University of Pittsburgh

The Value of Social: Comparing Open Student Modeling and Open Social Student Modeling

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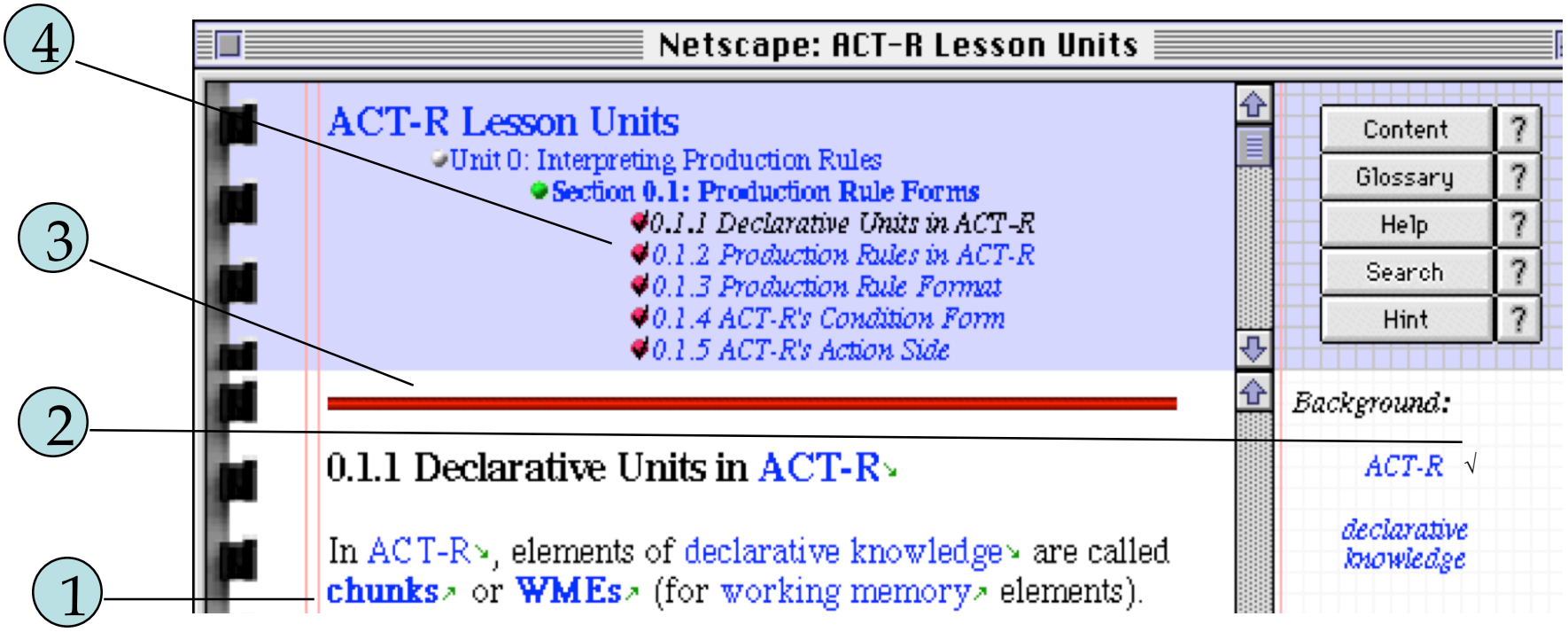
Overview

- The past
  - Why we are doing it?
- The paper
  - Open Social Sudent Modeling and its evaluation
- Beyond the paper
  - What we have done since submitting the paper?
- The future
  - What are our plans and invitation to collaborate

The Past

- Why?
  - Increase user performance
  - Increase motivation and retention
- How?
  - Adaptive Navigation Support
  - Topic-based Adaptation
  - Open Social Student Modeling

