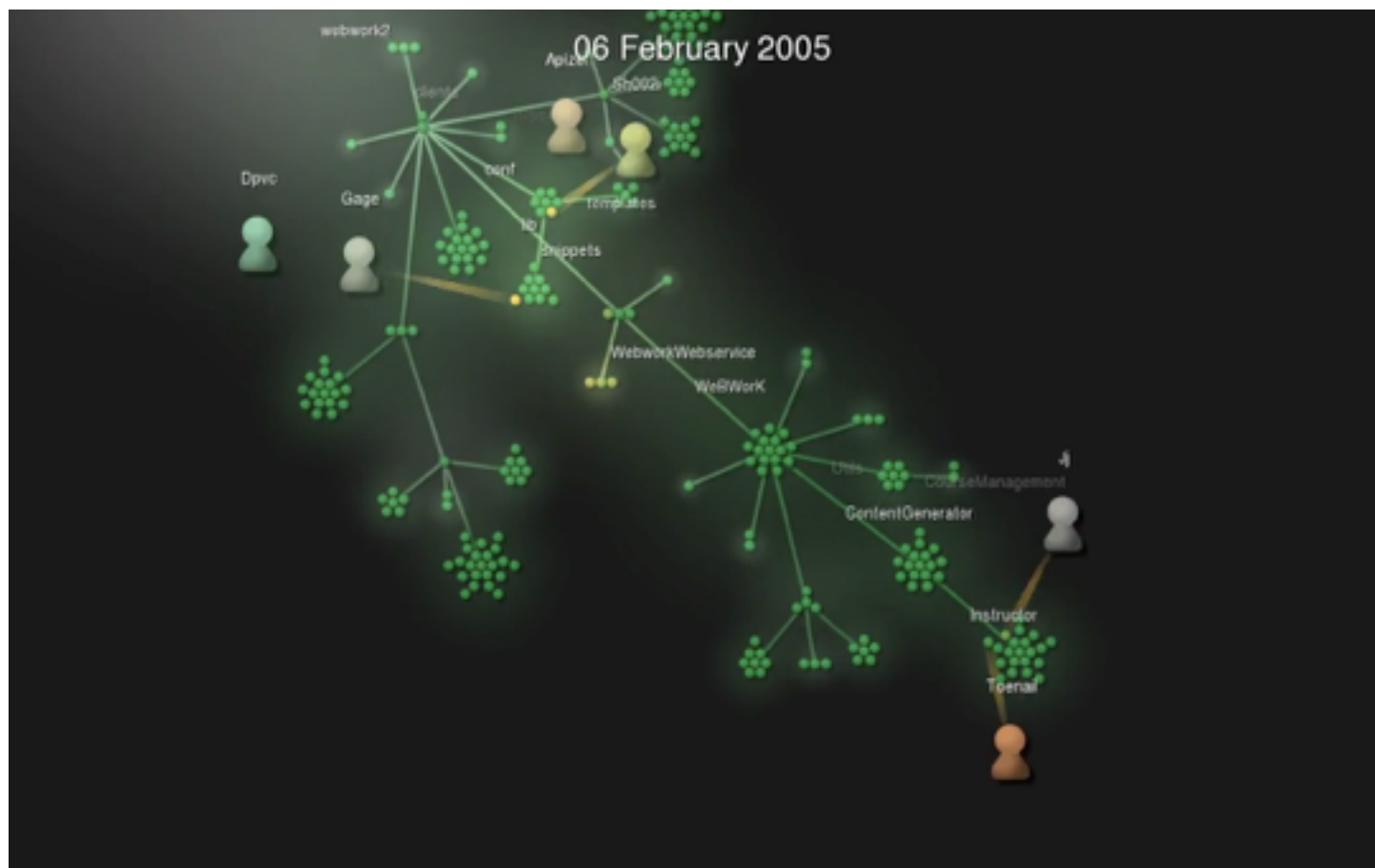# WeBWorK2 development
2002 -- 2012

Search for: youtube, webwork, gource

Gource stands for "Graphical source"

WeBWorK

The WeBWorK on-line homework system and its academic community

Michael Gage
University of Rochester

HKUST
June 10, 2014

http://webwork.maa.org

Outline

- What WeBWorK does.

