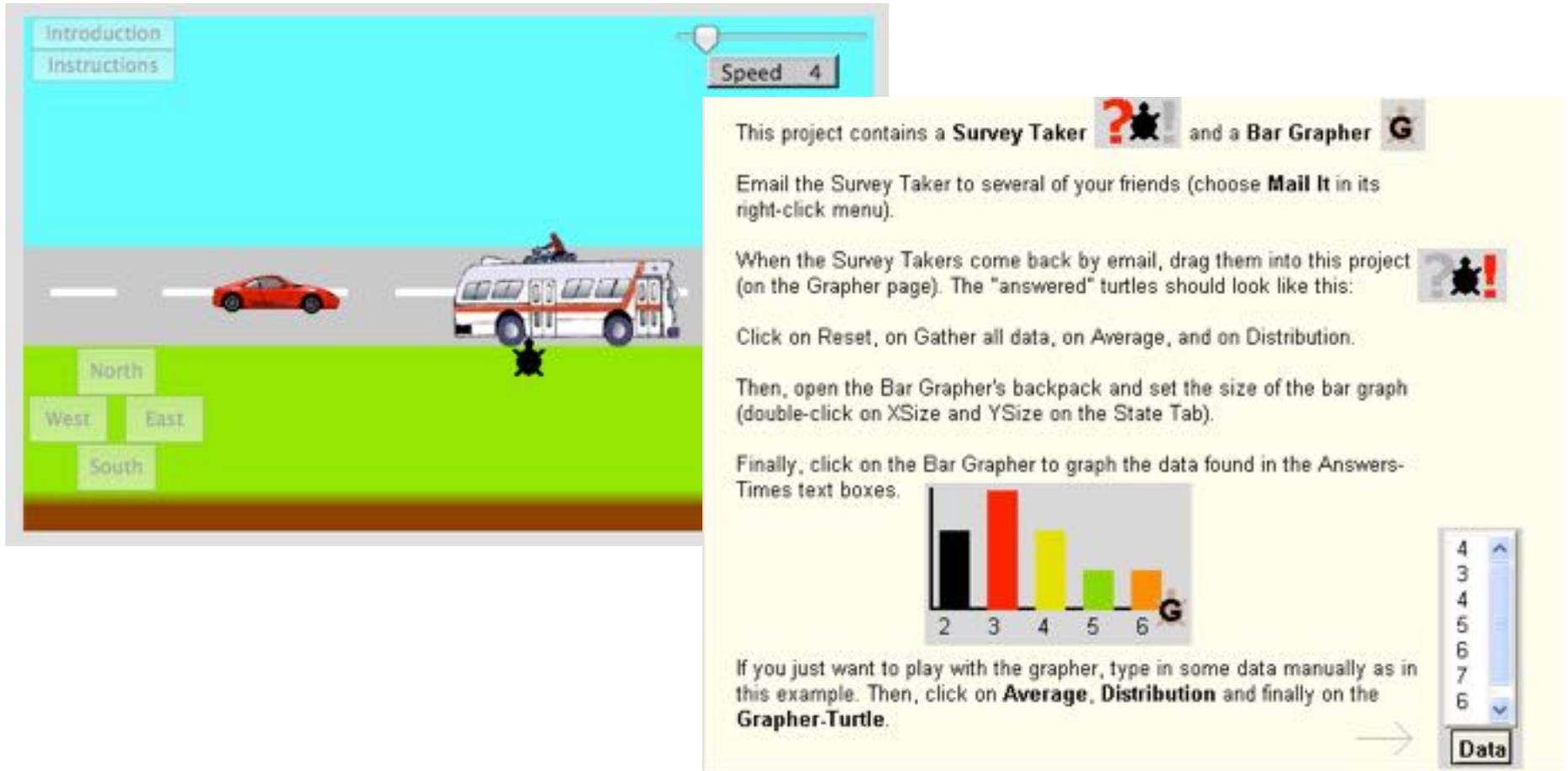


```
Welcome to Berkeley Logo version 5.5
? right 90
? forward 100
? forward 100
? □
```

Example: Wikipedia

Example: MicroWorlds

- Squish and SurveyGraph, written in MicroWorld EX



The screenshot shows the MicroWorlds EX environment. On the left, there are navigation buttons for "Introduction" and "Instructions". A "Speed 4" indicator is visible. The main scene depicts a road with a red car and a white bus. Below the road, there are directional buttons for "North", "West", "East", and "South". A small black turtle is positioned on the grass below the bus.

The tutorial window on the right contains the following text:

This project contains a **Survey Taker**  and a **Bar Grapher** .

Email the Survey Taker to several of your friends (choose **Mail It** in its right-click menu).