Adaptive Link Annotation: InterBook

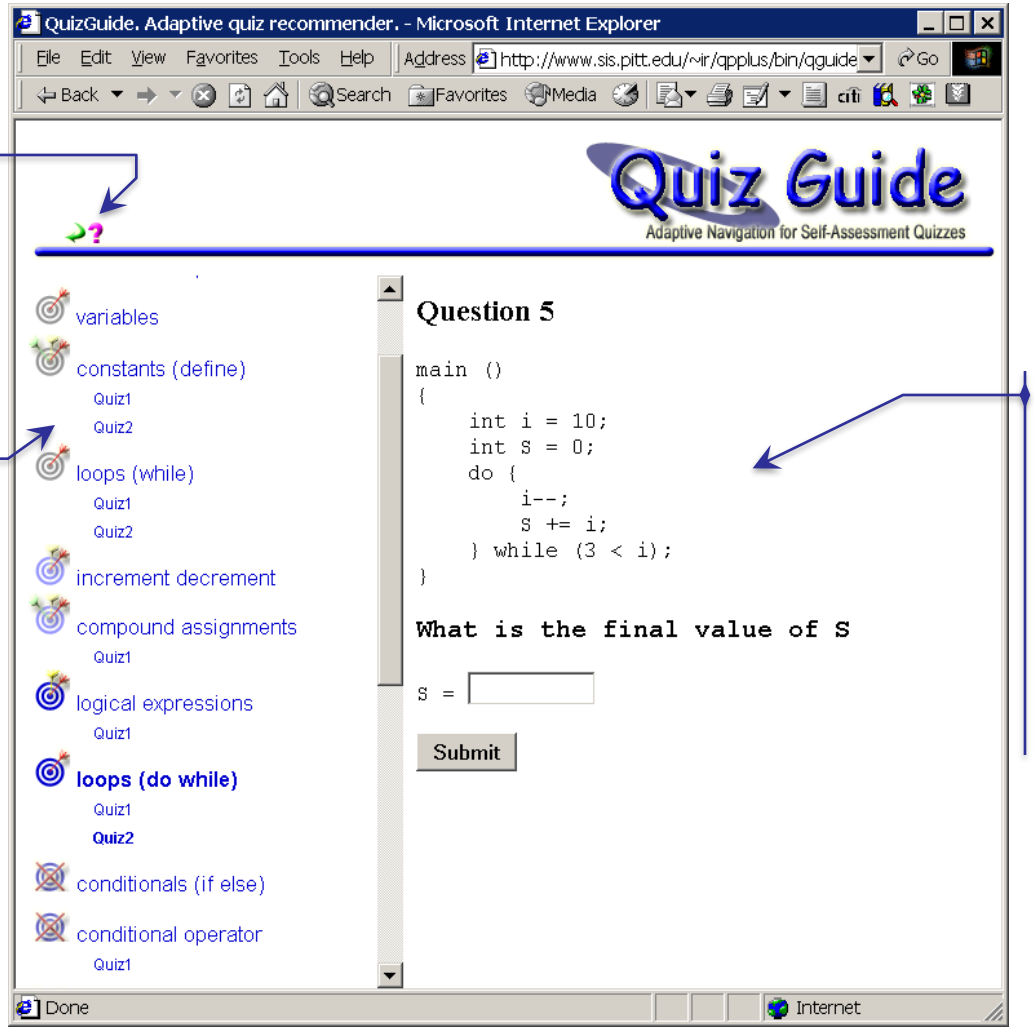


1. Concept role
2. Current concept state
3. Current section state
4. Linked sections state

QuizGuide = Topic-Based ANS

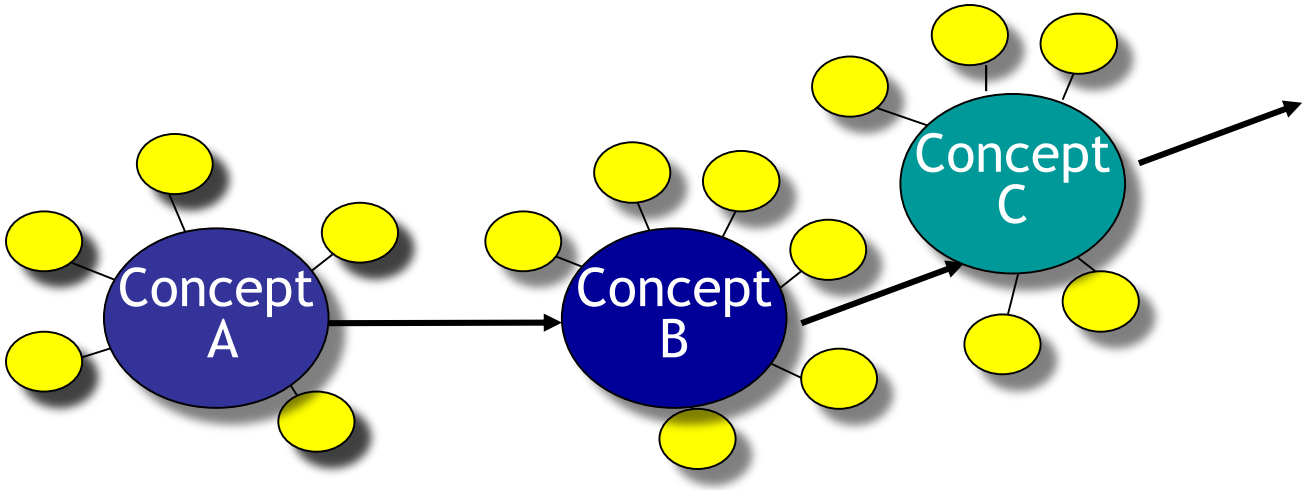
Refresh and help icons

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



Questions of the current quiz, served by QuizPACK

Topic-Based Adaptation



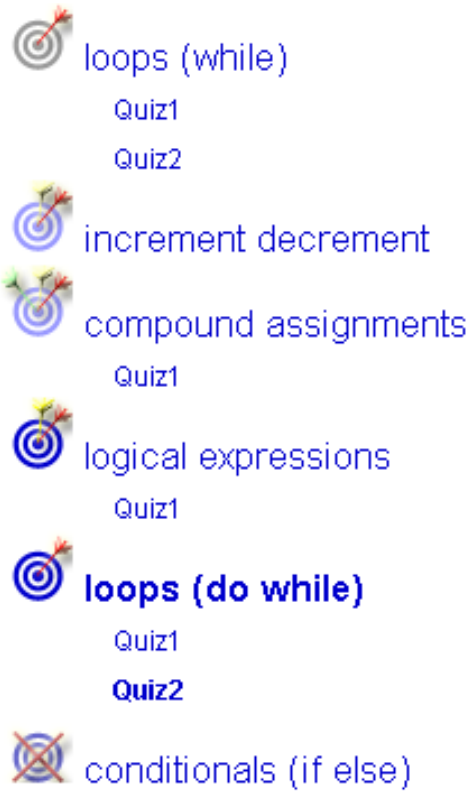
- Each topic is associated with a number of educational activities to learn about this topic
- Each activity classified under 1 topic

QuizGuide: Adaptive Annotations

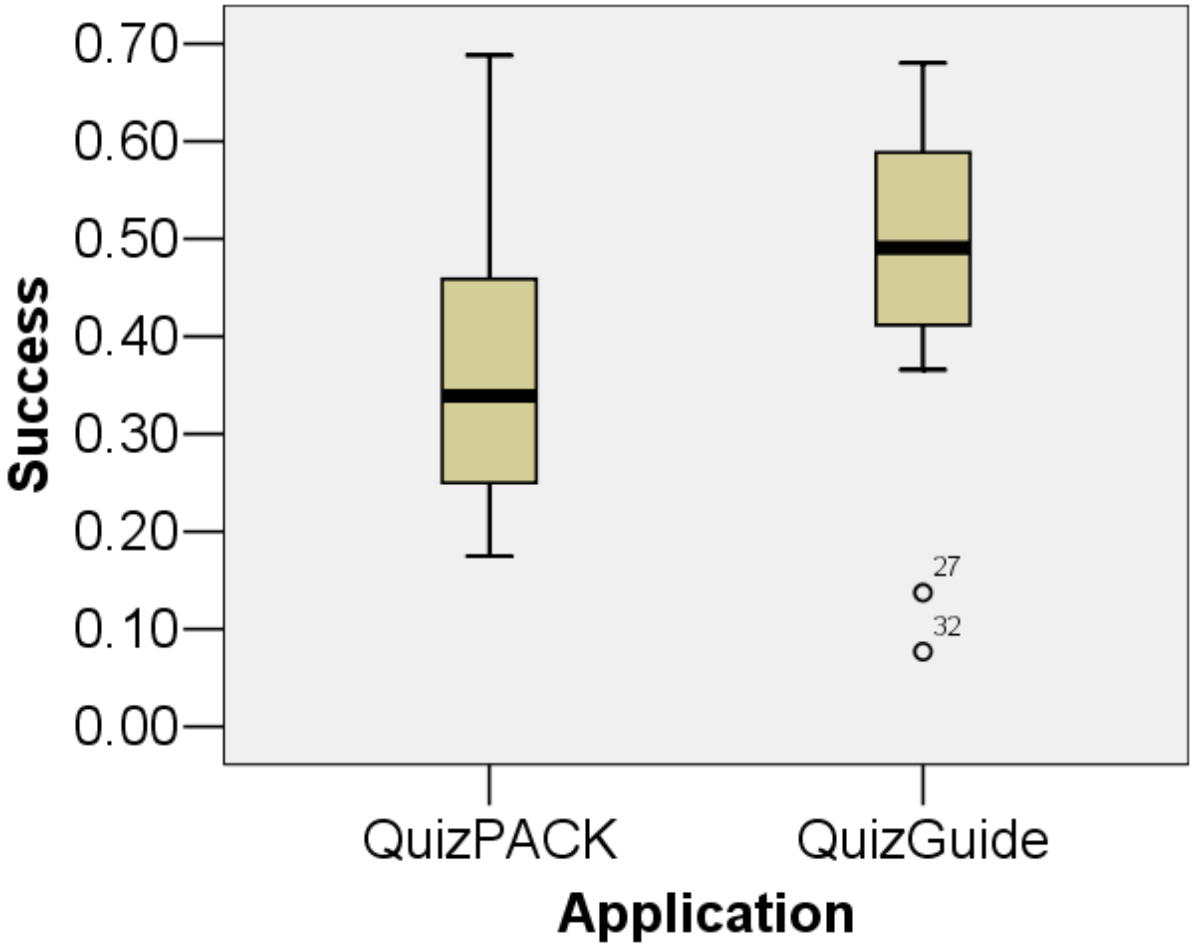
- Target-arrow abstraction:
  - Number of arrows – level of knowledge for the specific topic (from 0 to 3). *Individual, event-based adaptation.*

