University of Pittsburgh

The User Side of Personalization:
How Personalization Affects the Users

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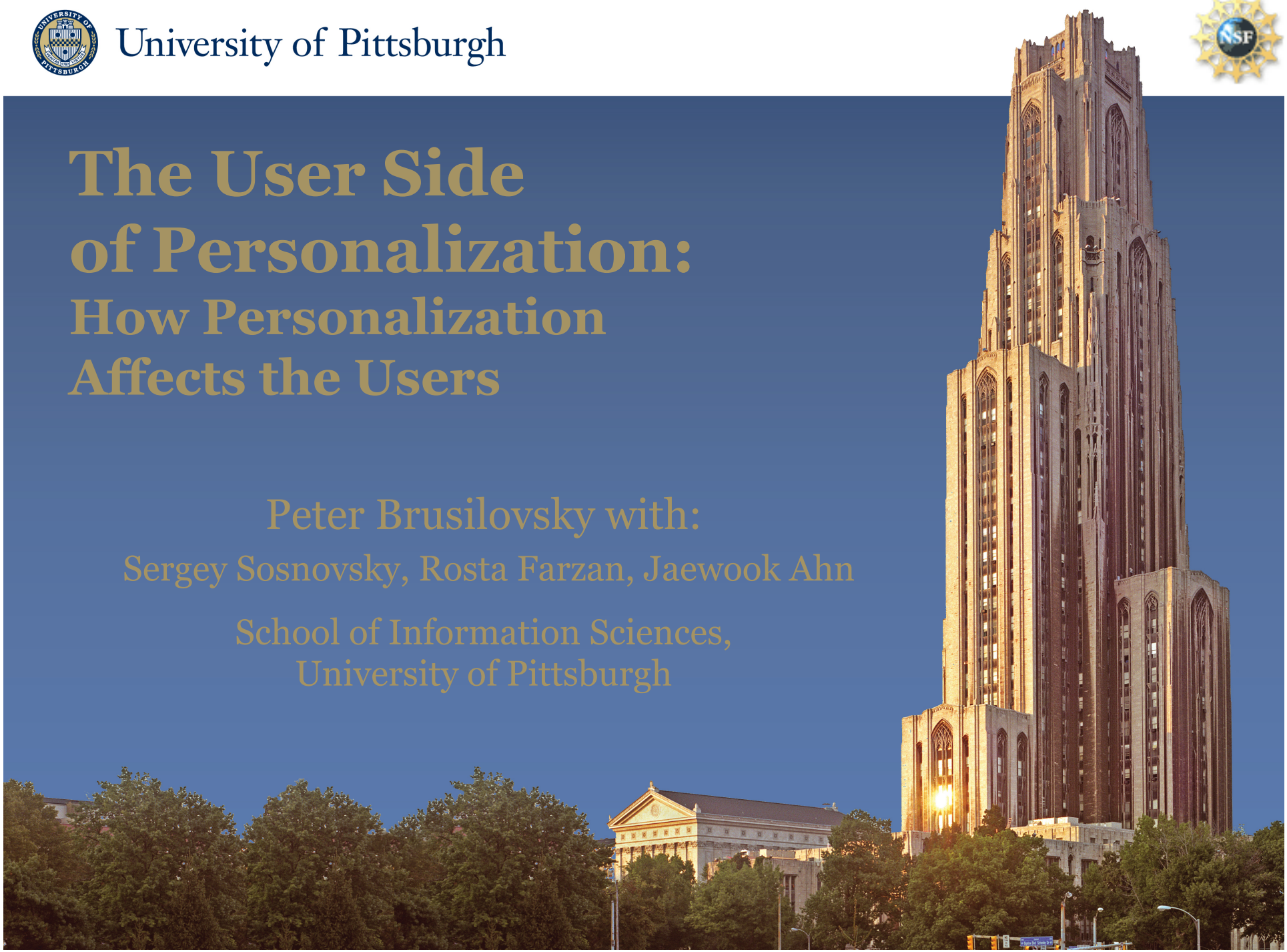
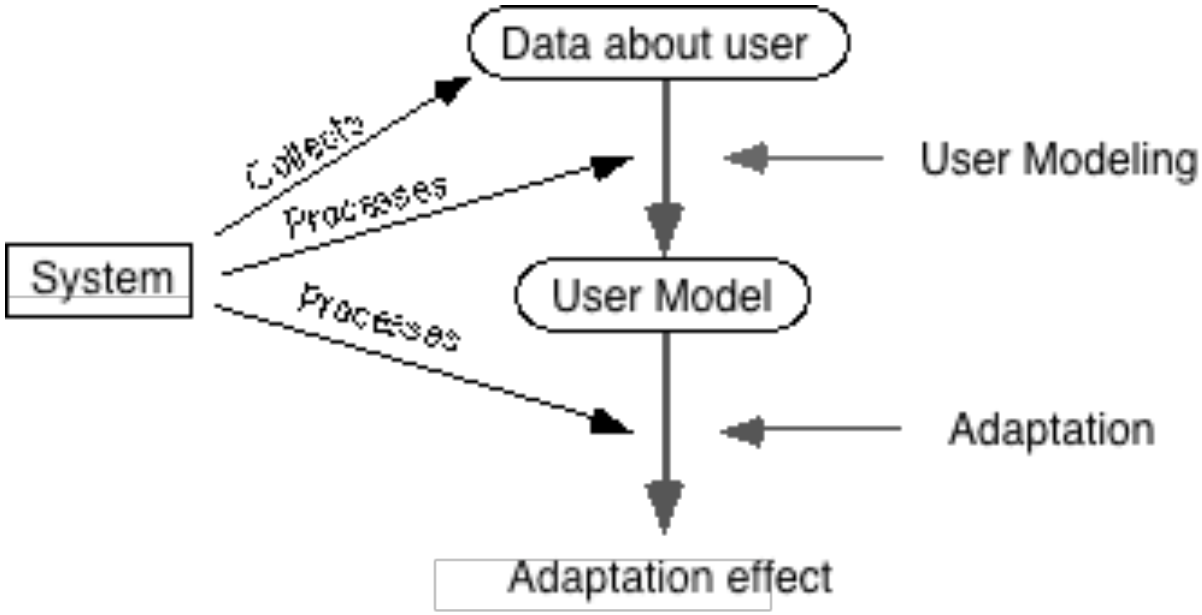
University of Pittsburgh