- Brief history of how and why WeBWorK was built.

- A few new features but much more tomorrow.

- WeBWorK community and how to participate.

- What to do about open source and academics??

WeBWorK
http://webwork.maa.org

- What is WeBWorK?

- Benefits for students and instructors

- Who is using WeBWorK?

- The WeBWorK Community Story

- WeBWorK Resources

  - http://webwork.maa.org/wiki

- Some WW features

- Tomorrow: WeBWorK feature details

Overview: what it is

- WeBWorK is a web-based homework checker. (WebAssign and WeBWorK are similar)

- Originally designed at University of Rochester and now actively supported by math and science faculty nationwide.

- Supported by Math Association of America (MAA) and by the NSF for 15 years.

Overview: what it does

- The overwhelming majority of students complete all of their homework correctly -- (sometimes after several attempts).

- It is particularly adept at handling mathematics and physics problems.

- The homework is corrected and graded, accurately, efficiently and completely.

WeBWorK's Goal:

Making mathematics homework more effective and efficient.

It increases the effectiveness of traditional homework as a learning tool by:

Providing students with **immediate feedback** on the validity of their answers and giving students the opportunity to correct mistakes while they are still thinking about the problem. As one student said, "I can fix my mistakes while [the] problem is fresh in my mind."

Providing students with **individualized versions** of problems so instructors can encourage students to work together; yet each student must develop an answer to his or her own version of the problem.

It increases the efficiency of traditional homework by:

Providing automatic grading of assignments.

Providing information on the performance of individual students and the course (or section or recitation) as a whole.

How WeBWorK works

Some sample questions and answers.

The interval described in set notation by the inequality $|5x - 10| < 25$ has interval notation:

interval example

Entered	Answer Preview
(-3,7)	$\left(-3, \frac{35}{5}\right)$

The answer above is correct.

(1 pt)

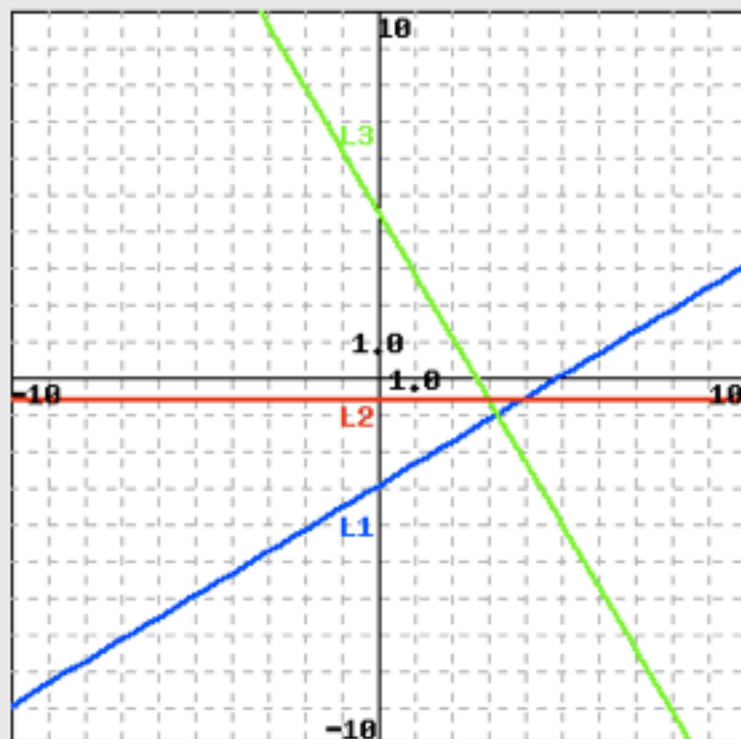The interval described in set notation by the inequality $|5x - 10| < 25$ has interval notation:

(−3,35/5)

Sample responses to incorrect answers

Entered	Answer Preview	Messages
(-3,7]	$(-3, 7]$	The type of interval is incorrect

Entered	Answer Preview	Messages
(-3,,35/5)		Missing operand before ','