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

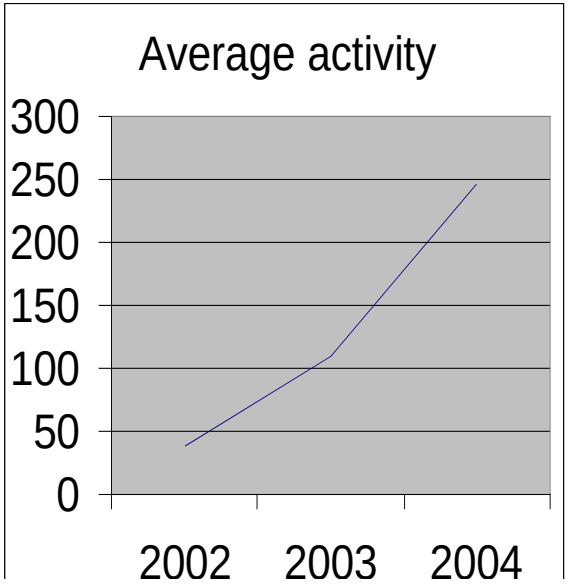
- Topic–quiz organization:

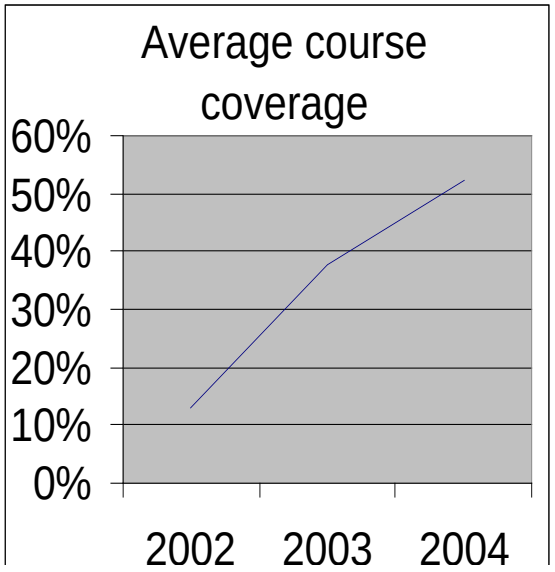


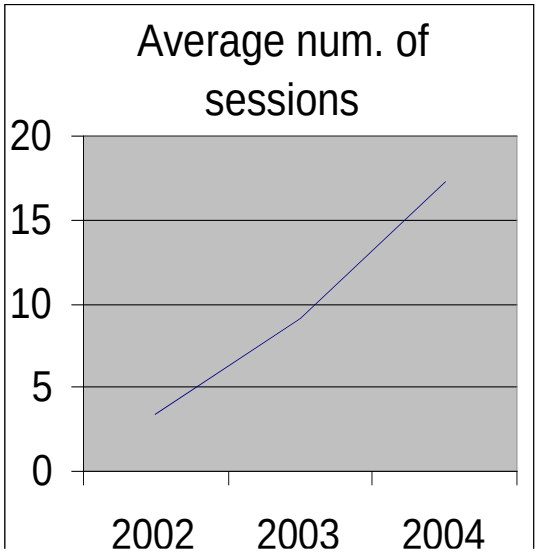
QuizGuide: Success Rate



QuizGuide: Motivation







- 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

Topic-Based ANS: Success Recipes

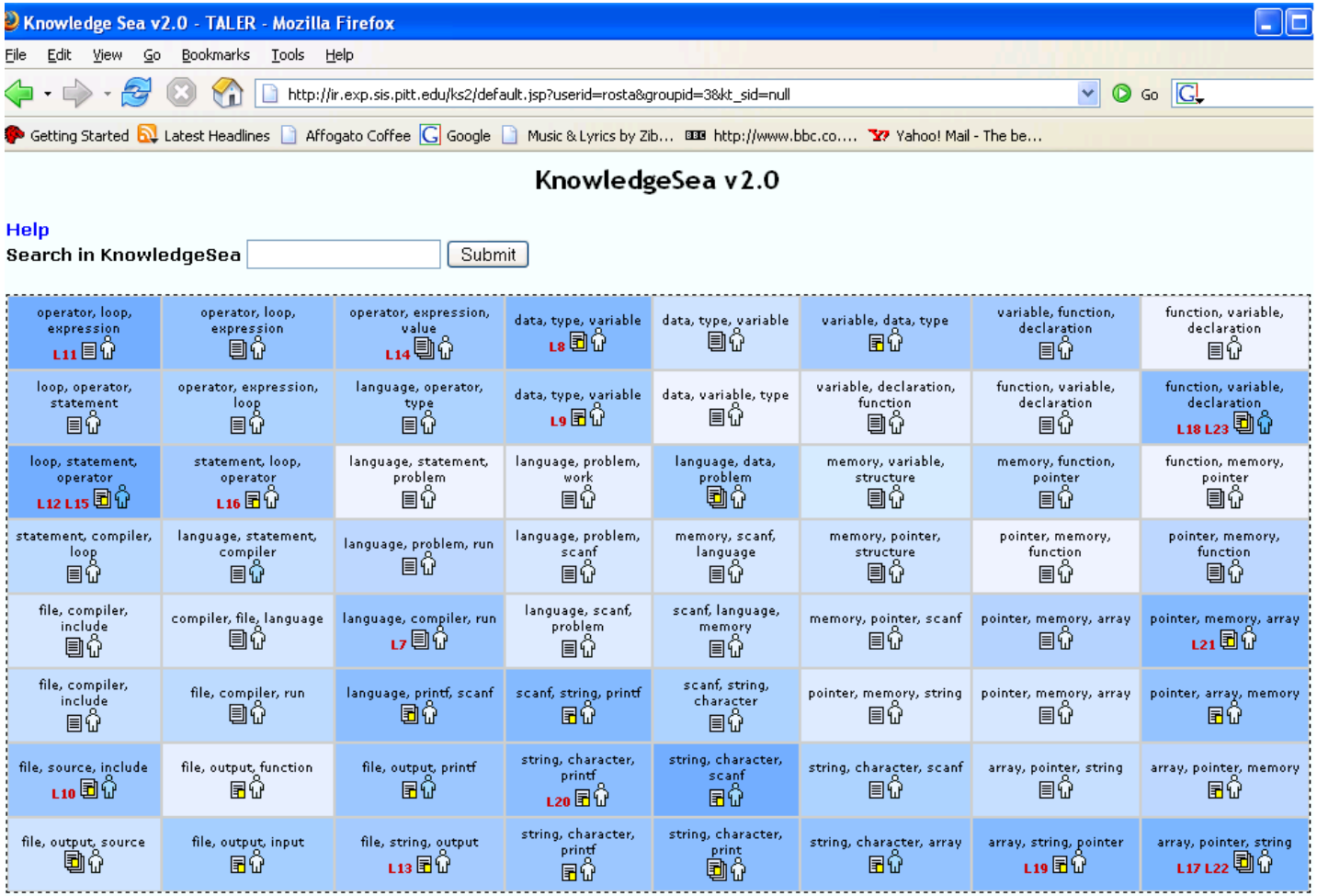
- Topic-Based interface organization is familiar, matches the course organization, and provides a compromise between too-much and too-little
- Two-way adaptive navigation support guides to the right topic
- Open student model provides clear overview of the progress