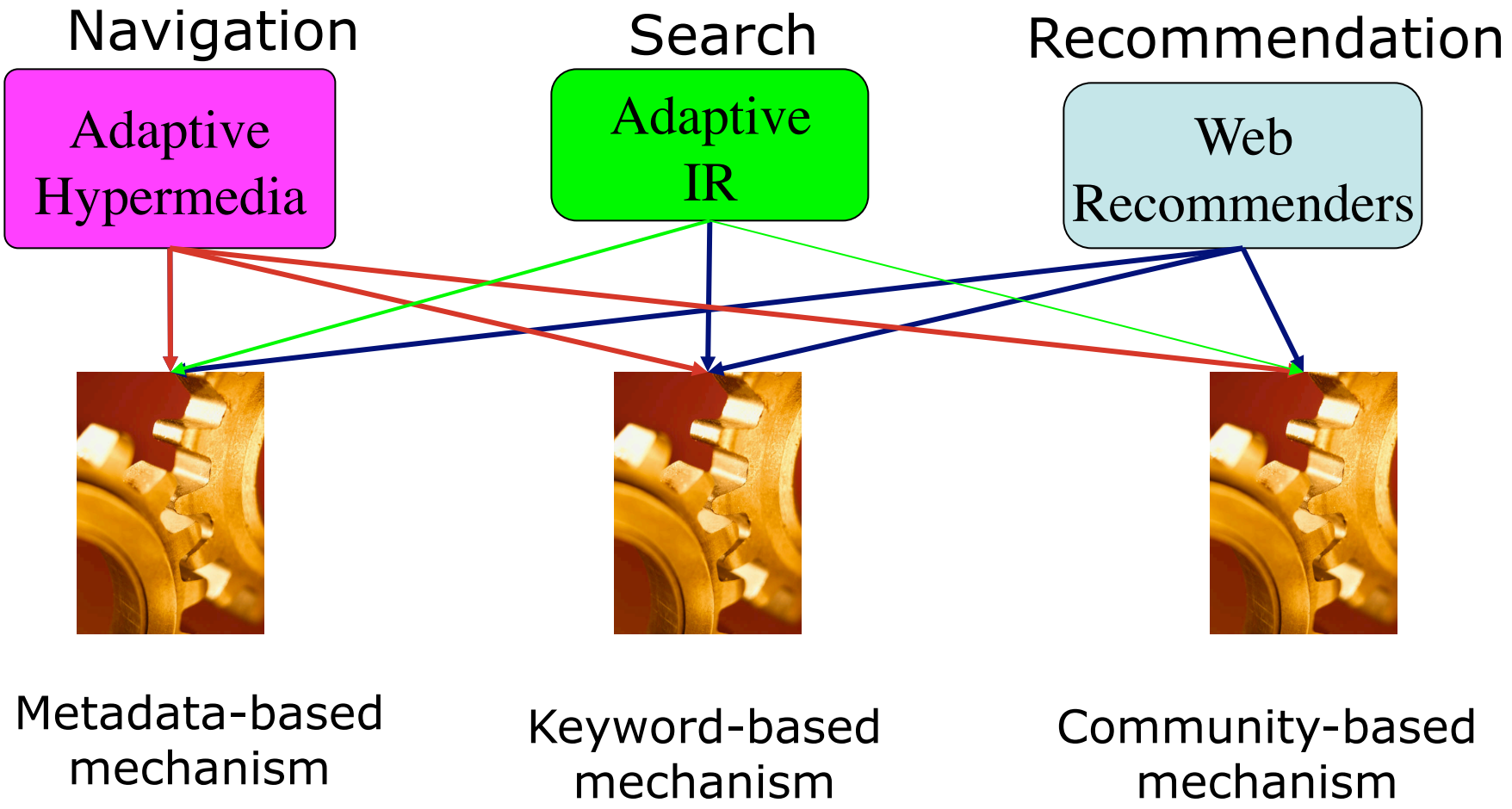


User-Adaptive Systems



Classic loop user modeling - adaptation in adaptive systems

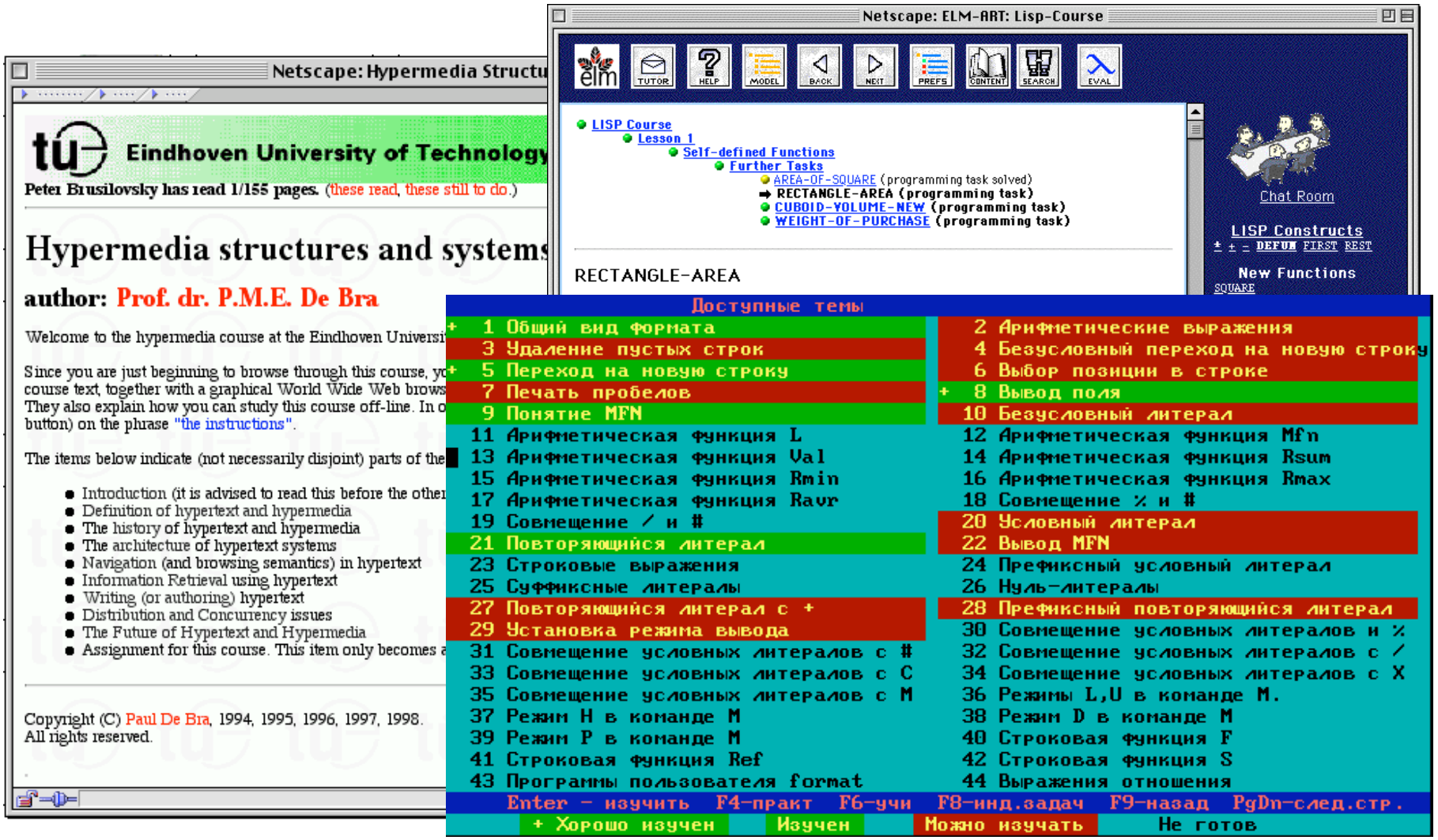
Personalized Information Access



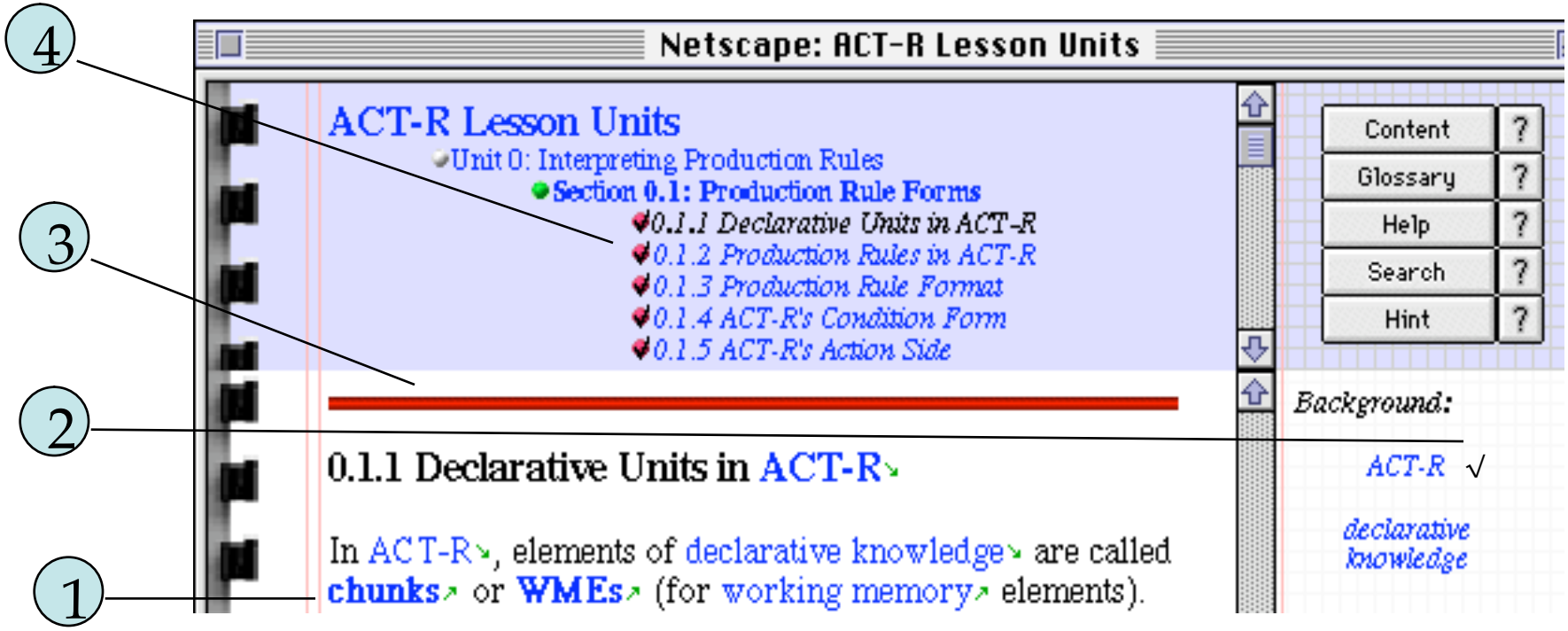
Adaptive Navigation Support

- System guidance is provided by manipulating links on hypertext/Web pages
- Direct guidance
- Hiding, restricting, disabling
- Generation
- Ordering
- Annotation

Adaptive Link Annotation



Case I: Link Annotation in InterBook



1. Concept role
2. Current concept state
3. Current section state
4. Linked sections state

Metadata-based mechanism

InterBook: Evaluation

- Goal: to find a value of adaptive annotation
- Electronic textbook about ClarisWorks
- 25 undergraduate teacher education students
- 2 groups: with/without adaptive annotation
- Format: exploring + testing knowledge
- Full action protocol

Experiment design

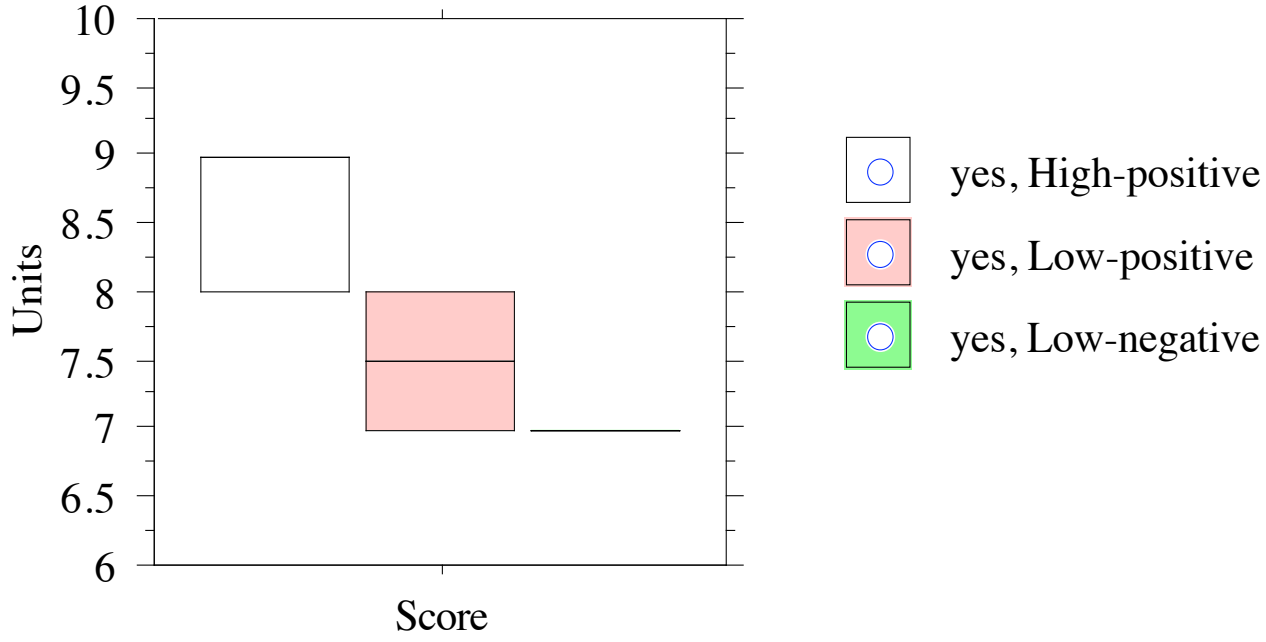
Group 1	Group 2
Database chapter WITH adaptive link annotation n= 12	Database chapter WITHOUT adaptive link annotation n=13
Spreadsheet chapter WITHOUT adaptive link annotation n=12	Spreadsheet chapter WITH adaptive link annotation n=13