When the Survey Takers come back by email, drag them into this project (on the Grapher page). The "answered" turtles should look like this: .

Click on Reset, on Gather all data, on Average, and on Distribution.

Then, open the Bar Grapher's backpack and set the size of the bar graph (double-click on XSize and YSize on the State Tab).

Finally, click on the Bar Grapher to graph the data found in the Answers-Times text boxes.

If you just want to play with the grapher, type in some data manually as in this example. Then, click on **Average**, **Distribution** and finally on the **Grapher-Turtle**.

The Bar Grapher window shows a bar graph with five bars of different heights and colors (black, red, yellow, green, orange) on a scale from 2 to 6. A "Data" button is located at the bottom right of the window.

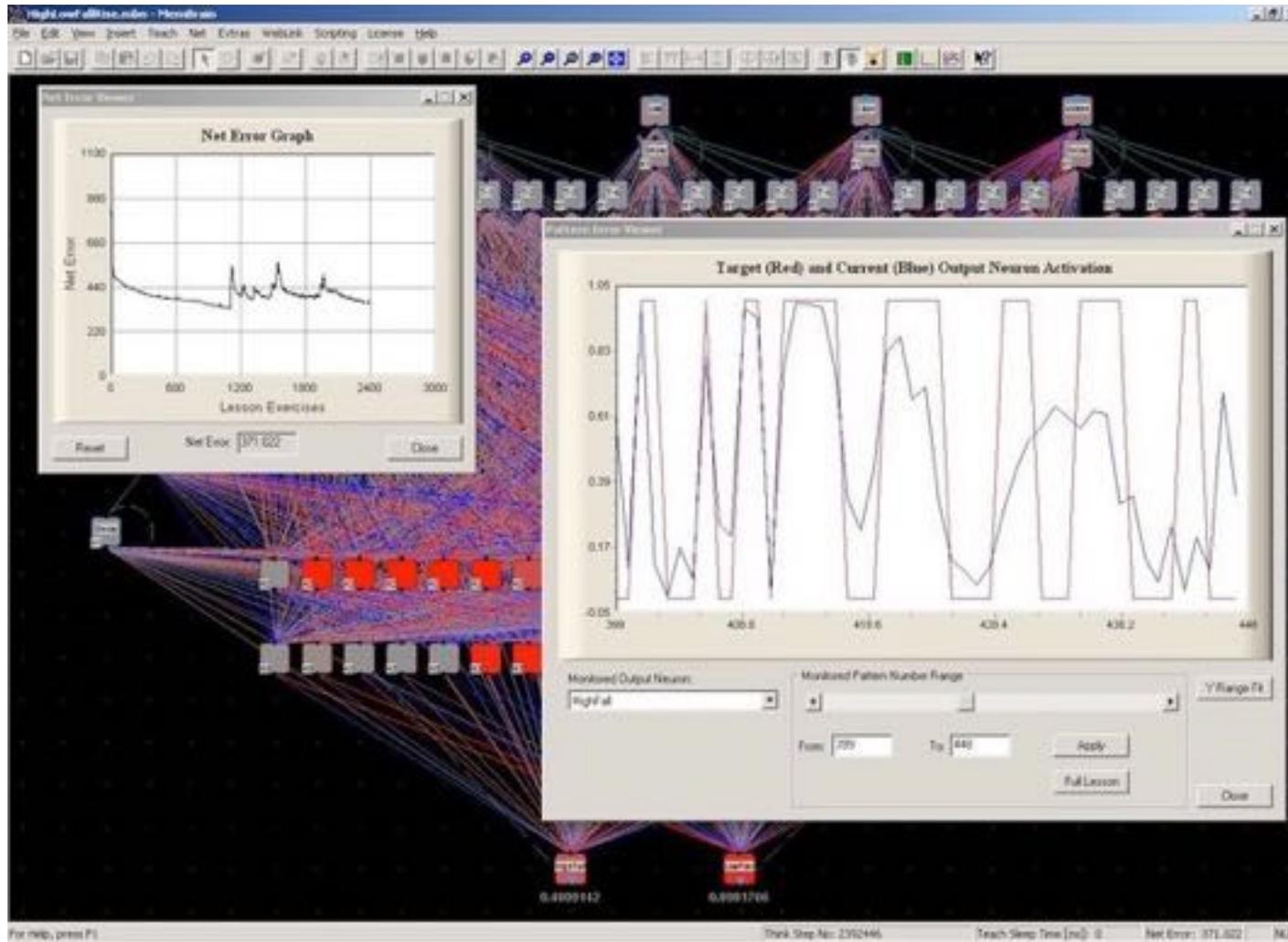
Example: Sniffy the Virtual Rat

The image shows a screenshot of the Sniffy software interface. On the left, a virtual white rat is positioned in a metal chamber. On the right, a dialog box titled "Classical Conditioning Experiment Design" is open. The dialog box is divided into several sections:

- Stage:** View/Edit Experiment Stage 1. Buttons: Next Stage, Previous Stage, New Stage, Delete Stage.
- Interval Between Trials:** 5 Minutes.
- Present Each Trial Type:** 1 Times.
- Trial Types:** View/Edit Trial Type A. Buttons: Next Type, Previous Type, New Type, Delete Type.
- First Stimulus:**
 - Intensity: Low, High.
 - Options: Light, Tone, Bell.
 - Intensity selection: Low (radio), High (radio).
- Second Stimulus:**
 - Intensity: Low, High.
 - Options: Shock US, CS used as US, Light, Tone, Bell, None.
 - Intensity selection: Low (radio), High (radio).

Buttons: Cancel, Save.

Example: Simulation of Neuronal Networks



<http://www.membrain-nn.de/>

Simulations and MicroWorlds

- “Learning by Doing”
 - Real (ill-structured) problems
 - Self-directed problem solving
 - Limited guidance (scaffolding)
- System components:
 - Realistic views on simulated world (also 3D / immersive)
 - Simulation
 - Tool selection and manipulation
 - Real input / output devices (e.g. driving or flight simulator)
 - Tutorial mode
 - Interactive help
 - Evaluation of progress
 - Triggers for reflection / meta-cognition

Example: Reflection Triggers

"What things happened that were not expected?"

"Advice for others!"