Graph examples

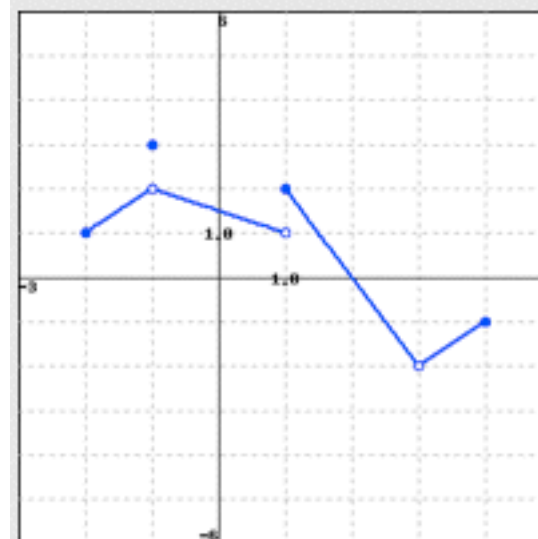Let F be the function below.

Match the Lines L1 (blue), L2 (red) and L3 (green) with the slop[e] each set listed below:

	1. The slope of line $L1$
	2. The slope of line $L3$
	3. The slope of line $L2$

A. $m = -1.7$
B. $m = 0.6$
C. $m = 0$

Evaluate each of the following expressions.

Note: Enter 'DNE' if the limit does not exist

a) $\lim_{x \to -1^-} F(x) = \boxed{}$

b) $\lim_{x \to -1^+} F(x) = \boxed{}$

c) $\lim_{x \to -1} F(x) = \boxed{}$

Function answer evaluator

Entered	Answer Preview	Result	Messages
8*x-2-([sin(x)]^2)-([cos(x)]^2)	$8x - 2 - \sin^2(x) - \cos^2(x)$	correct	This answer is equivalent to the one you just submitted.
21	$8 \cdot 3 - 3$	correct	

All of the answers above are correct.

(1 pt) **setDemo/s2_2_1.pg**
If $f(x) = 4x^2 - 3x - 20$, find $f'(x)$.

8x-2 - sin^2(x) -cos^2(x)

Solution: Find $f'(3)$.

8*3-3

Solution:

Show solution (after due date)

(1 pt) **setDemo/s2_2_1.pg**

If $f(x) = 4x^2 - 3x - 20$, find $f'(x)$.

> 8x-2 - sin^2(x) -cos^2(x)

Solution: Find $f'(3)$.

> 8*3-3

Solution:

(Instructor solution preview: show the student solution after due date.)

Solution:
To find the derivative we just have to evaluate $f'(x)$ at $x = 3$), i.e. $8 \cdot 3 - 3$ or 21.

WeBWorK Philosophy

Using WeBWorK, instructors can ask most questions typically found in mathematics and other scientific textbooks, as well as more advanced interactive questions.

Goal:

Ask the questions you should, not just the questions you can.

Do not compromise mathematics education because you are using new technology.

More examples of how WeBWorK can ask questions and check answers in tomorrow's lecture

More WeBWorK features

- A partial list of answer types that can be checked with current response evaluators.

  - Real and complex numbers - to specified accuracy

  - Functions - of one or more variables: (*x^3+5x-4+sin x*)

  - Numbers or functions with units (*500 cm or 5 m*)

  - Antiderivatives **--** up to a constant

  - True-False, multiple choice, short answer

  - Solutions to non-homogeneous ODE up to a solution of the homogeneous ODE

  - Eigenvectors, parallel vectors, vectors lying in a given span

  - Independence of a set of vectors

Sharing our work

We should be able to build on each other's work. It is good to contribute but we don't need to start from the beginning every time.

WeBWorK's Open Problem Library contains more than 22,000 questions covering trigonometry, college algebra, pre-calculus, calculus, vector calculus, linear algebra, differential equations, probability, statistics, physics, some chemistry and other subjects.

Additional contributions are welcome.

Hosting for small mathematics courses (<100 students per institution) is available through the MAA http://webwork.maa.org

Other institutions, including HKUST are serving as a hosting site for neighboring institutions.