First results: Performance

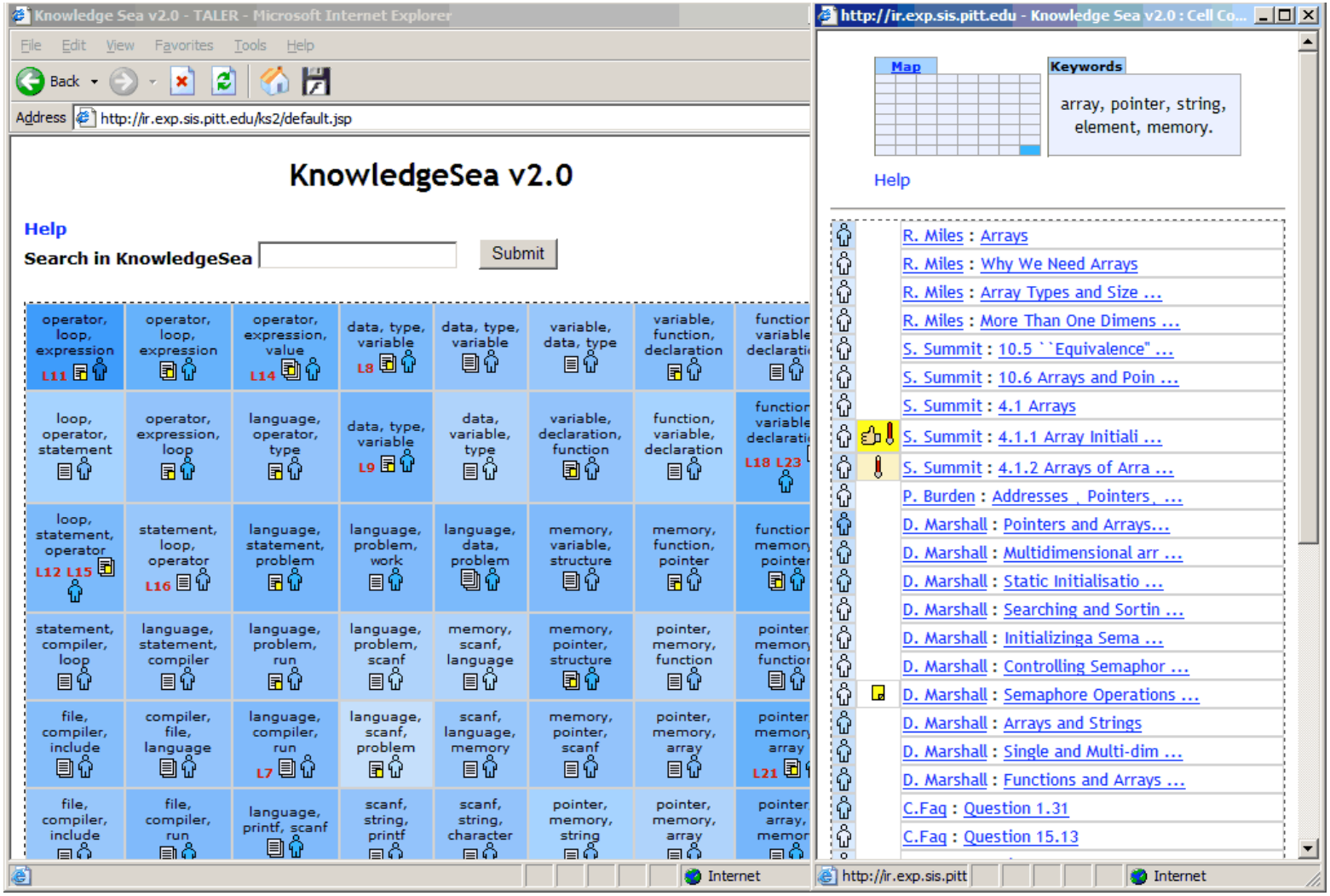
Group	Test Result Database	Test Result Spreadsheet
1 ANS on database only	6.41	7.77
2 ANS on spreadsheet only	7.12	8.10

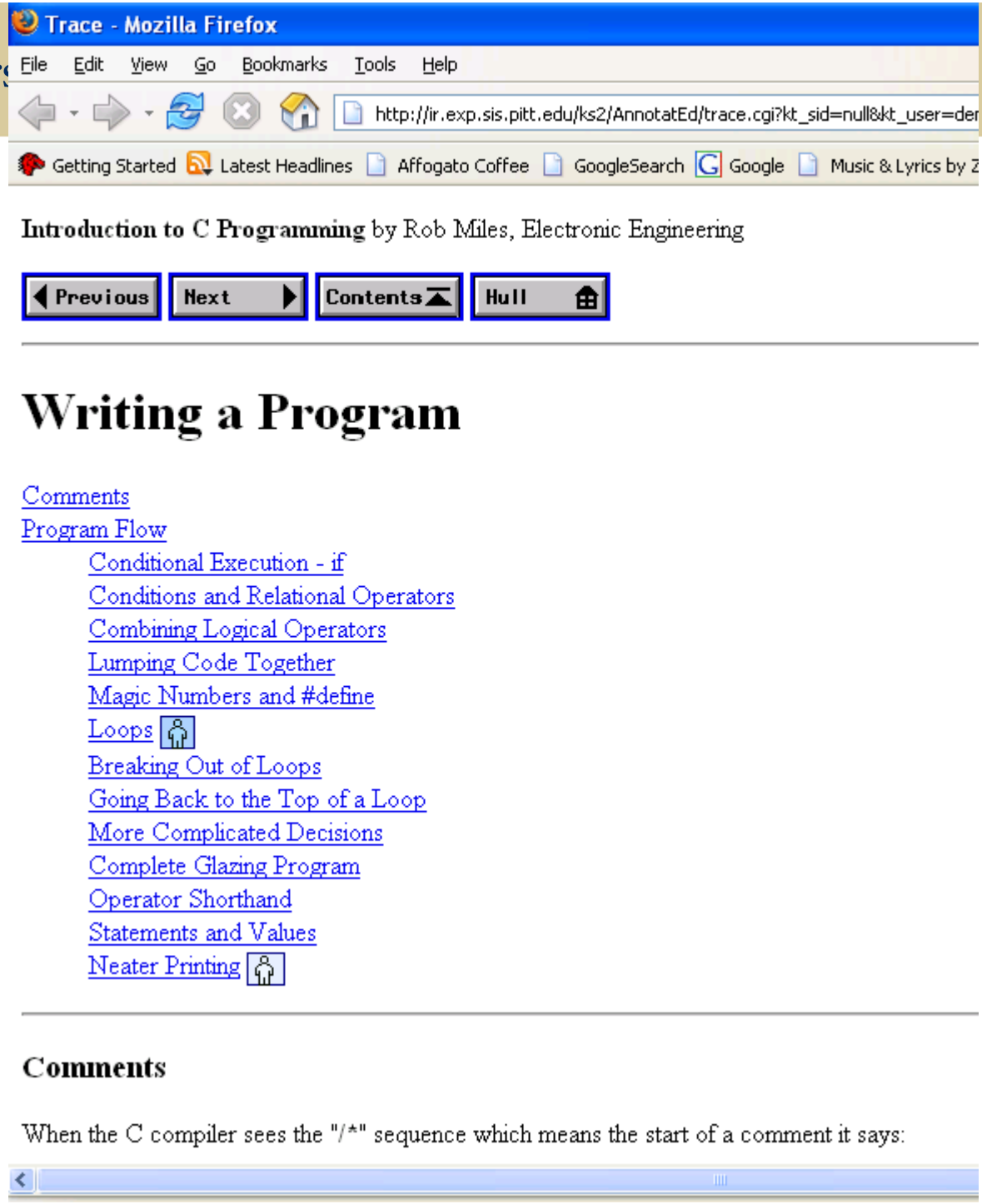
- ANS *negatively* influences users' performance on tests (?!)
- How they are using ANS?

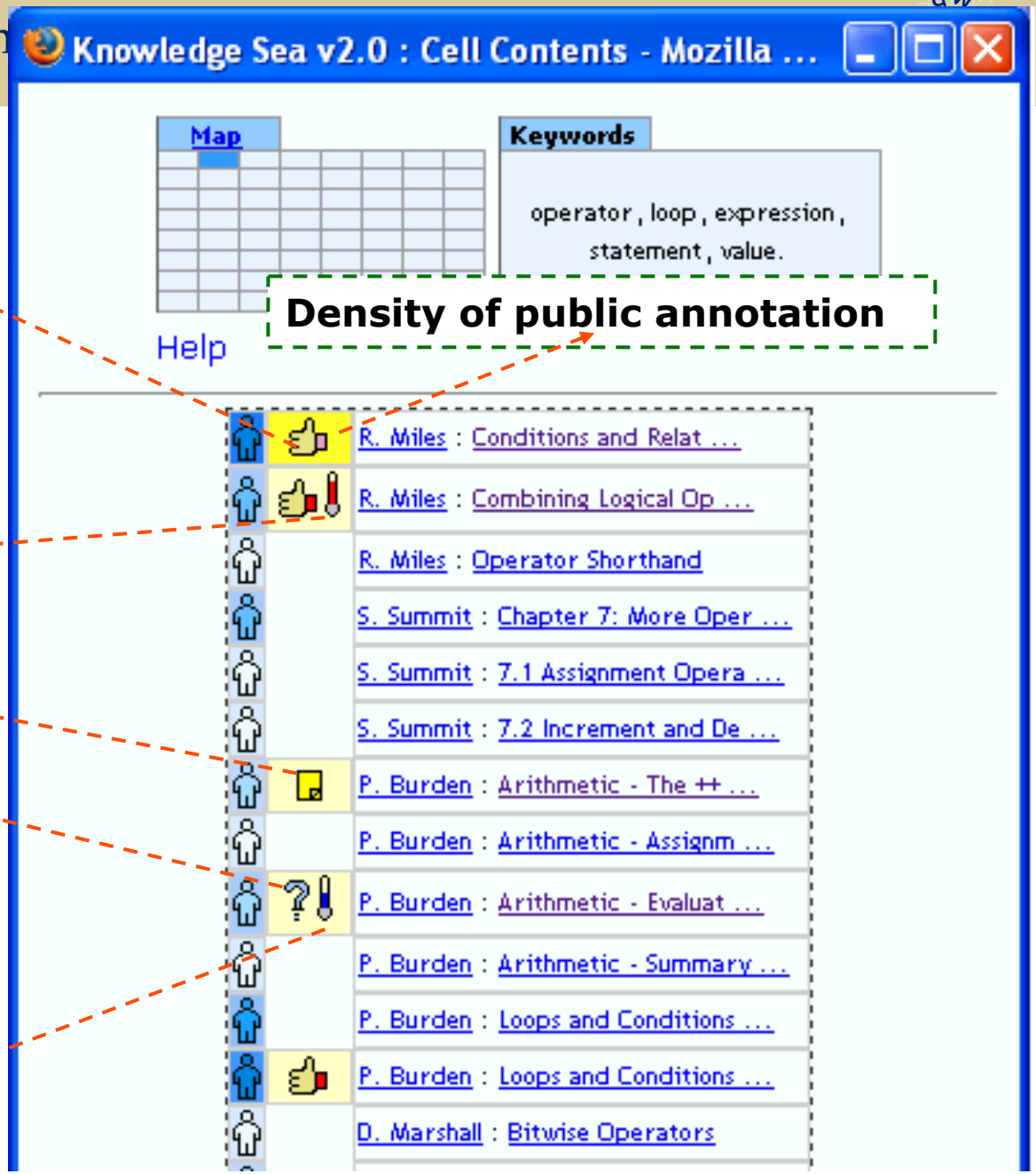
The effect of "following green" with ANS