Usage of sentence templates

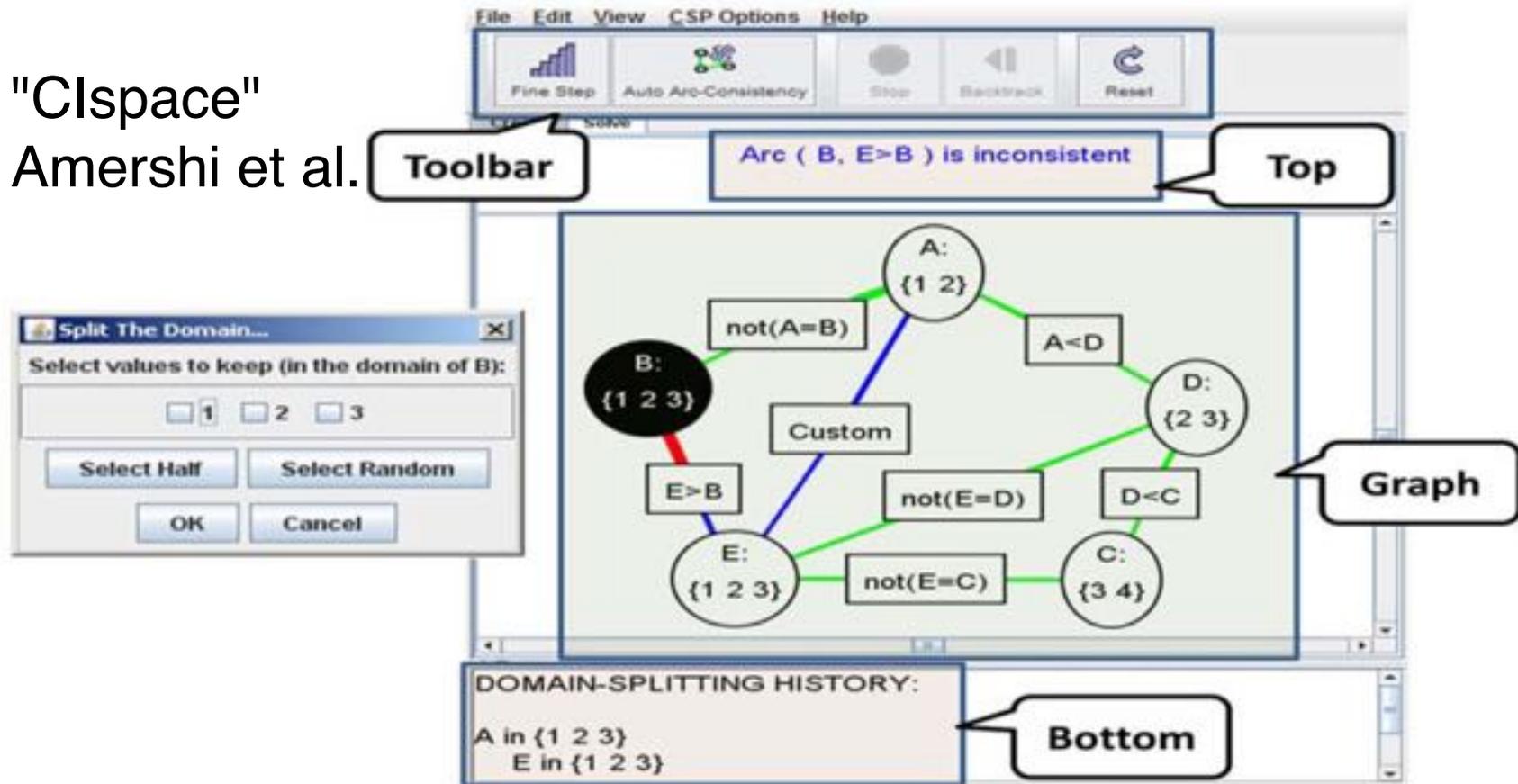
SMILE,
Kolodner/Nagel
1999

Criticism of Learning with Simulations

- Günter Daniel Rey 2009 and others
- Learners struggle to design experiments
 - Variables, hypotheses
 - Interpretation, reasoning
- Learners struggle with self-management
 - Self-monitoring
 - Time planning
- Tendency:
 - Simulations often are too demanding
 - Lead to time-inefficient learning

Current Research: Observing Learners

"Clspace"
Amershi et al.

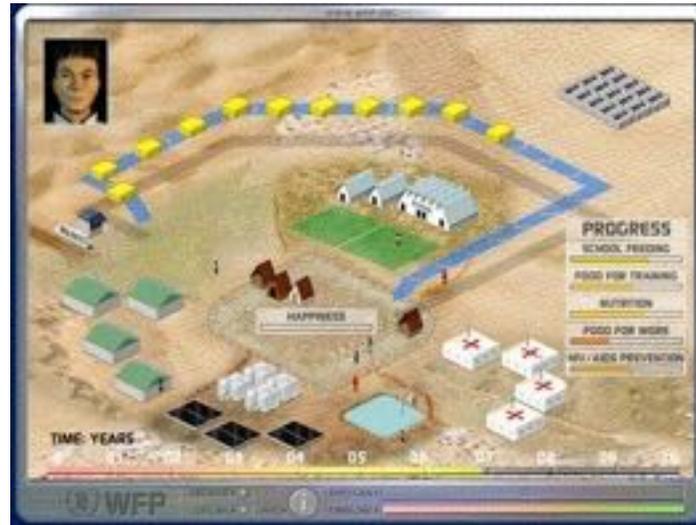


Kardan/Conati, UBC (e.g. paper on CHI 2015):
Exploring Gaze Data for Determining User Learning with an Interactive Simulation,
Designing adaptive interventions

Games for Learning: Serious Games



America's Army (2002)



Food Force (2005)



Latin America (2008)



The Magi and the Sleeping Star (2009)

Problem-Based Learning (PBL)

- Authentic, ill-structured problem
- Self-directed learning process, often in teams
- Computer usage: Access to resources, documentation, communication

The Geritol Solution

Written by Deborah Allen. August, 1993; Revised August, 1995.

(page 1)

John H. Martin, the director of the Moss Landing Marine Laboratories, thinks the potential problem of global warming could be addressed by dumping iron into the ocean waters off Antarctica. He and his coworkers have demonstrated that the amount of chlorophyll found in ocean water samples collected (in 30 L bottles) from the Gulf of Alaska can be increased up to nine-fold by the addition of iron.

When they repeated this fertilization experiment with samples collected from a few hundred miles off the Antarctic coast, he and his colleagues found that for every unit of iron added to antarctic sea water, the organic carbon content increased by a factor of 10,000.