Why students like WeBWorK

- *"Yes. It was very helpful to know if I was wrong and be able to work the problem through until I knew and understood how to get it right."*
- *"I understand the problems better when given the ability to correct them."*
- *"I think it's a better way to learn."*
- *"I really like finding out right away and being able to rework a problem I got wrong."*
- *"I loved it. It helped me develop on my skills."*
- *"Significant increase in motivation [thus] giving students more confidence"*
- *"It was helpful in learning from mistakes & seeing mistakes."*
- *"Very much so. I don't have to wait for lecture to see if I'm doing it right."*
- *"Yes. It makes you want to redo it; after finding an answer, you feel accomplished, immediate feedback makes sure you have accomplished something."*

Why instructors like WeBWorK [1]

John Curran, Eastern Michigan University

"There is a great variety of technology that can be used in teaching mathematics courses…. In my opinion, the WeBWorK system provides the greatest improvement in student learning among these technologies. I have taught the same courses with and without WeBWorK. Based on this, I know that WeBWorK increases students' motivation when working on homework. In addition, it increases the amount of discussion between my students and me about an assignment. That discussion is of higher quality… and it is more conceptual and detailed than it otherwise would be."

Why instructors like WeBWorK [2]

Alan Tucker, SUNY Stony Brook:

"...Without instant grading of math homework, even if students do math homework assignments, they do not know if they have done them correctly-- unless the answer is in the back of the book (in which case it is tempting to copy the answer and work backward from it). Being told immediately that their answer is wrong is a strong motivation for students to keep working on a problem. Engaging students to stick with a problem until they get it right is an extremely powerful strategy for good learning...."

Who is using WeBWorK?

- 220 universities known to be serving WeBWorK homework from their own servers.

- 540 institutions hosted at the MAA for courses at colleges and high schools and for first timers.

- We estimate in total there are more than 760 institutions using WW including at least 64 high schools.

- Mostly mathematics courses but there are some physics and engineering courses as well.

WeBWorK Sites — 2014
760+ institutions

- How did WeBWorK develop?

First WW course in 1996

- Started at University of Rochester

- We needed to grade **all** of students' homework to keep them motivated.

- Inspired by CAPA used in Frank Wolf's physics course.
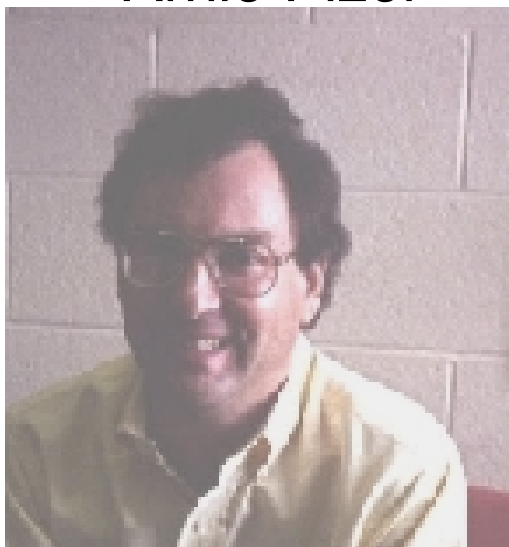
Arnie Pizer

Mike Gage

1999 - ICTCM award and first NSF grant

- Fall 1996 - WeBWorK first used in classes at U of R
- Spring 1999 - NSF support for WeBWorK at U of R NSF
- Fall 1999 - WeBWorK received ICTCM award for Excellence and Innovation with the Use of Technology in Collegiate Mathematics ICTCM

Arnie Pizer   Mike Gage   Vicki Roth

2004 — 2007 WeBWorK2

- Spring 2003 - WeBWorK2 is first released
- Summer 2004 - MSRI sponsors WeBWorK programming workshop
- More developers:

Sam Hathaway

Davide Cervone

Gavin LaRose

John Jones

2007 — AIM workshop

- August 2007 - American Institute of Mathematics in Palo Alto, CA sponsors workshop on WeBWorK development and outreach

WeBWorK Workshop at AIM
August 2007
and
100's of instructors writing questions
(more than 12,000 collected in the national library)

More development

- by 2009 -- WeBWorK 2.4.7 released
  - MathObjects
  - Gateway quizzes
  - Moodle interoperability
  - flash, java and geogebra API's in beta
- Sept 2009 -- awarded 5 year NSF dissemination grant to MAA for encouraging WeBWorK's use.

2009- NSF dissemination grant

The plan:

- With developed homework software and methods of using it effectively in classrooms in hand we sought to make this tool more widely available.