Social Guidance

- Concept-based and topic-based navigation support work well to increase success and motivation
- Knowledge-based approaches require some knowledge engineering – concept/topic models, prerequisites, time schedule
- In our past work we learned that social navigation – "wisdom" extracted from the work of a community of learners – might replace knowledge-based guidance
- Social wisdom vs. knowledge engineering

Knowledge Sea II

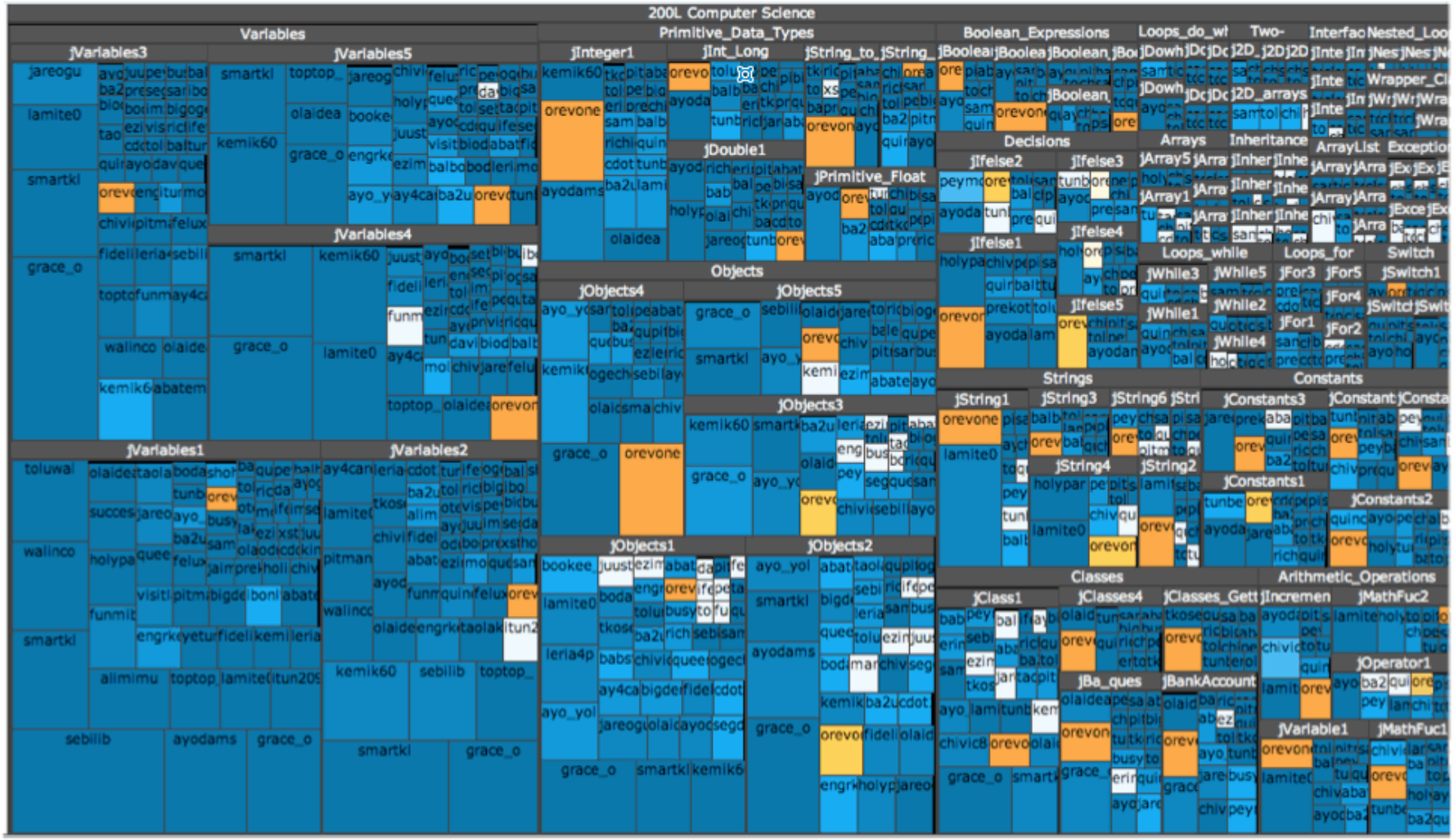
- Social Navigation to support course readings



Open Social Student Modeling

- Key ideas
  - Assume simple topic-based design
  - Show topic- and content- level knowledge progress of a student in contrast to the same progress of the class
- Main challenge
  - How to design the interface to show student and class progress over topics?
  - We went through several attempts…

QuizMap


200L Computer Science
Variables
jVariables3
jVariables5
jVariables4
jVariables1
jVariables2
Primitive_Data_Types
jInteger1
jInt_Long
jString_to_
jString_
jDouble1
jPrimitive_Float
Objects
jObjects4
jObjects5
jObjects3
jObjects1
jObjects2
Boolean_Expressions
Loops_do_wl
Two-
Interfac
Nested_Loo
Wrapper_Cl
Decisions
Arrays
Inheritance
ArrayList
Exceptio
jIfelse2
jIfelse3
jIfelse1
jIfelse4
jIfelse5
Loops_while
Loops_for
Switch
jWhile3
jWhile5
jWhile1
jWhile2
jWhile4
jFor3
jFor5
jFor4
jFor1
jFor2
jSwitch1
Strings
Constants
jString1
jString3
jString6
jStri
jString4
jString2
jConstants3
jConstant
jConsta
jConstants1
jConstants2
Classes
Arithmetic_Operations
jClass1
jClasses4
jClasses_Gett
jIncremen
jMathFuc2
jBa_ques
jBankAccount
jOperator1
jVariable1
jMathFuc1