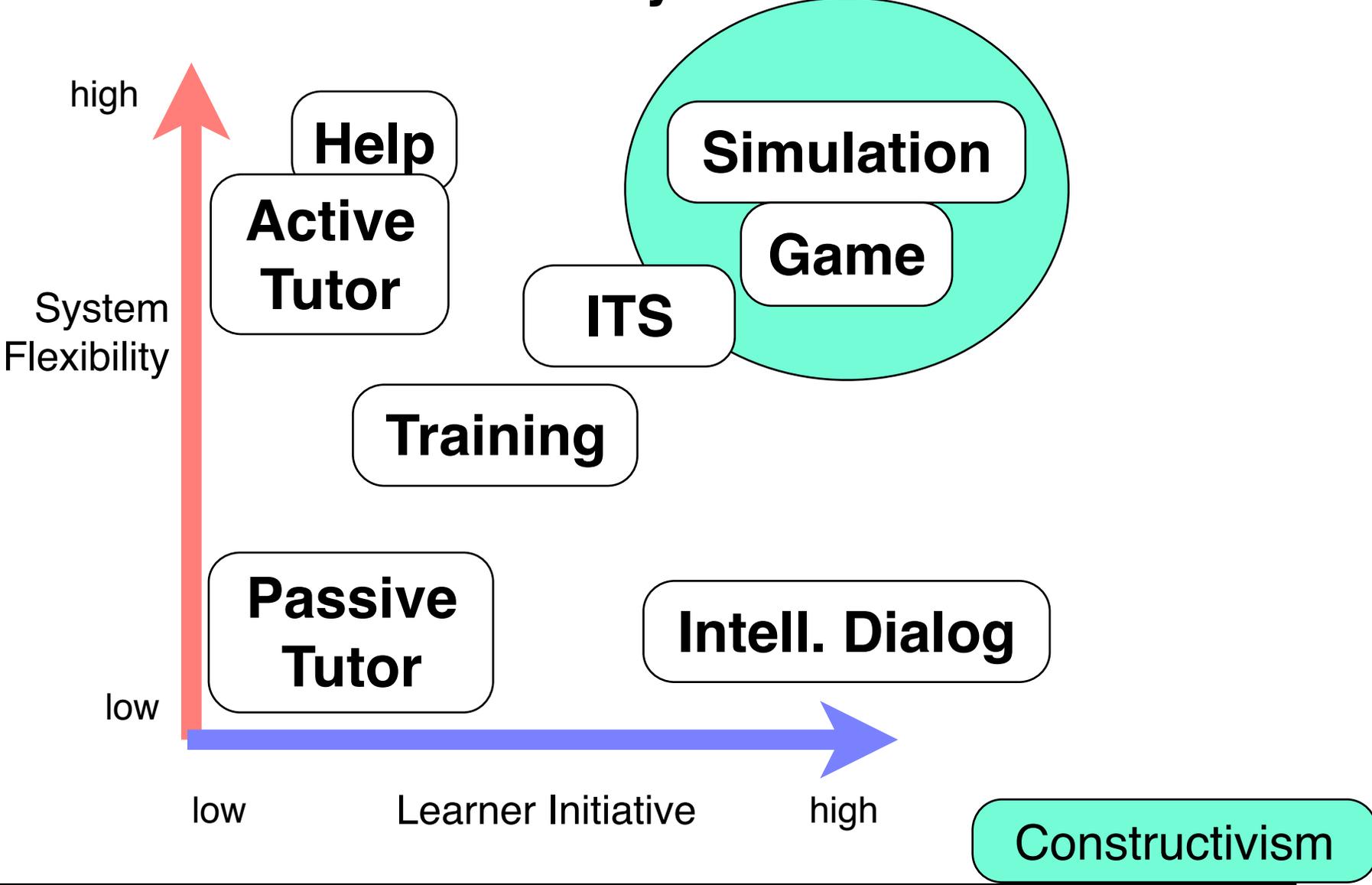
Martin's degree of confidence in his proposal is reflected in a remark he (half-jokingly) made during a lecture at the Woods Hole Oceanographic Institute: "Give me half a tanker of iron and I'll give you an Ice Age."

Questions

- What is the basis for Martin's premise that seeding the ocean with iron would help combat potential greenhouse warming?...