- We would hold semi-annual consultant workshops explaining how to use WeBWorK and how to encourage others to try it out.

- MAA would host courses for other institutions.

- Goal: Increase number of institutions using WeBWorK from around 150 to 450 over five years.

2009-2014 Dissemination

The plan worked well:

- 2009 — 150 institutions

- 2010 — MAA hosting service goes live

- 2011 — 490 institutions

- May 2013 — 670 institutions, 220 websites serving WW, 450 hosted at MAA website, more than 64 high schools

- June 2014 — 768 institutions,

WeBWorK sites -- 2011

WeBWorK Sites — 2013

WeBWorK Sites — 2014

760+ institutions

The new needs

- With a larger user base more of our users were not self-sufficient experimentalists. Everyone wanted an easier user interface.

- The standard Web1.0 interface which remained fairly static between 2000 and 2006 began to change rapidly — Google docs and gmail apps leading the way to Web2.0.

- The targeting mobile devices became more important.

The fix: Code camps 2012—

- Code camps are short, intense development workshops.

- We got the idea from attending SageDays code camps (Sage is an open source Mathematica).

- and from POSSE "Professor's open source summer experience".

- From 2005 through 2012 we had produced a new WeBWorK release about every 1.5 years

- Since 2012 we have been averaging 4 code camps per year and have moved from WeBWorK version 2.5 to 2.9 with approximately 2 releases a year.

WW code camps

- WW::Winona -- August 2012
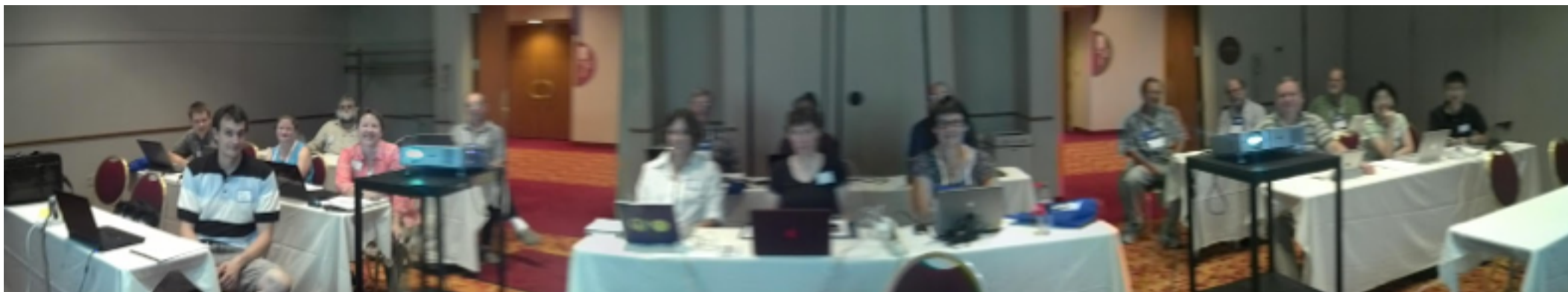
Stealing the sageday ideas from Sage we have are now holding WW development camps regularly:

- WW::Rochester -- June 2012

- WW::Fitchburg -- October 2012

WW code camps

- WW::Raleigh **--** March 2013

- WW::AnnArbor **--** May 2013 (modelCourses & database)

- WW::Vancouver **--** June 2013 (UI and database)

- WW:: Rochester::2013 — October 2013

- WW::Asheville — May 2014

- WW::Portland —August 2014

- Read about the code camps on our blogs:
  http://webwork.maa.org/planet

planet webwork

WeBWorK

Subscriptions

RSS for this page.

ere, which means that I can get
of what I will talk about was
re about that here.

t, ww_install, recently
llation process.

nning on a fresh linux
irtual machine, or doing
e, however, that most
ation methods, or an email

ry. The current master branch
branch, support Apache version
f the main improvements we
s release/2.9 and develop, both
what it is...)

- Alasdair McAndrew
- Anneke Bart
- Christopher Hughes
- David Gage
- Djun Kim
- Geoff Goehle
- Jason Aubrey
- John Jones
- John Travis
- Michael Gage
- Paul T. Pearson
- Peter Staab
- Sebastien Labbe

Last updated:
June 01, 2014 09:00 PM
All times are UTC.