Progressor

Progressor
File Edit View History Bookmarks Window Help
Google
Sort by
overall progress
progress on topic
access to my data
name
Top Progress (3)
Rest Open (47)
You have no access request
Basic Concepts
Inheritance
Classes
Objects
Inheritance
Interfaces
Two-dimensional Arrays
ArrayList
Arrays
Variables
Primitive Data Types
Constants
Strings
Wrapper Classes
Data Types
Decisions
Switch-Statement
Arithmetic Operations
Do-While-Loop
For-Loop
Nested Loops
Boolean Expressions
Operations
Legend
Pending
Completed
Coming
No Access
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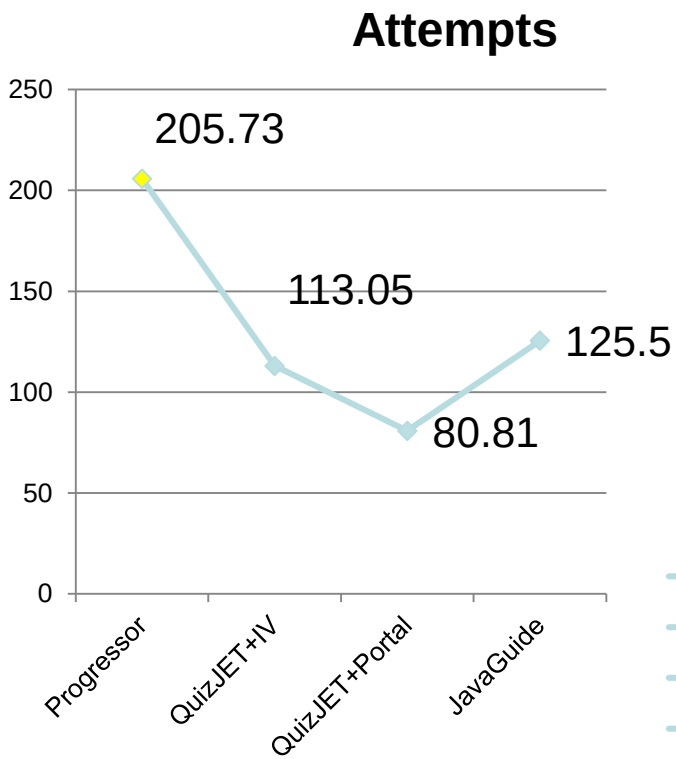
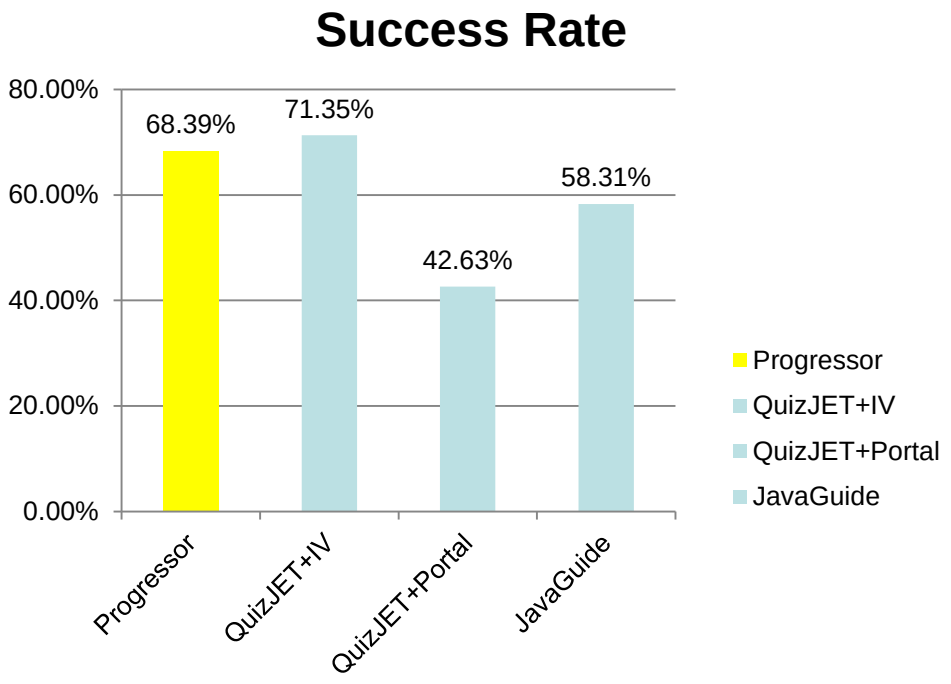
OSLM: Success Recipes

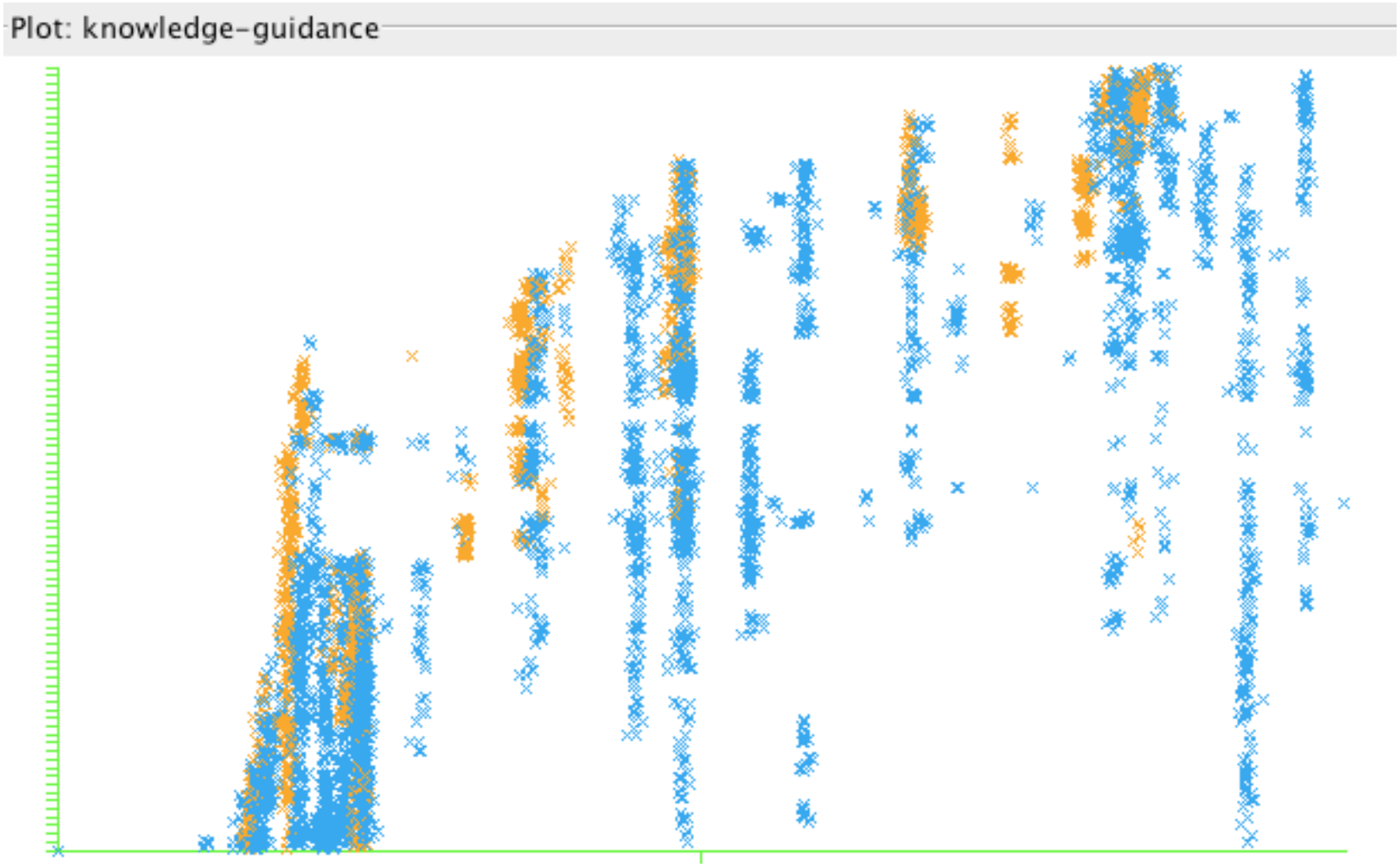
- Topic organization should follow the natural progress or topics in the course
- Clear comparison between “me” and “group”
- Ability to compare with individual peers, not only the group
- Privacy management