Case 2: KnowledgeSea II/ AnnotatEd




Trace - Mozilla Firefox
File Edit View Go Bookmarks Tools Help
http://ir.exp.sis.pitt.edu/ks2/AnnotatEd/trace.cgi?kt_sid=null&kt_user=der
Getting Started Latest Headlines Affogato Coffee GoogleSearch Google Music & Lyrics by Z
Introduction to C Programming by Rob Miles, Electronic Engineering
Previous Next Contents Hull
Writing a Program
Comments
Program Flow
Conditional Execution - if
Conditions and Relational Operators
Combining Logical Operators
Lumping Code Together
Magic Numbers and #define
Loops
Breaking Out of Loops
Going Back to the Top of a Loop
More Complicated Decisions
Complete Glazing Program
Operator Shorthand
Statements and Values
Neater Printing
Comments
When the C compiler sees the "/*" sequence which means the start of a comment it says:



personal positive annotation

Density of public annotation

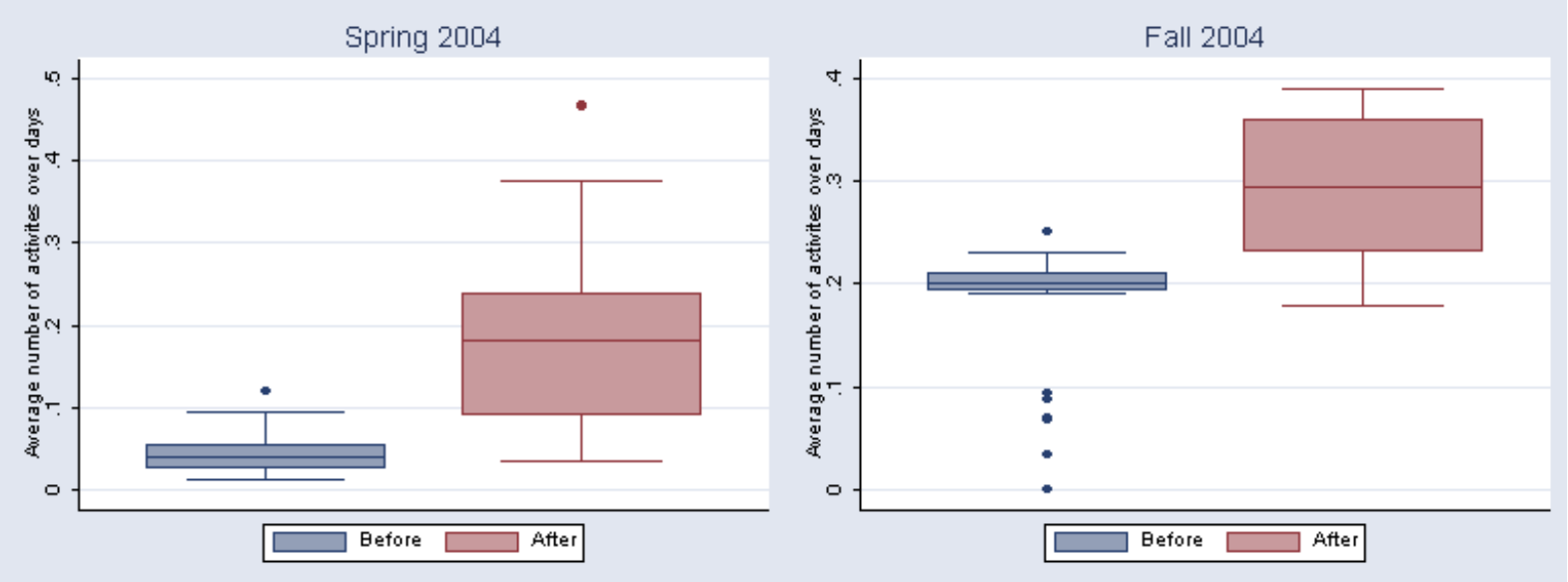
Overall positive temperature

general annotation

personal negative annotation

Overall negative temperature

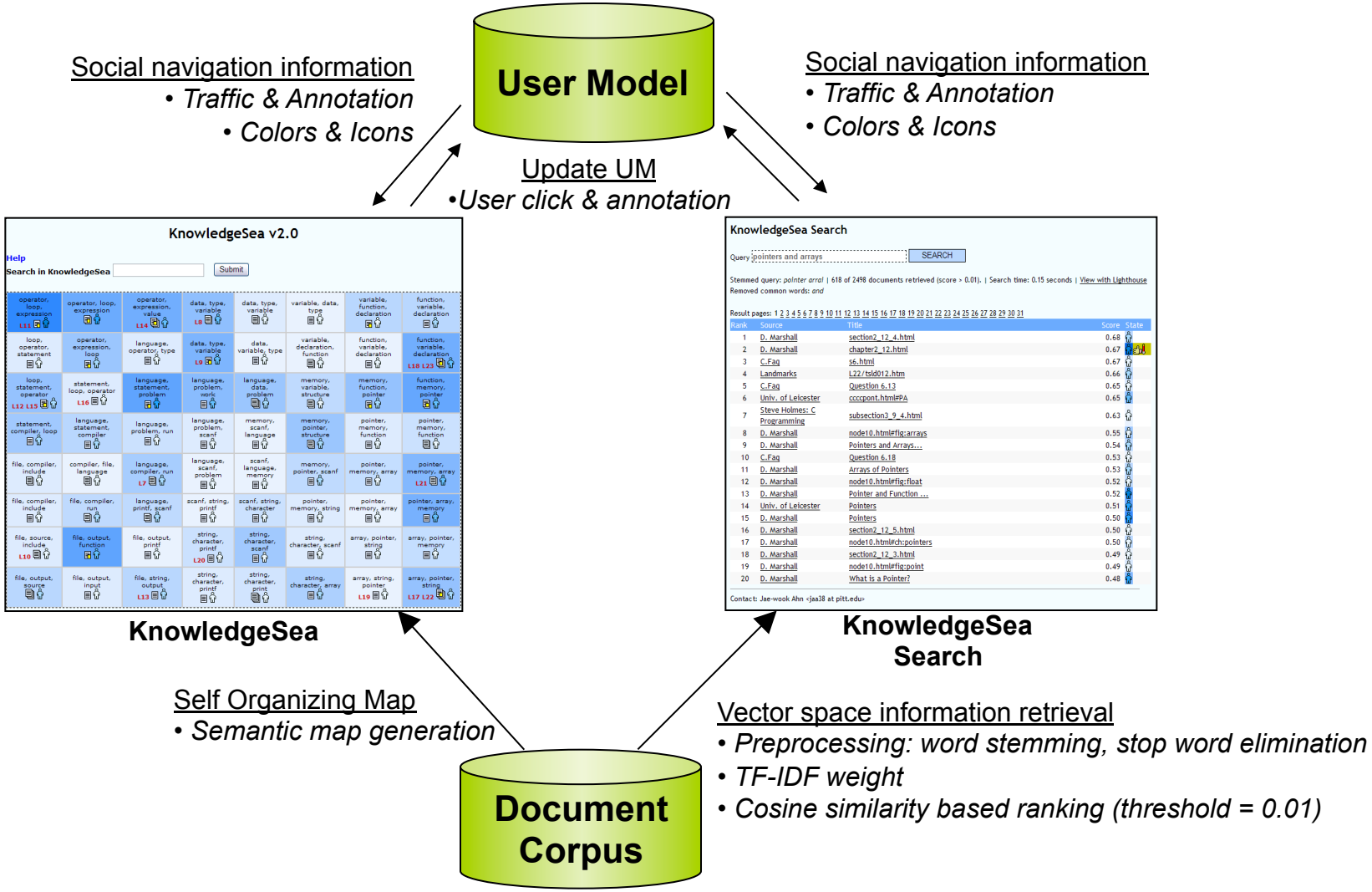
The Impact of Annotations on Visits



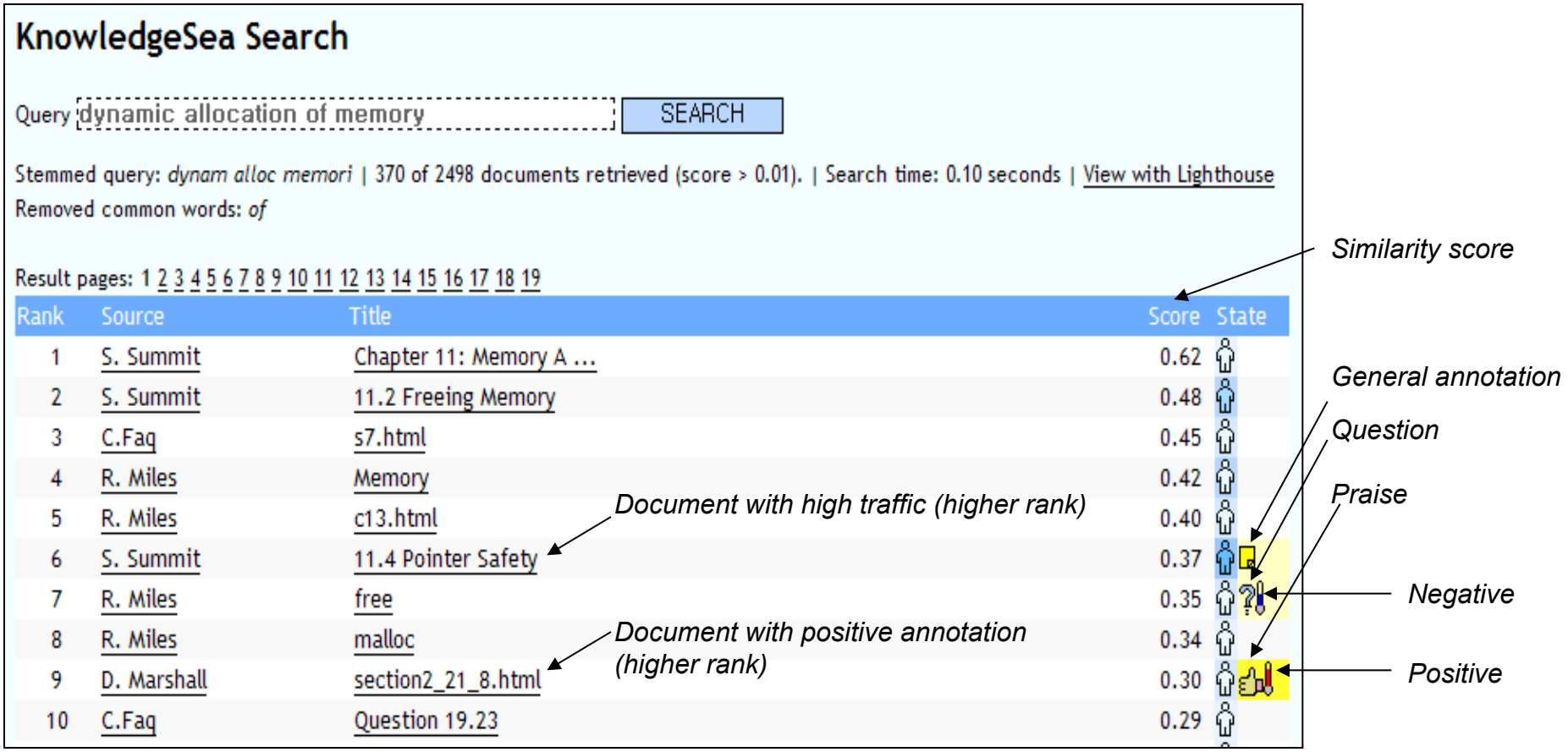
Tutorial pages are getting significantly more visitors after being annotated

Annotation based navigation support guides the students to the useful pages

Search and Navigation in KSII

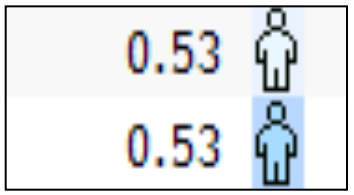


Ranking and Annotation in Search



Annotations in Search Results

- Traffic
  - More group traffic
    - Darker background color
  - More user traffic than others
    - Human-like icon
    - Darker foreground color
- Annotation
  - More annotations
    - Darker background color
  - General, Praise, Question
    - Sticky notes, Thumbs-up, Question-mark
  - Positive or Negative
    - Red or Blue thermometer