<http://www.udel.edu/pbl/curric/bisc207prob.html>

Constructivism-Oriented Systems



4 Typology of Learning Environments

4.1 Classification Schemata for Learning Software

4.2 Systems Oriented Towards Behaviorism

4.3 Systems Oriented Towards Cognitivism

4.4 Systems Oriented Towards Constructivism

4.5 Systems Supporting Social Learning 

4.6 Learning Management Systems

Social Learning

Learning in Groups

Model Learning

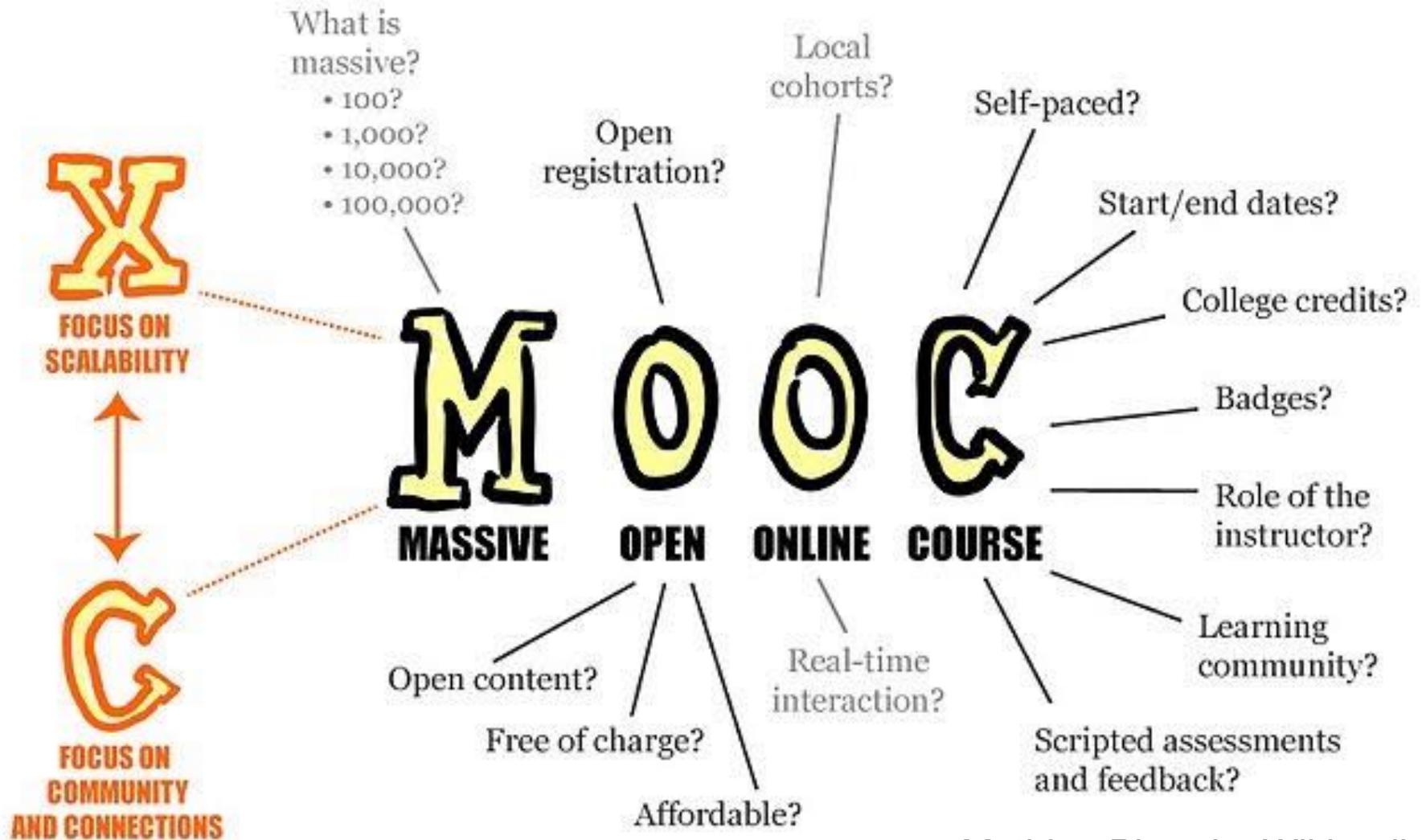
Zone of
Proximal Development

Situated Cognition

Online Learning Communities

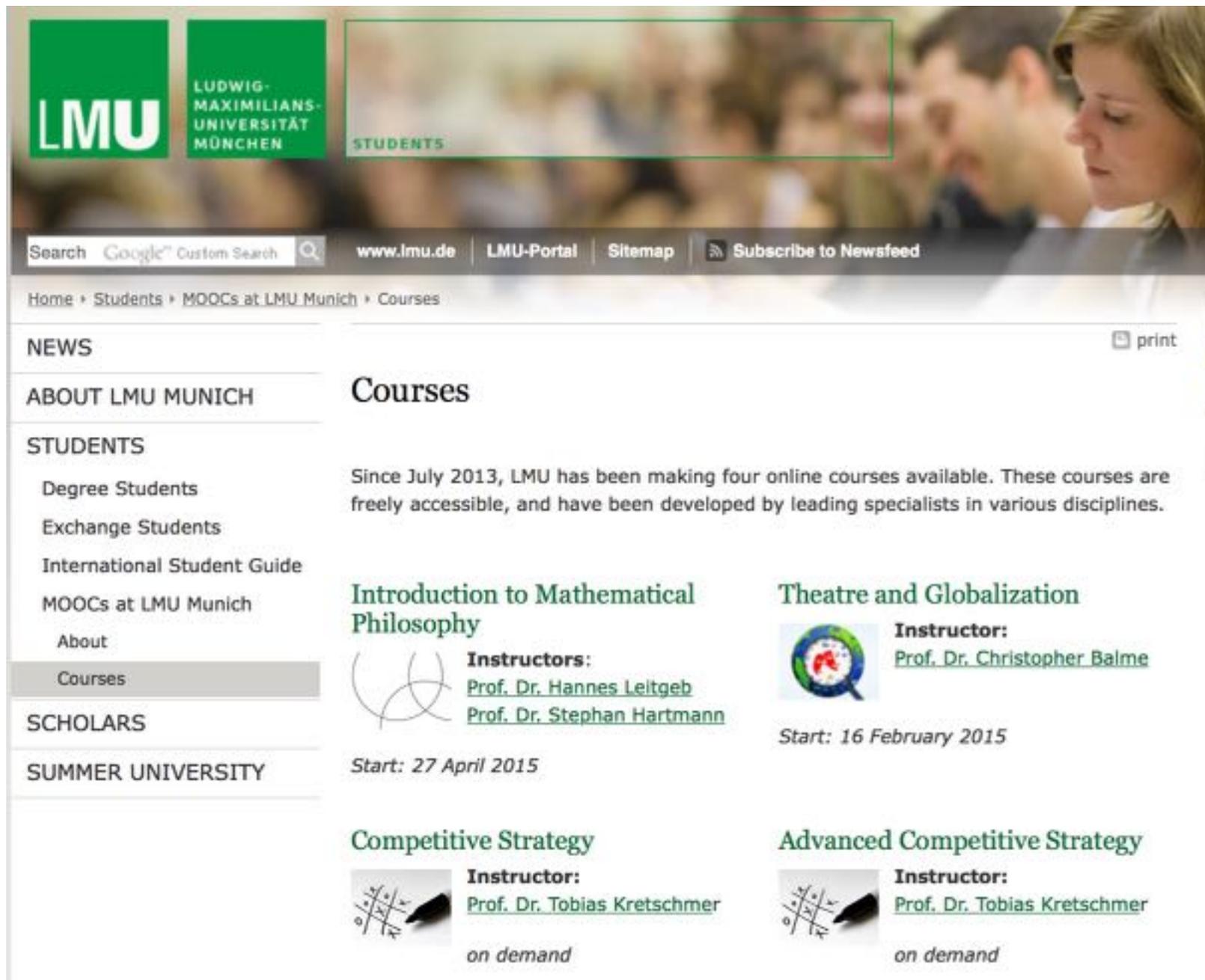
- From the isolated e-learner to an active community
- System support required for:
 - Creating awareness of the activities of others
 - Supporting individual learning styles
 - Supporting individual control of learning speed
 - Making it easy to share products
- System architectures:
 - Either centered on one medium
 - » Forum
 - » Document management, assignments, grading
 - » E-Portfolios
 - » Multimedia materials like video recordings
 - Or providing a general integrative platform
 - » Learning management systems, see below

Massive Open Online Course (MOOC)



Mathieu Plourde, Wikipedia

MOOCs at LMU (Coursera)



The screenshot shows the LMU Munich website with a navigation menu on the left and a main content area. The navigation menu includes: NEWS, ABOUT LMU MUNICH, STUDENTS (with sub-items: Degree Students, Exchange Students, International Student Guide, MOOCs at LMU Munich, About, Courses), SCHOLARS, and SUMMER UNIVERSITY. The main content area is titled "Courses" and features a paragraph: "Since July 2013, LMU has been making four online courses available. These courses are freely accessible, and have been developed by leading specialists in various disciplines." Below this, four course cards are displayed:

- Introduction to Mathematical Philosophy**
Instructors: Prof. Dr. Hannes Leitgeb, Prof. Dr. Stephan Hartmann
Start: 27 April 2015
- Theatre and Globalization**
Instructor: Prof. Dr. Christopher Balme
Start: 16 February 2015
- Competitive Strategy**
Instructor: Prof. Dr. Tobias Kretschmer
on demand
- Advanced Competitive Strategy**
Instructor: Prof. Dr. Tobias Kretschmer
on demand