The Value of OSLM





The Secret



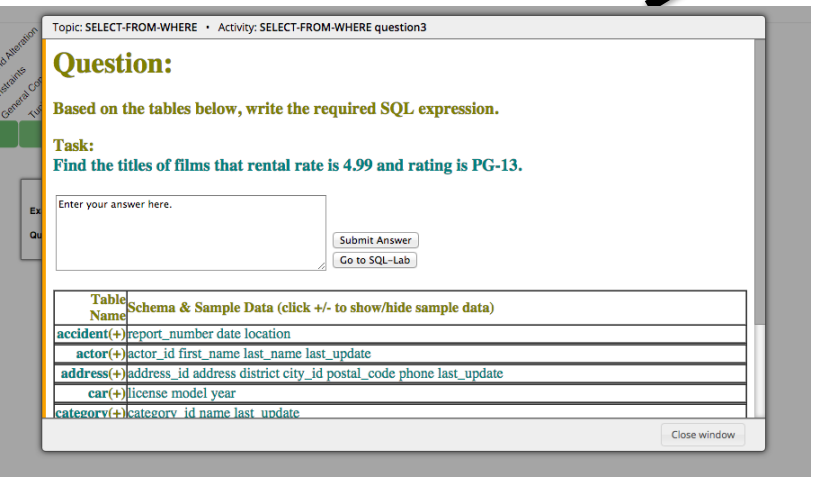
MasteryGrids

- Adaptive Navigation Support
- Topic-based Adaptation
- Open Social Student Modeling
- Social Educational Progress Visualization
- Multiple Content Types
- Open Source
- Concept-Based Recommendation
- Multiple Groups