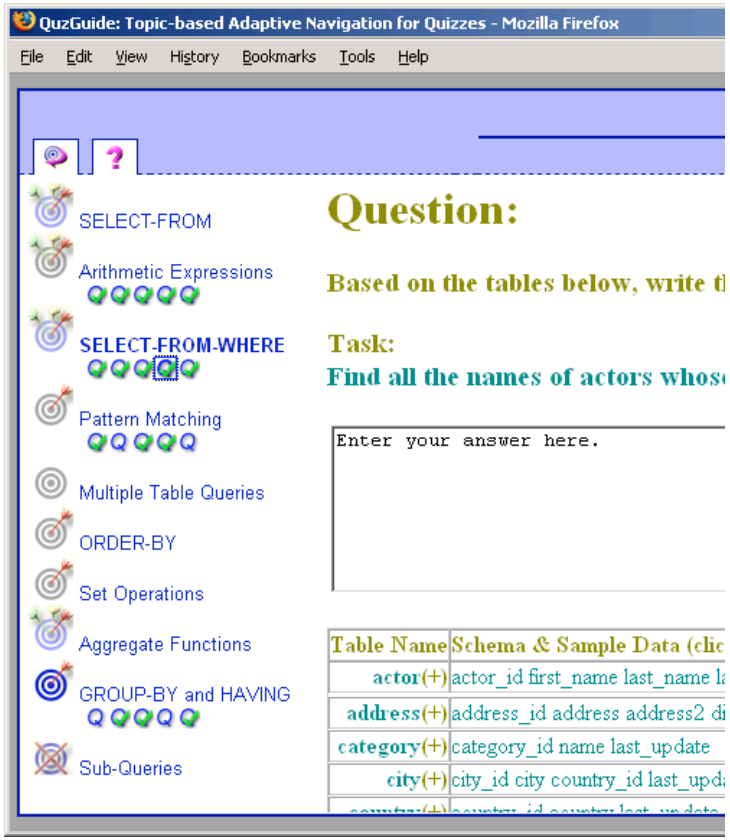
Example of Social Traffic

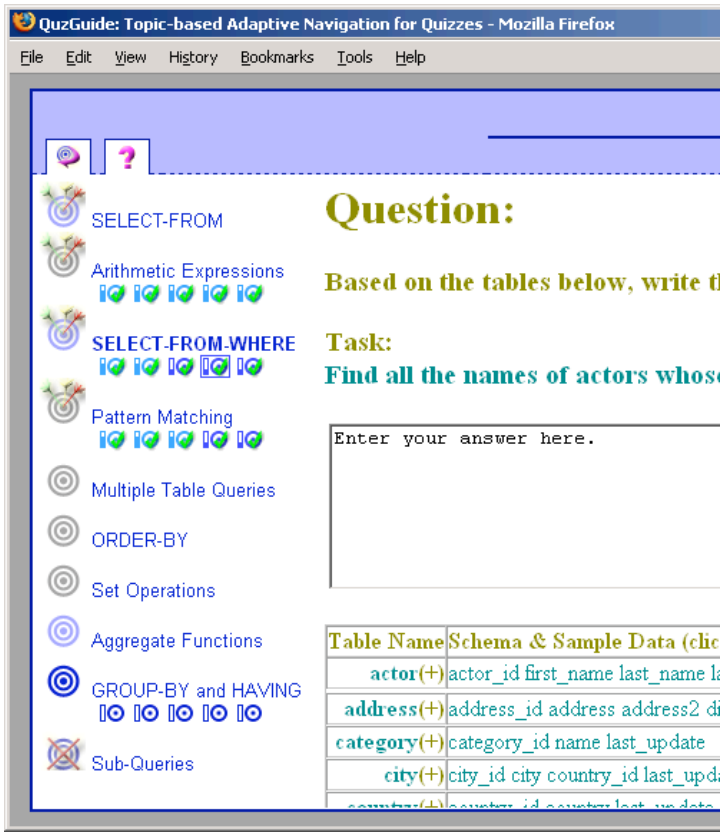
Example of Social Annotations

Case 3: *Overnavigation* in SQL-Guide

- Two versions of SQLGuide:

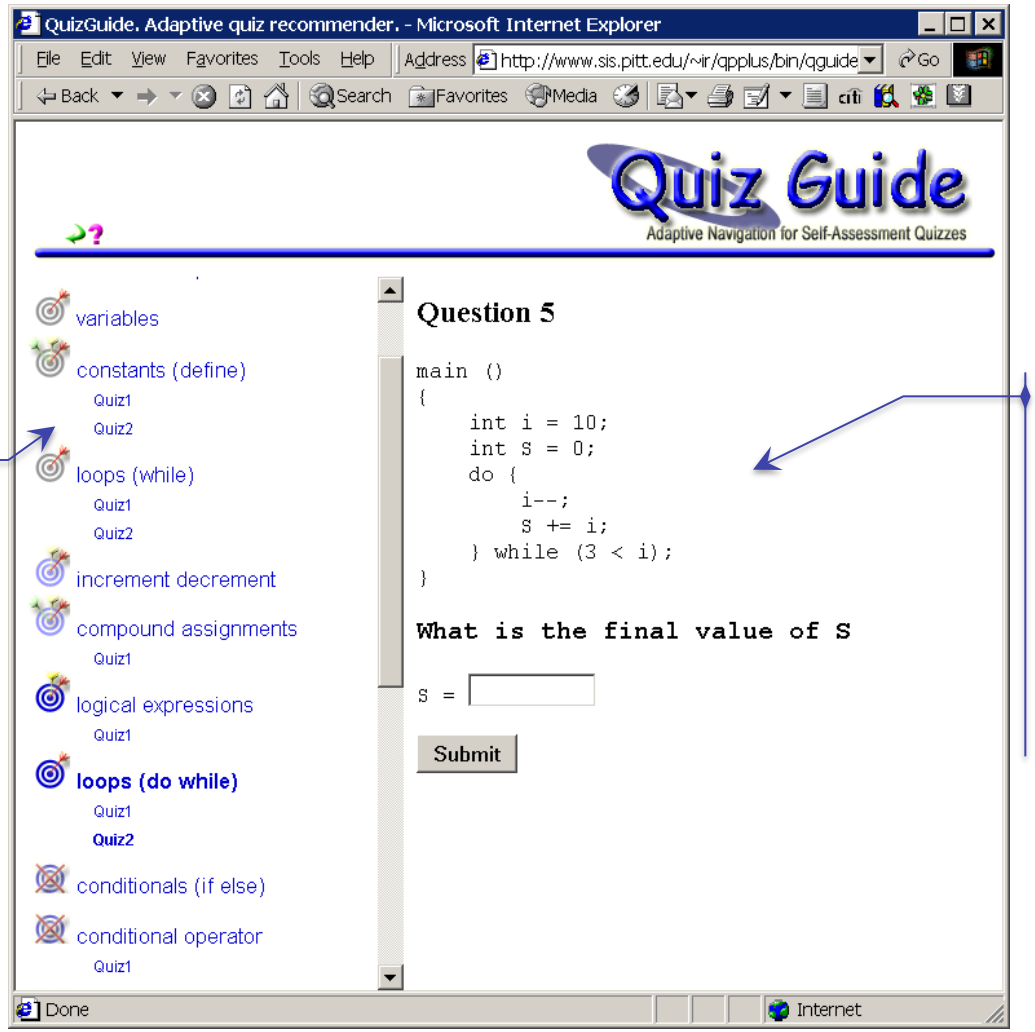
Topic-based **Topic-based+Concept-Based**





QuizGuide: C Questions with ANS

List of annotated links to all quizzes available for a student in the current course



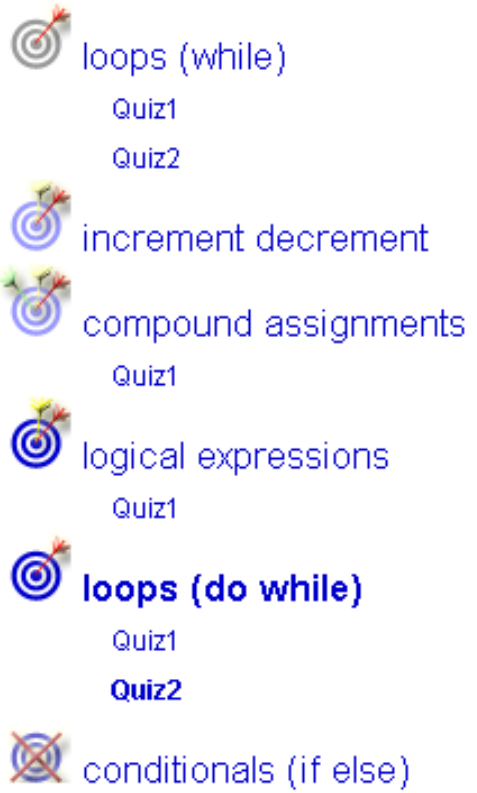
Questions of the current quiz, served by QuizPACK

QuizGuide: Adaptive Annotations

- Target-arrow abstraction:
  - Number of arrows – level of knowledge for the specific topic (from 0 to 3). *Individual, event-based adaptation.*

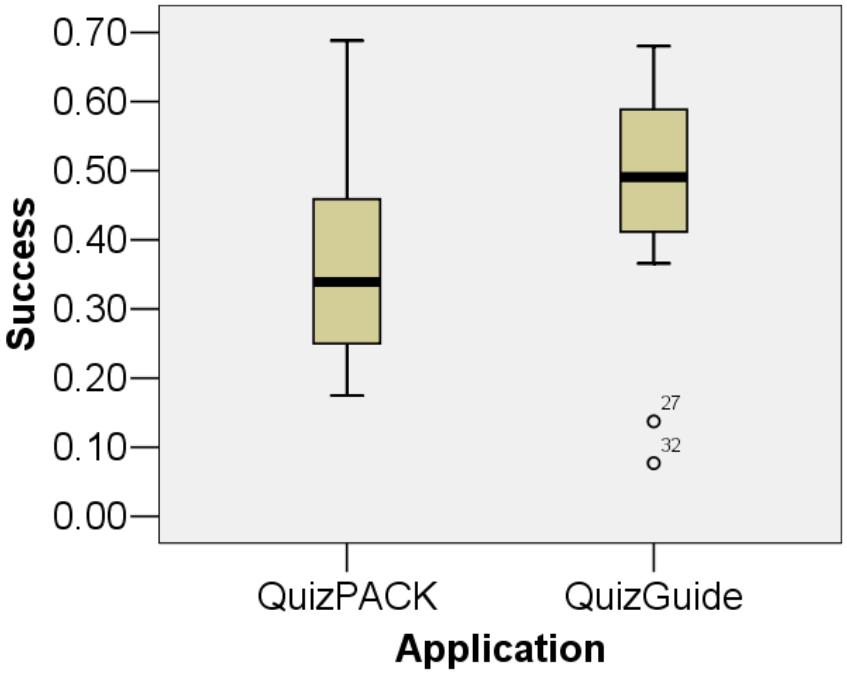
  - Color Intensity – learning goal (current, prerequisite for current, not-relevant, not-ready). *Group, time-based adaptation.*

- Topic–quiz organization:



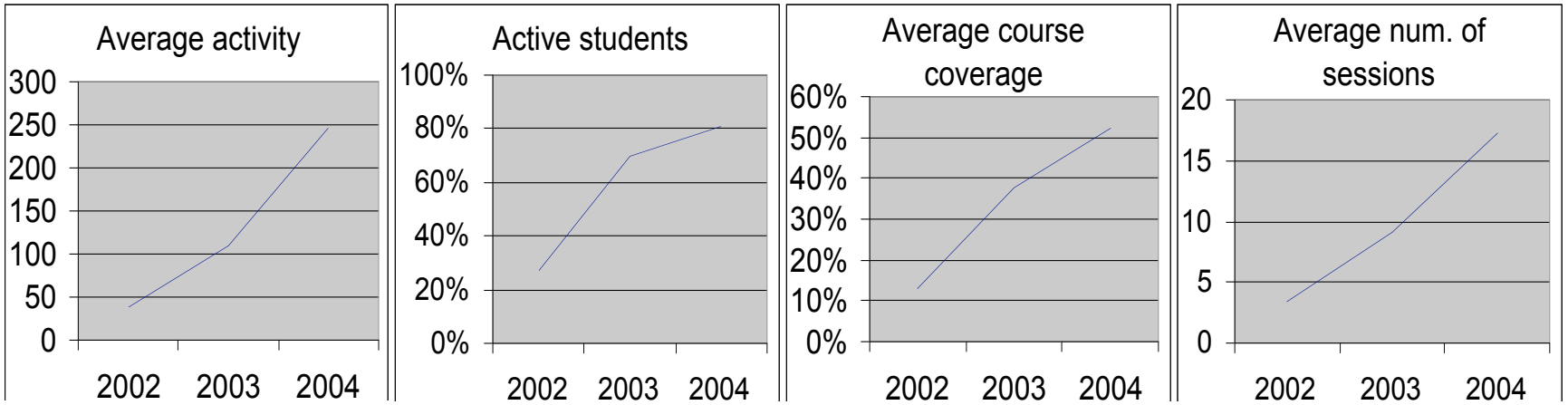
QuizGuide: Success Rate

- Arrive in time: Much higher chance to solve the problem
- One-way ANOVA shows that mean success value for QuizGuide is significantly larger then the one for QuizPACK:
  $F(1, 43) = 5.07$
  (p-value = 0.03).



QuizGuide: Motivation

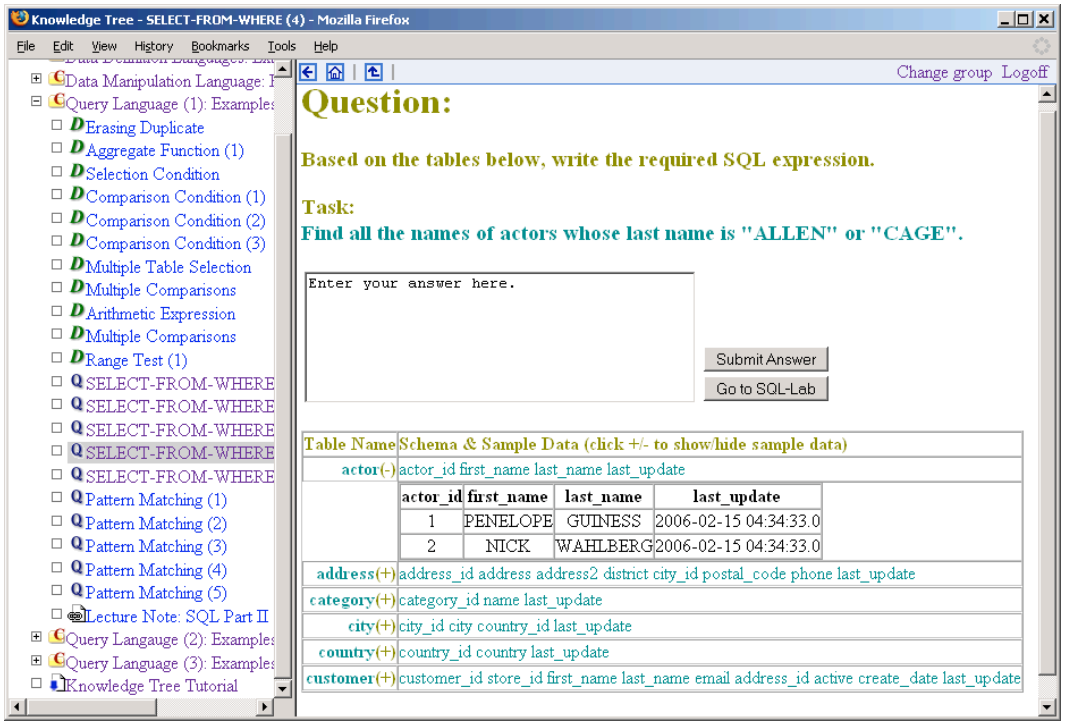
- Adaptive navigation support increased student's activity and persistence of using the system



- Within the same class QuizGuide session were much longer than QuizPACK sessions: 24 vs. 14 question attempts at average.
- Average Knowledge Gain for the class rose from 5.1 to 6.5

SQL Knowledge Tester

- SQL-KnoT delivers online SQL problems, checks student's answers and provides a corrective feedback
- Every problem is dynamically generated using a template and a set of databases
- All problems have been assigned to 1 of the course topics and indexed with concepts from the SQL ontology

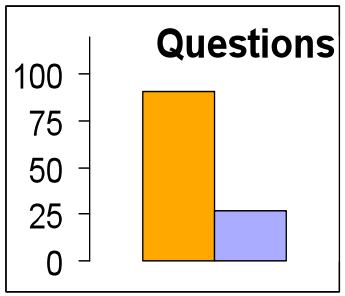


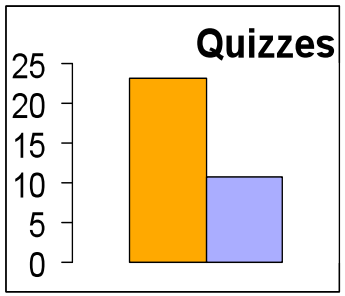
Study Design

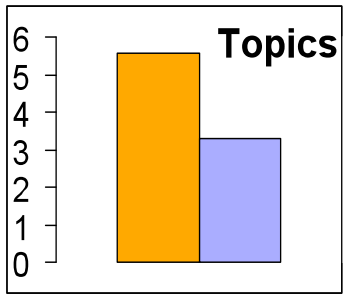
- Two Database Courses (Fall 2007):
  - Undergraduate (36 students)
  - Graduate (38 students)
- Each course divided into two groups:
  - Topic-based navigation
  - Topic-based + Concept-Based Navigation
- All students had access to the same set of SQL-KnoT problems available in adaptive (QuizGuide) and in non-adaptive mode (Portal)

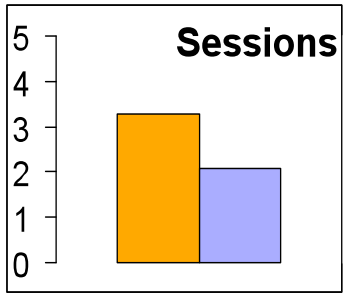
It works! Again! Like magic…

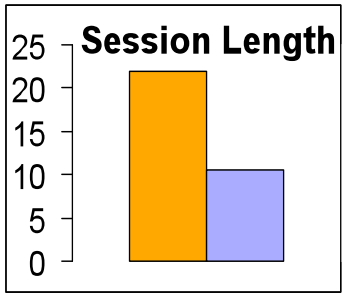
- Total number of attempts made by all students: in adaptive mode (4081), in non-adaptive mode (1218)
- Students in general were much more willing to access the adaptive version of the system, explored more content with it and to stayed with it longer:









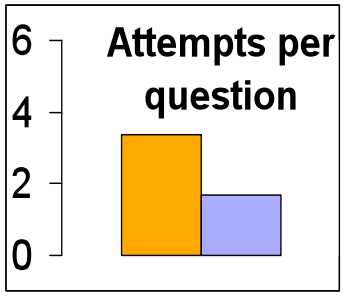


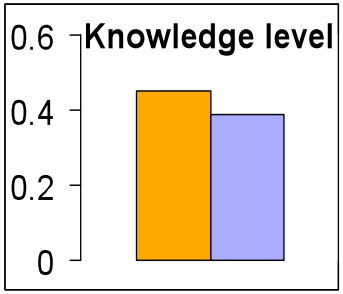
Adaptive
Non-adaptive

Concept-based ANS: Added Value?

- Did concept-based adaptation increase the magnitude of the motivational effect?
  - No significant difference in the average numbers of attempts, problems answered, topics explored
  - No significant difference in the session length

- Was there any other observable difference?
  - Average number of attempts per question
  - Resulting Knowledge Level (averaged across all concepts)