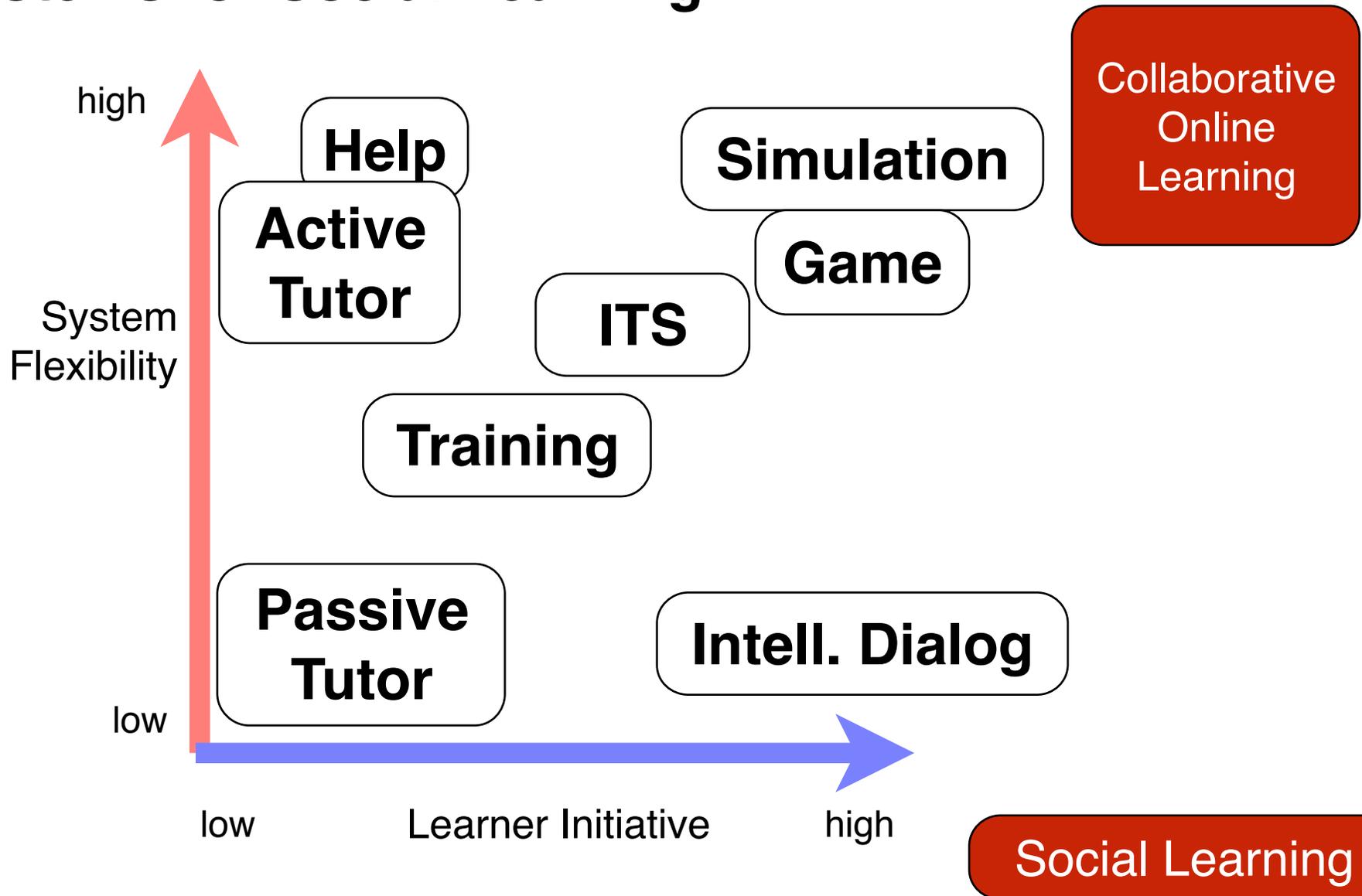
iSocial: 3D Virtual Learning World



Based on *Second Life*

http://blogs.sun.com/wonderland/entry/isocial_3d_virtual_learning

Systems for Social Learning



4 Typology of Learning Environments

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Literatur:

U. Höbarth: Konstruktivistisches Lernen mit Moodle,
Verlag Werner Hülsbusch 2010

C. Wiegrefe: Das Moodle-2 Praxisbuch, Addison-Wesley 2011

Learning Management System (LMS)

- Software application for the administration, documentation, tracking, and reporting of training programs, classroom and online events, e-learning programs and training content. (Ellis 2009)
- LMSs combine functionalities on a common platform which have been available and have been used as separate instances for a long time.
 - Administrative systems for enrollment and access to materials and examinations
 - Content management for learning materials
 - Online tests
 - Communication tools for learners and advisors
- LMSs are radically different from authoring systems for individual learning materials
 - The authored products become materials or modules in the LMS

Example Moodle

- Moodle = *Modular Object Oriented Learning Environment*
- Open source product, see <http://moodle.org>
- Key inventor: Martin Dougiamas (Curtin University, Australia)
 - Start of development 1999
 - First version published in August 2002
 - Moodle Version 2: November 2010, current 2.9 (May 2015)
- Modular system for establishing a virtual course room
 - Containing
 - » working materials (Arbeitsmaterial) and
 - » activities (Aktivitäten)
- Social-constructivist approach to teaching and learning

Standard Activities in Moodle

- Assignment (Aufgabe)
- Chat
- Data base (Datenbank)
- Feedback
- Forum
- Glossary (Glossar)
- Lesson (Lektion)
- Quiz (Test)
- SCORM (Lernpaket)
- Survey (Umfrage) – according to COLLES or ATTLS
- Wiki
- Workshop – collaborative team work