Powered by:

More key developers

The consulting sessions and code camps were key to getting new people involved.   Among them

Peter Staab   Geoff Goehle   Paul Pearson   John Travis
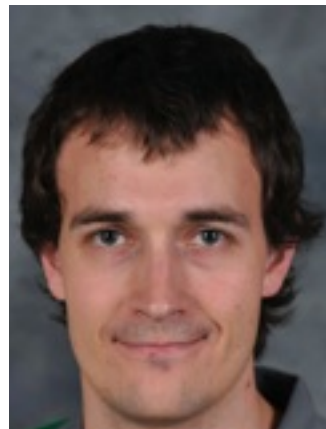
Release schedule

- release/2.4.5 — July 11, 2008

- release/2.4.7 — June 28, 2009

- release/2.4.9 — December 1, 2010

- release/2.5.0 — July 12, 2011

Code camps start — switch to github

- release/2.6 — August, 2012

- release/2.7 — June 30, 2013

- release/2.8 — December 20, 2013

- release/2.9 — July, 2014

- WeBWorK3 beta — now, final release planned for December 2014

WeBWorK2 development
2002 -- 2012
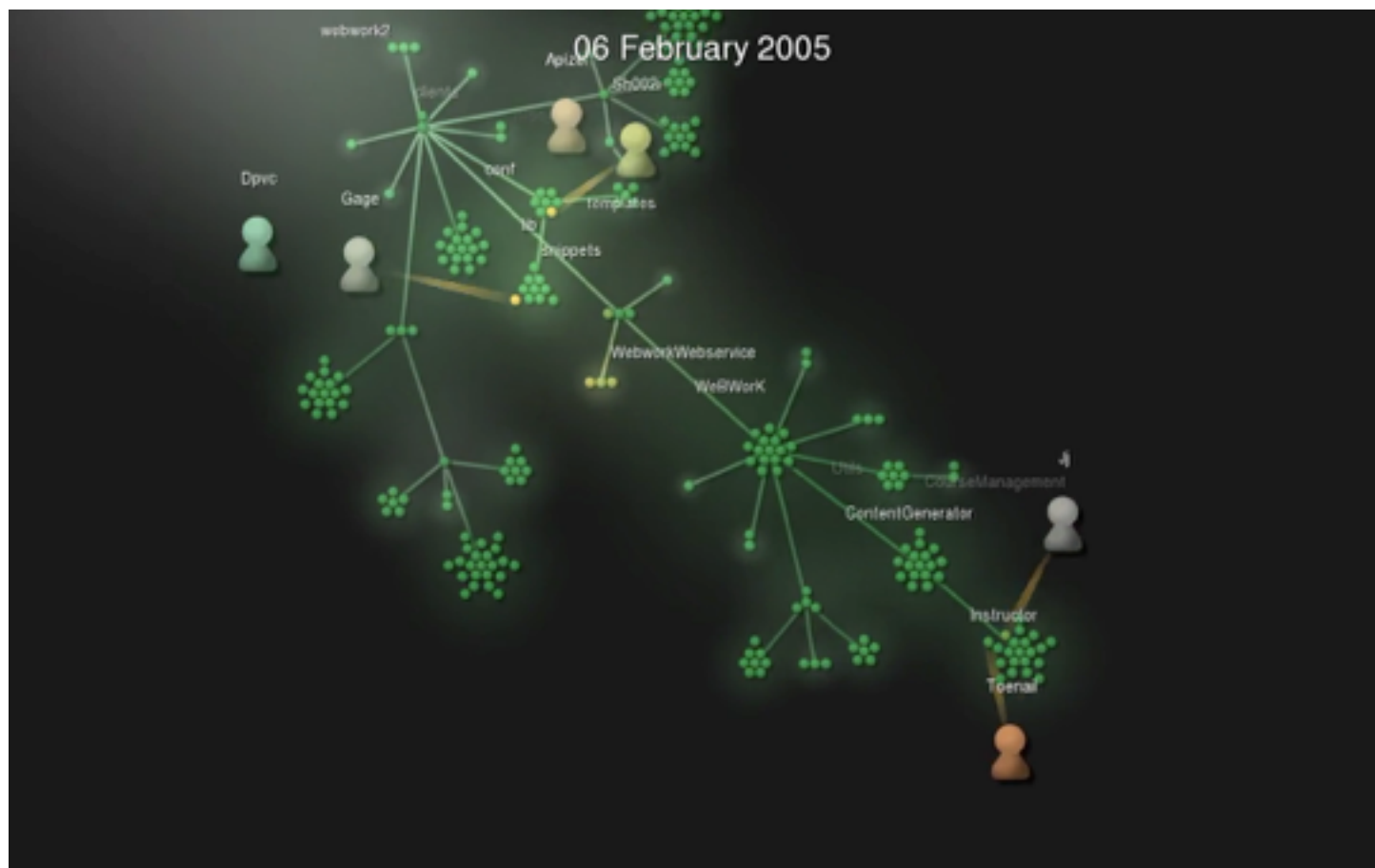
Search for: youtube, webwork, gource