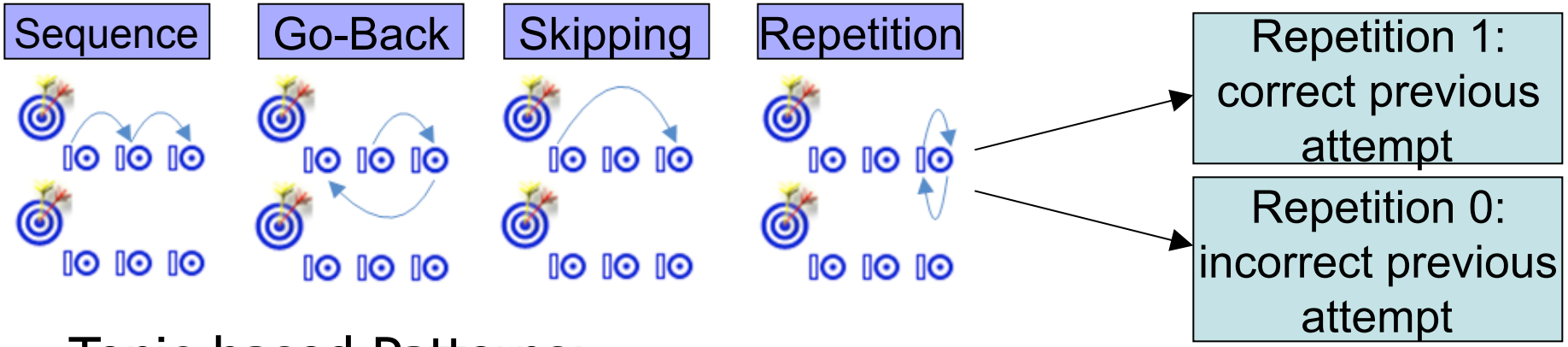




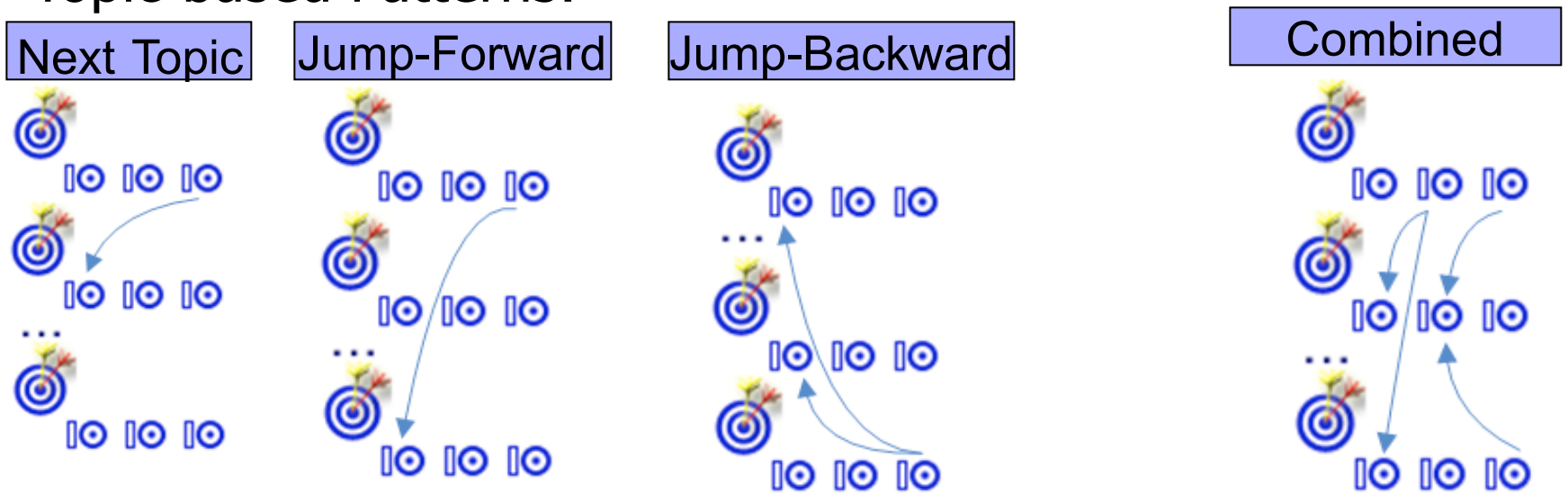
Combined
Topic-based

Pattern Analysis

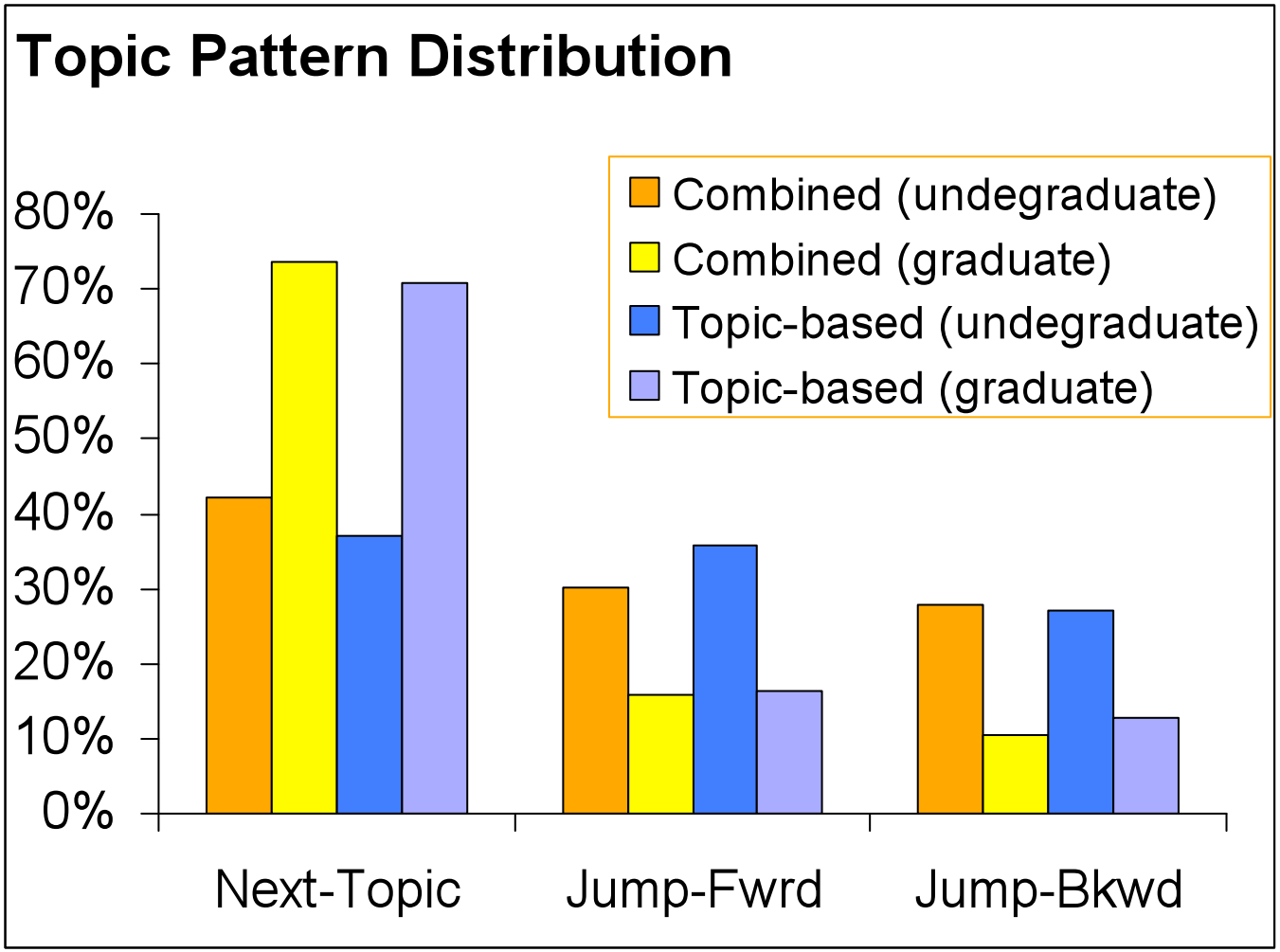
- Question-based Patterns:



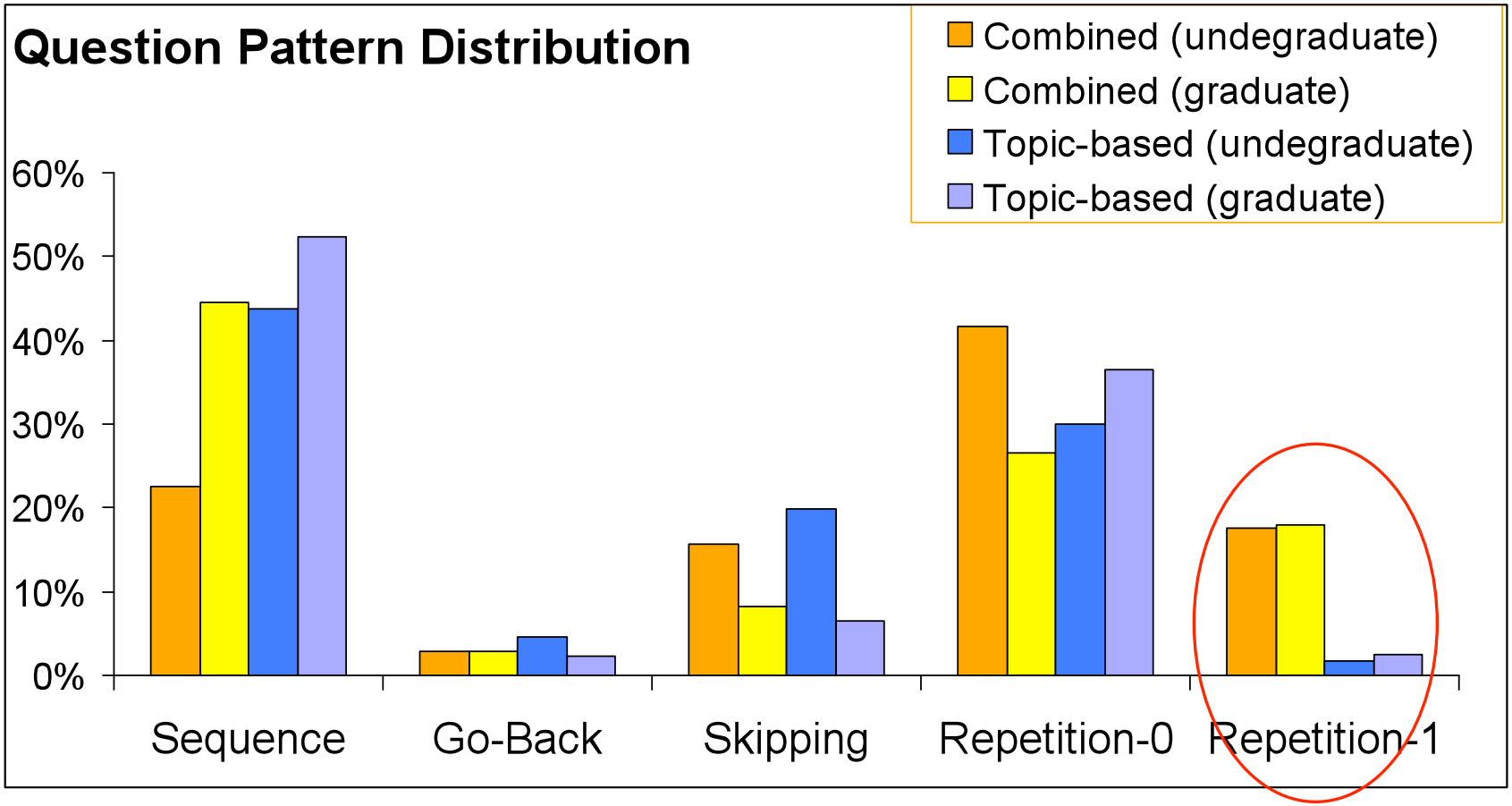
- Topic-based Patterns:



Pattern Analysis (2)



Pattern Analysis (3)