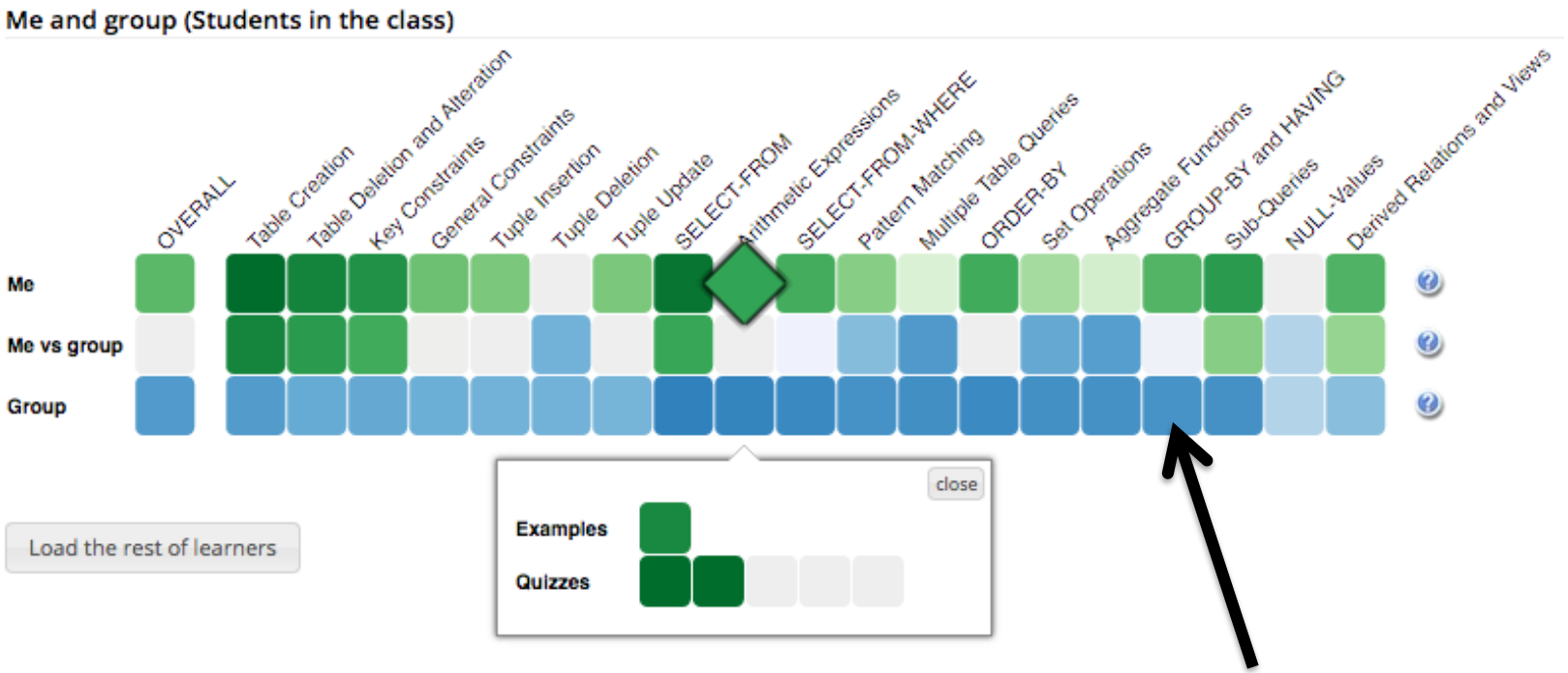
MasteryGrids OSM Interface

exercises and examples are directly accessed

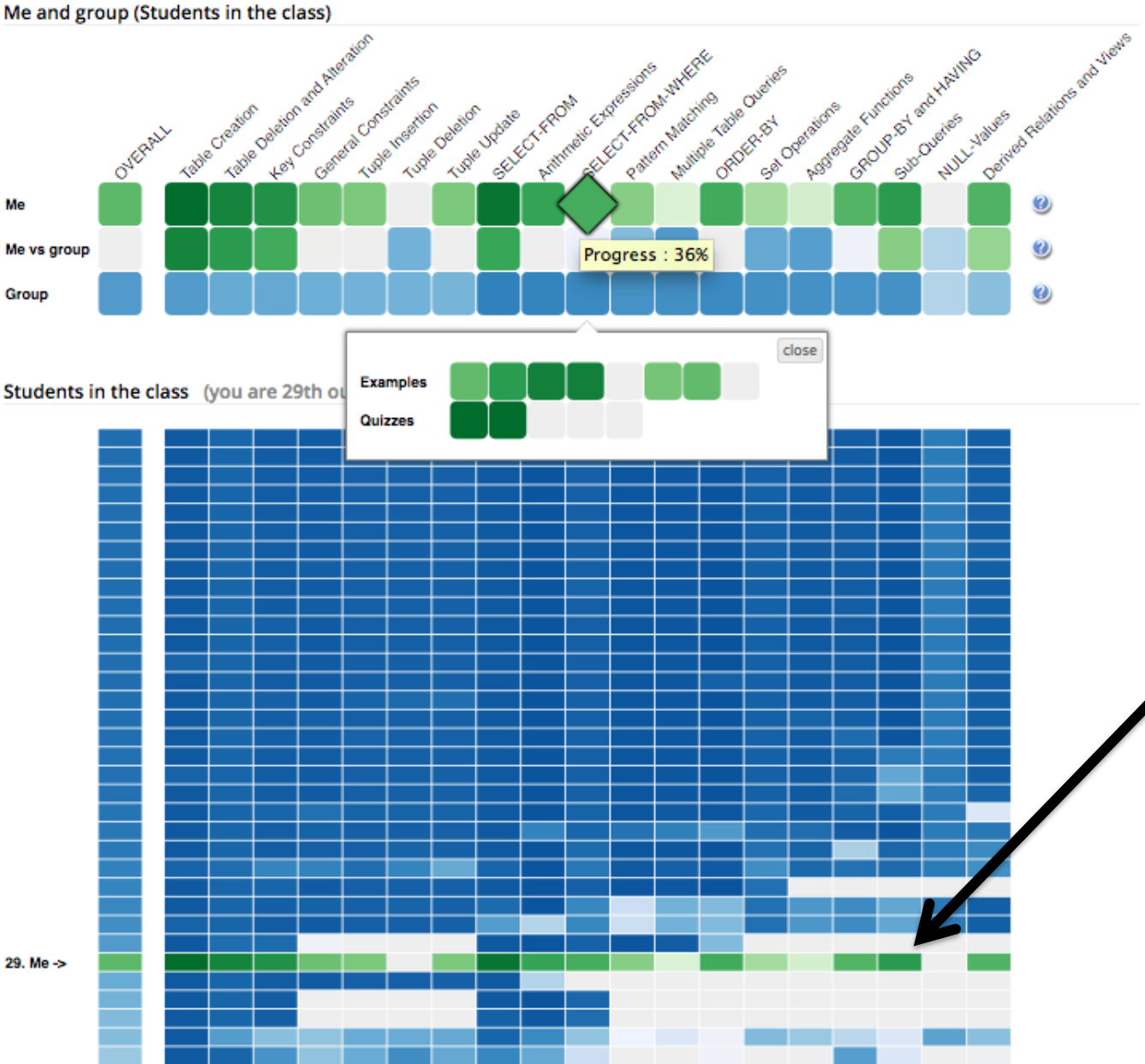
Colors: knowledge progress



MasteryGrids OSSM Interface



progress of knowledge of the group is represented in blue


Me and group (Students in the class)
OVERALL
Table Creation
Table Deletion and Alteration
Key Constraints
General Constraints
Tuple Insertion
Tuple Deletion
Tuple Update
SELECT-FROM
Arithmetic Expressions
SELECT-FROM-WHERE
Pattern Matching
Multiple Table Queries
ORDER-BY
Set Operations
Aggregate Functions
GROUP-BY and HAVING
Sub-Queries
NULL-Values
Derived Relations and Views
Me
Me vs group
Group
Progress : 36%
close
Examples
Quizzes
Students in the class
29. Me ->
Peer students ranked by progress

The Study

- A classroom study in a graduate Database Course
- Two sections of the same class. Same teacher, same lectures, etc.
- The students were able to access non-mandatory database practice content (exercises, examples) through Mastery Grids
- 47 students worked with OSM interface and 42 students worked with OSSM interface

Participants

Systems/sex	OSSM		OSM	
	f	%	f	%
Female	26	55.3	21	50
Male	21	44.7	21	50
Total	47	100	42	100

Data Collection

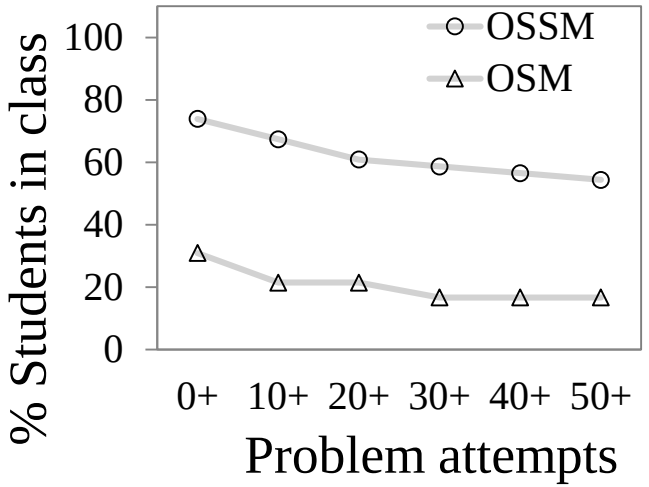
- Pre- and post-test
- Student activities with the system
  - every attempt to solve problems,
  - every example line viewed
  - …
- The Iowa-Netherlands Comparison Orientation Measure
  - how often students compare themselves with other people
  - Likert-type questionnaire, 11 items
- End of semester questionnaire

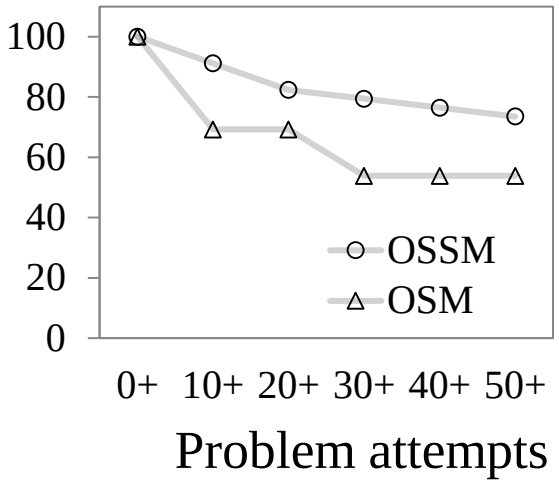
Impact on Learning

- Student knowledge significantly increased in both groups
- Number of attempted problems significantly predicts the final grade (SE=0.04,p=.017).
- We obtained the coefficient of 0.09 for *number of attempts on problems*, meaning attempting 100 problems increases the final grade by 9
- The mean learning gain was higher for both weak and strong students in OSSM group
- The difference was significant for weak students (p= .033)

Does OSSM increase student engagement

- OSSM group had much higher student usage
- Looking much more interesting to students at the start (compare #students after the first login)
- At the level of 30+, serious engagement with the system, the OSSM group still retained more than 50% of its original users while OSM engagement was below 20%.





Does OSSM increases system usage?

Variable	OSM	OSSM	U
	Mean	Mean	
Sessions	3.93	6.26	685.500*
Topics coverage	19.0%	56.4%	567.500**
Total attempts to problems	25.86	97.62	548.500**
Correct attempts to problems	14.62	60.28	548.000**
Distinct problems attempted	7.71	23.51	549.000**
Distinct problems attempted correctly	7.52	23.11	545.000**
Distinct examples viewed	18.19	38.55	611.500**
Views to example lines	91.60	209.40	609.000**
MG loads	5.05	9.83	618.500**
MG clicks on topic cells	24.17	61.36	638.500**
MG click on content cells	46.17	119.19	577.500**
MG difficulty feedback answers	6.83	14.68	599.500**
Total time in the system	5145.34	9276.58	667.000**
Time in problems	911.86	2727.38	582.000**
Time in MG (navigation)	2260.10	4085.31	625.000**

Does OSSM increase Efficiency?

- Time per line, time per example and time per activity scores of students in OSSM group are significantly lower than in the other group.
- Students who used OSSM interface worked more efficiently.

Variable	OSM	OSSM	U
	Mean	Mean	
Time per line	22.93	11.61	570.000**
Time per example	97.74	58.54	508.000*
Time per problem	37.96	29.72	242.000
Time per activity	47.92	34.33	277.000*

Usability and Usefulness
Questionnaire Analysis

- 53 students (81 – 28 usage < 300 seconds)
  - 32 in OSM+Social (18 f, 14 m)
  - 21 in OSM (10 f, 11 m)
- Questions in 5-Likert scale (1 low -> 5 high)
- 3 parts:
  - **Part 1** (all students) about common OSM features
  - **Part 2** (only OSM group) about the prospetive of using OSSM features
  - **Part 3** (only OSM+Social group): about social comaprison features

Findings: Part 1

Part 1		OSM		OSM+Social	
		M	SE	M	SE
1	In general, it was useful to see my progress in Mastery Grids (MG)	3.76	.228	4.03	.145
2	In general, I liked the interface of MG	3.86	.221	3.84	.163
3	Seeing my progress in the tool motivated me to work on quizzes and examples	3.52	.214	4.09	.130
4	The interface helped me to understand how the class content is organized	3.62	.223	3.81	.176
5	The interface helped me to identify my weak points	3.52	.190	3.84	.186
6	The interface helped me to plan my class work	3.33	.211	3.22	.160
7	It was clear how to access questions and examples	3.81	.264	3.56	.190
8	It was useful to see my knowledge progress for each topic [in MG]	3.71	.171	4.03	.135
9	It was useful to see how I am doing with individual quizzes and examples	3.71	.197	4.16	.128
10	Using green colors in different intensity to show my progress was easy to understand	3.90	.217	4.09	.151