Gource stands for "Graphical source"

2014 — New features

- MathAchievements

- Essay answers

- Geogebra applets

- Graphical input (Flash applets)

- AskSage and sage interacts (experimental)

- Scaffolding (sequential problems)

- More on this tomorrow:

  - https://hosted2.webwork.rochester.edu/webwork2/HKUST101

  - login: profa   password: profa

  - courses 101 to 120.

    - explore but don't expect your work to be saved

Building community

- One of the hardest aspects of open source development is keeping in touch with the community.

- There are no salespeople, no ads. It's like a mathematics research subfield — if you want to keep up with what is going on you need to keep in touch with the leaders; read the journals and the arxiv; ask questions of colleagues.

- Here are some ways to keep in touch with WeBWorK without making it a full time job:

Communication

Maintaining communication takes constant, sustained effort. We maintain:

- Wiki -- for documentation and news
- Forums -- for help
- Blogs -- for individual essays and new feature descriptions
- github.com/openwebwork -- for software distribution
- IRC — for chat room communication

Providing all the disparate members of the community with appropriate information is a major challenge.

Start at http://webwork.maa.org/wiki

Ongoing and future projects

- Library re-organization — John Jones and Jeff Holt

- WeBWorK3 UI using AJAX — Peter Staab

- ModelCourse creation — John Travis

- Interoperability — with Moodle, Sakai, other CMS

- Interoperability — with Sage, Geogebra

- New question types — Flash, Essay, HTML5, Drag and Drop

- MathAchievements — Geoff Goehle

- Accessibility — Alex Jordan, Chris Hughes

- Localization — need help with coordination

- One click installation — Jason Aubrey, Geoff Goehle

Summary about WeBWorK

- Immediate feedback on homework is educationally valuable -- big time!

- WeBWorK offers maximum extensibility and flexibility -- **Ask the questions you *should*, not just the questions you can!**

- **Free** -- open source software - Mathematics community support - share the work. Install your own server

- **or** -- Hosting for moderate size classes can be arranged at the MAA server -- sign up at http://webwork.maa.org and perhaps at other regional institutions.

Open source's role in academia

Open source software vs. commercial software

(or perhaps some mixture)

- WeBWorK — WebAssign, MyMathLab

- Sage — Mathematica, Maple

- Geogebra — Geometer's sketchpad

- Moodle — Blackboard

- TexShop — commercial TeX typesetters

- open text books (UTMOST) — publishers

- developed by academics for themselves vs. sold to academics

- what will happen in the long run?

Thank you

This is an interesting time to be teaching mathematics.

There are a lot of choices.

http://webwork.maa.org/wiki

For tomorrow

- Newest features of WeBWorK

- Authoring new types of questions

  - https://hosted2.webwork.rochester.edu/webwork2/HKUST10x

    - use profa for login and profa for password

- Other links

  - http://www.math.ust.hk/~support/workshop.html

  - http://webwork.maa.org/wiki

How it works: Demo

- Practice courses are at:

  - http://hosted2.webwork.rochester.edu/webwork2/maa101

  - http://hosted2.webwork.rochester.edu/webwork2/maa102

  - http://hosted2.webwork.rochester.edu/webwork2/maa103

  - ...