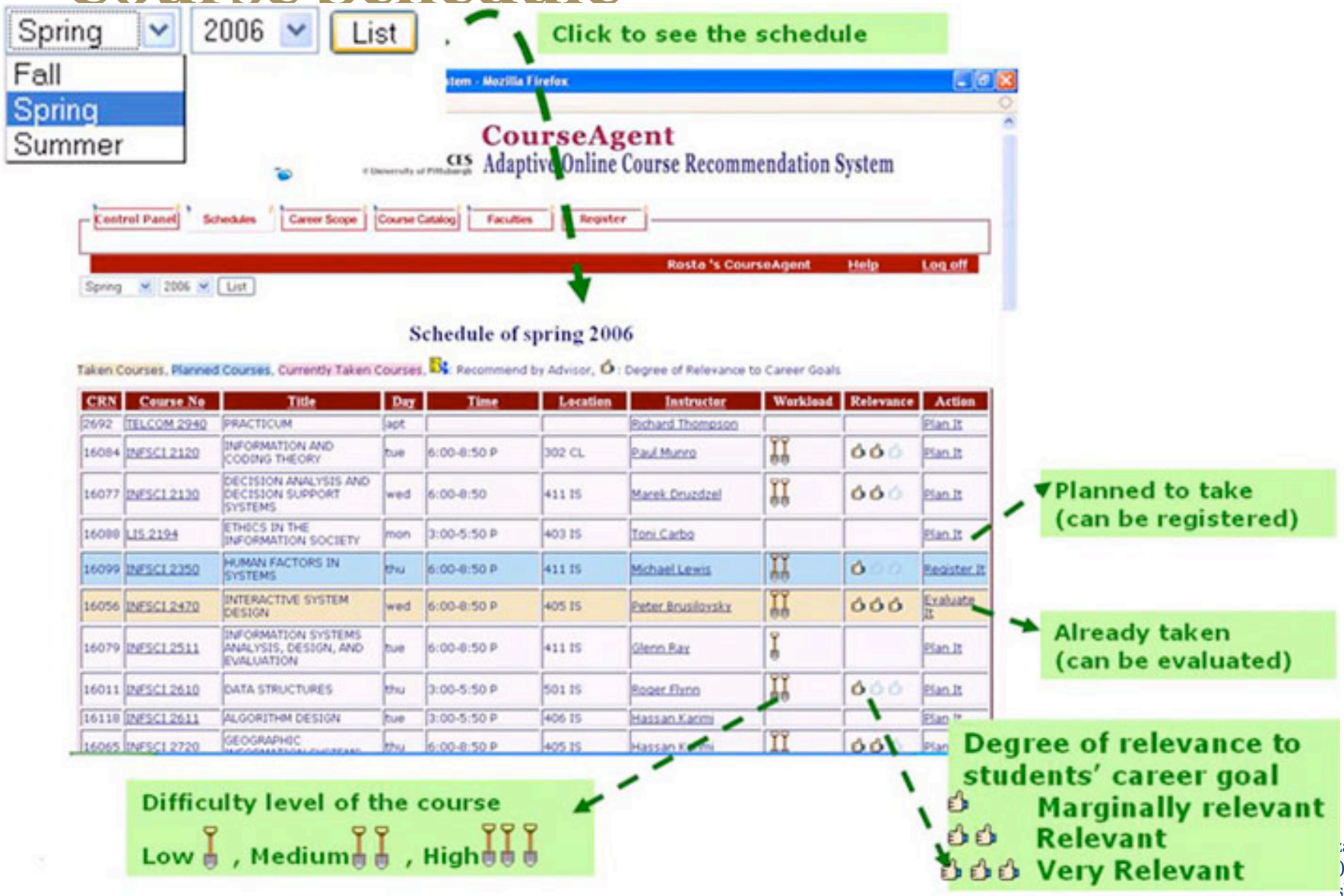


Discussion

- Difference in the ratio of Repetition1 pattern explains:
  - difference in the average number of attempts per question
  - difference in the cumulative resulting knowledge level
- Students repeat the same question again and again:
  - They “get addicted“ to the concept-based icons
  - Is it a good thing for us?
    - YES – they react to the navigational cues, they work more
    - NO – we expect them to concentrate on those questions where they have smaller progress instead of drilling in the same question

Case 4: CourseAgent

Course Schedule



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Course Rating in CourseAgent

Course Evaluation

INFSCI 2120 - INFORMATION AND CODING THEORY

1. Workload of the course:

1	2	3
○	○	○
Low	Average	High

2. How relevant is this course to each of your career goals:

Career Goal	1	2	3	4	5
College Professor	○	○	○	○	○
Digital Libraries Professional	○	○	○	○	○
Graphical User Interface (GUI) Programmer	○	○	○	○	○
Research in Industry	○	○	○	○	○
Web Application Developer	○	○	○	○	○
Web Designer	○	○	○	○	○
Web Master	○	○	○	○	○
	Irrelevant	Marginally Relevant	Relevant	Very Relevant	Essential

Comments

Save

Under-Contribution Problem

- Do it for yourself
  - Encouraging participation by turning the rating activity into important and meaningful activity
  - Personal gain depends on contribution to the community
- CourseAgent
  - Career Scope
    - Presenting progress towards each career goal
    - Only evaluated courses contribute to the progress

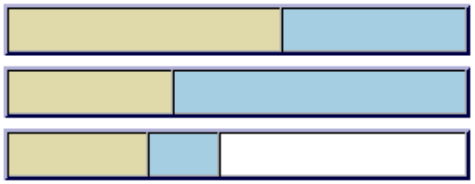
Career Planning

Progress (Taken, Planned, Recommended)

+College Professor

+Digital Libraries Professional

-Graphical User Interface (GUI) Programmer



Taken Courses

Course Number	Course Title	My Rating	Action
INFSCI 2120	INFORMATION AND CODING THEORY		Evaluate It!
INFSCI 2300	HUMAN INFORMATION PROCESSING	★★★☆☆	Evaluated
INFSCI 2470	INTERACTIVE SYSTEM DESIGN		Evaluate It!
INFSCI 2610	DATA STRUCTURES	★★☆☆☆	Evaluated
LIS 2000	UNDERSTANDING INFORMATION	★☆☆☆☆	Evaluated

Planned Courses

Course Number	Course Title	Community Rating	Action
INFSCI 2000	Intro to Information Science	★★☆☆☆	Registered
INFSCI 2020	MATHEMATICAL FOUNDATIONS FOR INFORMATION SCIENCE	★★☆☆☆	Registered
INFSCI 2140	INFORMATION STORAGE AND RETRIEVAL	★★☆☆☆	View Study Plan
INFSCI 2160	DATA MINING	☆☆☆☆☆	View Study Plan

Recommended Courses

Course Number	Course Title	Community Rating	Action
INFSCI 2510	INFORMATION SYSTEMS	★★★☆☆	Add to Study Plan
INFSCI 2550	CLIENT-SERVER AND WORKSTATION SYSTEMS	★★★★★	Add to Study Plan

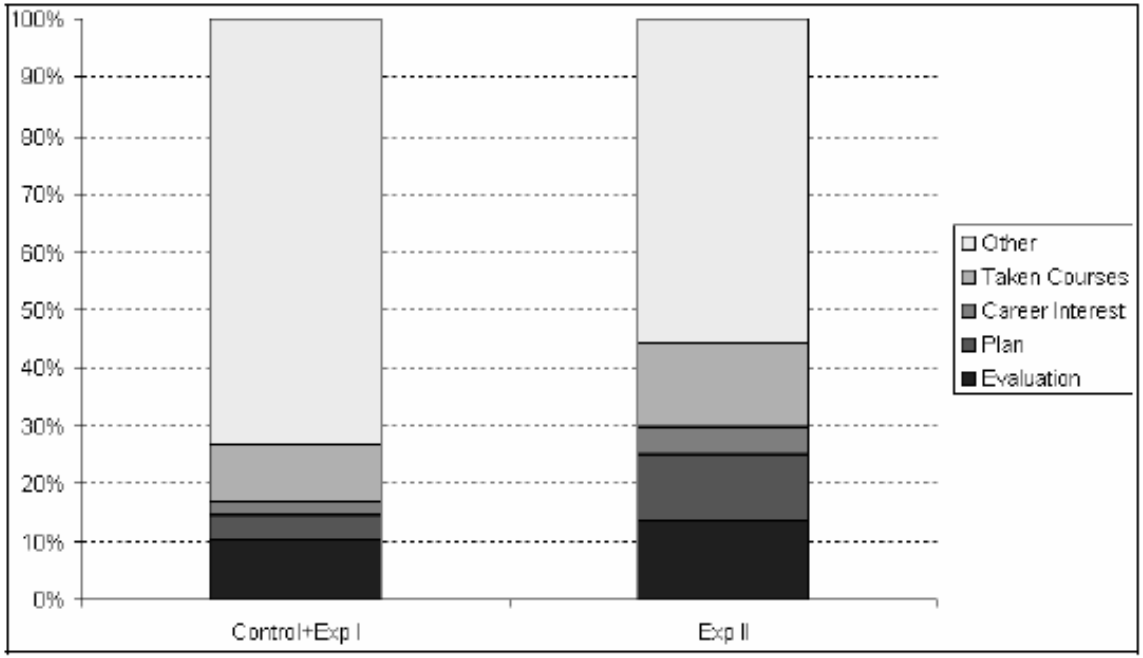
Results

- Contribution of experimental users who did not use Career Scope is close to control group
- Significant different between contribution of experimental group II and control group + experimental group I

	# of students	Ave. # of added courses	Ave. # of planned courses	Ave. # of added career interests	Ave. # of saved evaluation
Control Group	11	5	2	0.91	4.55
Experimental group I	4	2.25	1.5	1.25	3.75
Control + Experimental I	15	4.27	1.87	1	4.33
Experimental group II	5	8.8	7	3	8.2

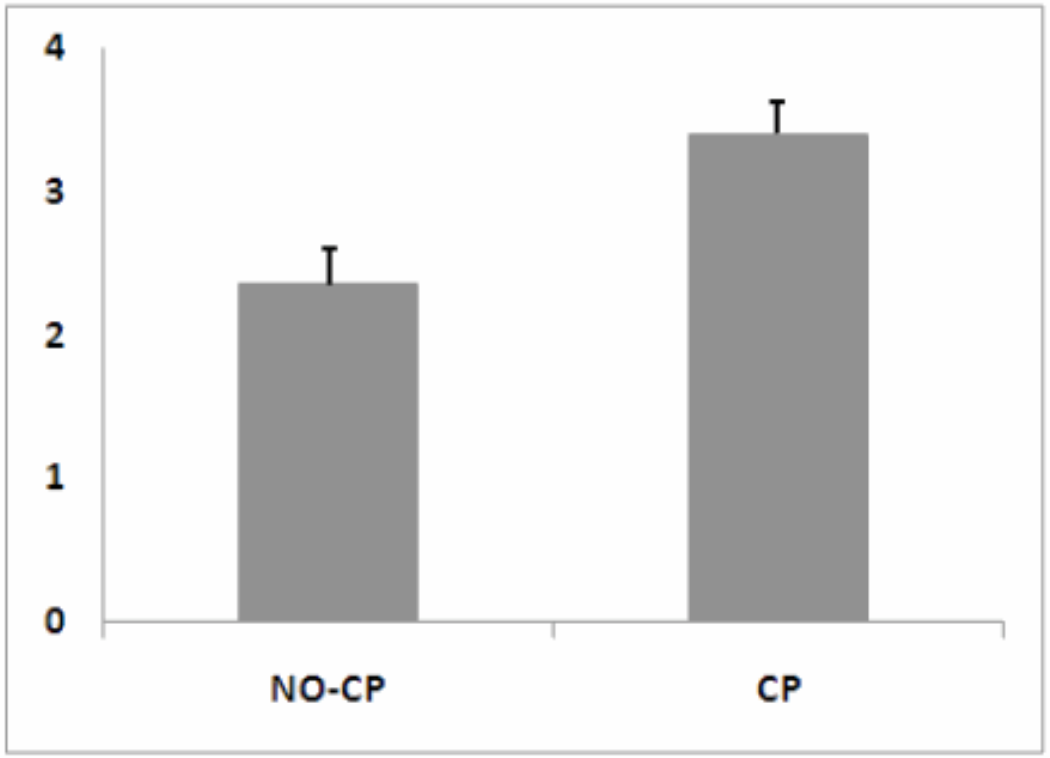
Analysis of Activities of each group

- Experimental group II spent a higher fraction of their time on activities useful to the community



A Probe for Overmotivation

- Career Progress implicitly encourages students to over-rate taken courses



Summary

- It is important to study how your recommender systems are used
  - Log studies vs. eye tracking studies
- Do users follow the recommendations?
- Does recommendation provoke suboptimal behavior?
- What is the back side of user engagement technology?