(3) OSSM group value OSM features more than than OSSM

(Mann-Whitney U=225, p=.026 two-tailed)

(all) Tendency OSM+Social > OSM

(all responses higher, but not significant diff)

Findings

		OSM		OSM+Social	
Part 1		M	SE	M	SE
1	In general, it was useful to see my progress in Mastery Grids (MG)	3.76	.228	4.03	.145
2	In general, I liked the interface of MG	3.86	.221	3.84	.163
3	Seeing my progress in the tool motivated me to work on quizzes and examples	3.52	.214	4.09	.130

p=.031
(Wilcoxon Signed Rank test)

Part 3, question 10

10	Viewing my classmates' progress motivated me to work more in quizzes and examples	3.88	.193

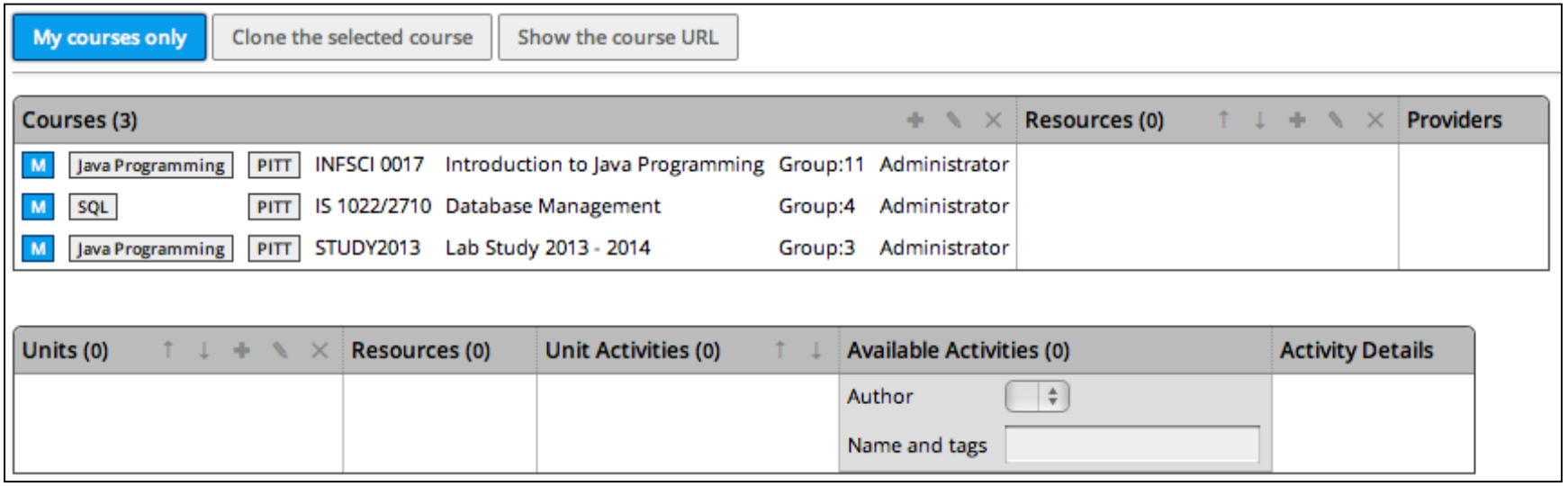
Findings

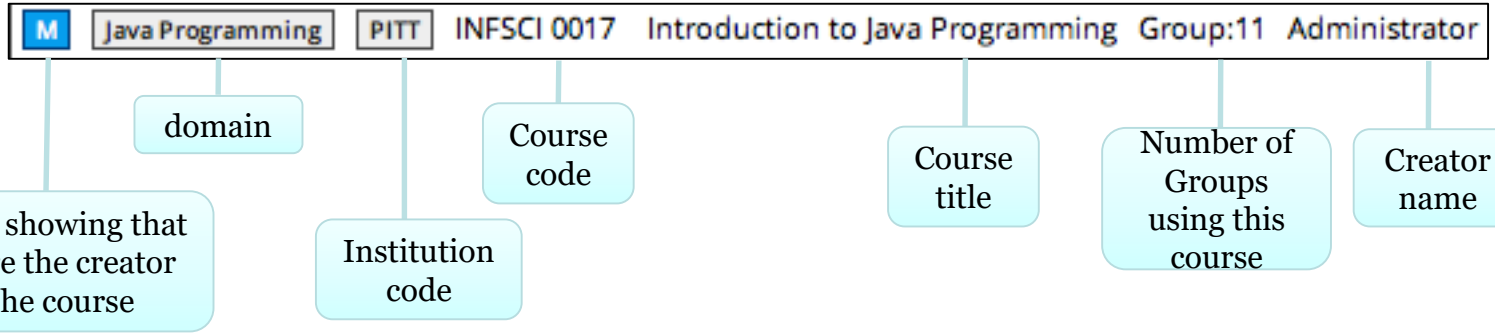
- OSSM group is more excited about OSM part
- OSSM group value OSM features more than OSM group (Mann-Whitney U=225, p=.026 two-tailed)
- OSSM group is more positive about social features that OSM
  - **the actual experience is better than they think it would be.**

What we are doing now?

- Sex analysis
- Easy authoring to define “your course”
- Exploring more advanced guidance and modeling approaches based on large volume of social data
- Interface and cultural studies in a wide variety of classes from US to Nigeria
  - Interested to be a pilot site? Write to peterb@pitt.edu

Course Authoring Interface





Acknowledgements

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  - Sergey Sosnovsky
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- NSF Grants
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  - IIS 0426021
  - CAREER 0447083
- ADL "PAL" grant to build MasteryGrids

Read About It! Try It!

- GitHub link
  - https://github.com/PAWSLabUniversityOfPittsburgh/MasteryGrids
- **Brusilovsky, P., Sosnovsky, S., and Yudelson, M.** (2009) Addictive links: The motivational value of adaptive link annotation. *New Review of Hypermedia and Multimedia* **15** (1), 97-118.
- **Hsiao, I.-H., Sosnovsky, S., and Brusilovsky, P.** (2010) Guiding students to the right questions: adaptive navigation support in an E-Learning system for Java programming. *Journal of Computer Assisted Learning* **26** (4), 270-283.
- **Hsiao, I.-H., Bakalov, F., Brusilovsky, P., and König-Ries, B**. (2013) Progressor: social navigation support through open social student modeling. *New Review of Hypermedia and Multimedia*
- **Brusilovsky, P., Somyurek, S., Guerra, J., Hosseini, R., and Zadorozhny, V.** (2015) The Value of Social: Comparing Open Student Modeling and Open Social Student Modeling. In: F. Ricci, K. Bontcheva, O. Conlan and S. Lawless (eds.) Proceedings of 23nd Conference on User Modeling, Adaptation and Personalization (UMAP 2015), Dublin, Ireland, , June 29 - July 3, 2015, Springer Verlag, pp. 44-55, also available at http://link.springer.com/chapter/10.1007/978-3-319-20267-9_4.