- Student login:

  - login: student1   password: student1

- Instructor login:

  - login: profa   password: profa

WeBWorK community docs

Information: http://webwork.maa.org

and

support: http://webwork.maa.org/wiki

also forums, blogs, and IRC,

Vicki Roth: What students think of WeBWorK: survey results

- **Positive – the top of the list**

  - Immediate feedback

  - Prefer WeBWorK to paper & pencil homework

  - Structured system supports homework completion

- **Negative – the top of the list**

  - Syntax--difficult to type in long answers

  - No partial grade

  - No way to tell if answer is almost correct

UR math students, fall semester 2002, 2003, 2004, n = 2387

How students interact with the system

Students complete their problem sets

Score = # of successfully solved problems over the course of a semester. Each data point = % of students in the specific interval

N = 196, 158 and 135 students

Fall 2002, 2003, 2004
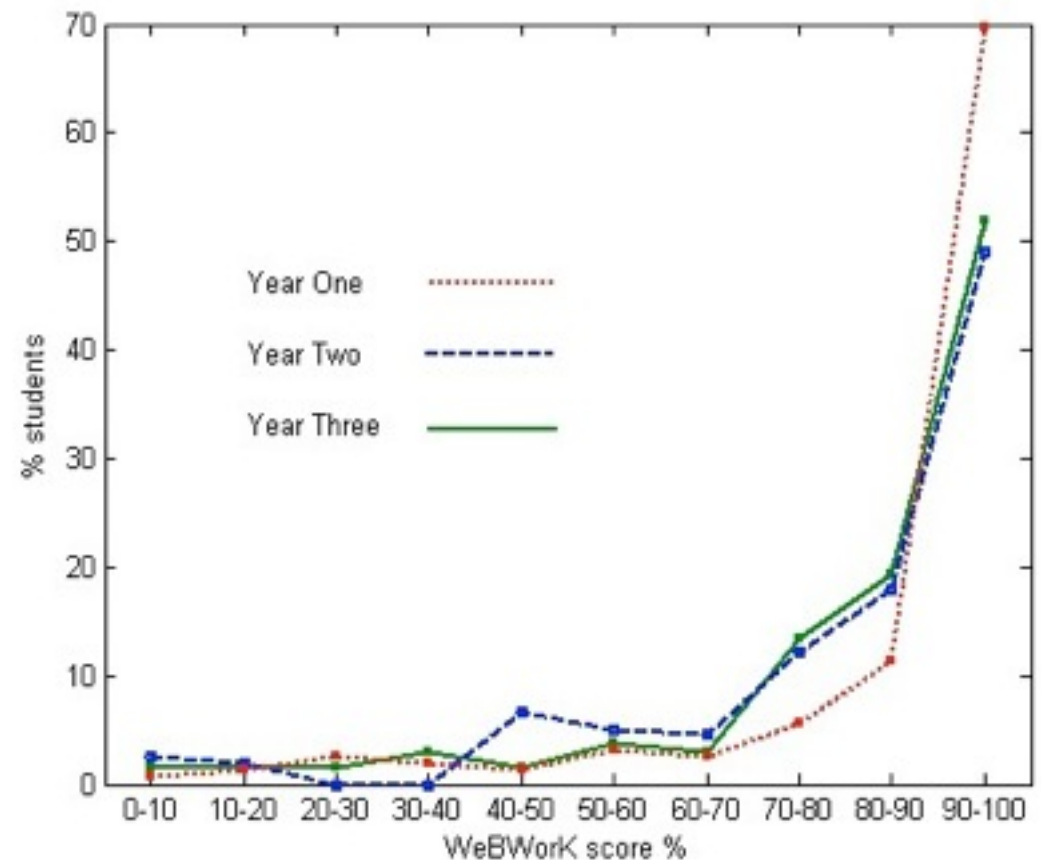
How students interact with the system, continued

- Detailed analysis at the keystroke level for 96 Calculus 1 students (2002, 2003, 2004, A, B, C, D students in each cohort)

- Responses to error messages could be categorized
  - Reworking the problem
  - Fixing an entry error
  - Resubmitting the same or equivalent answer--a surprise
  - Guessing
  - Nonsense

How changes to WeBWorK influence interaction

- Preview feature: before Fall 2003

- Resubmission alert: before Fall 2004

How changes to WeBWorK influence interaction

Distribution of entry errors Calculus 1, 2002, 2003, 2004. Data are averaged across 32 students for each year and across two raters.

WeBWorK errors
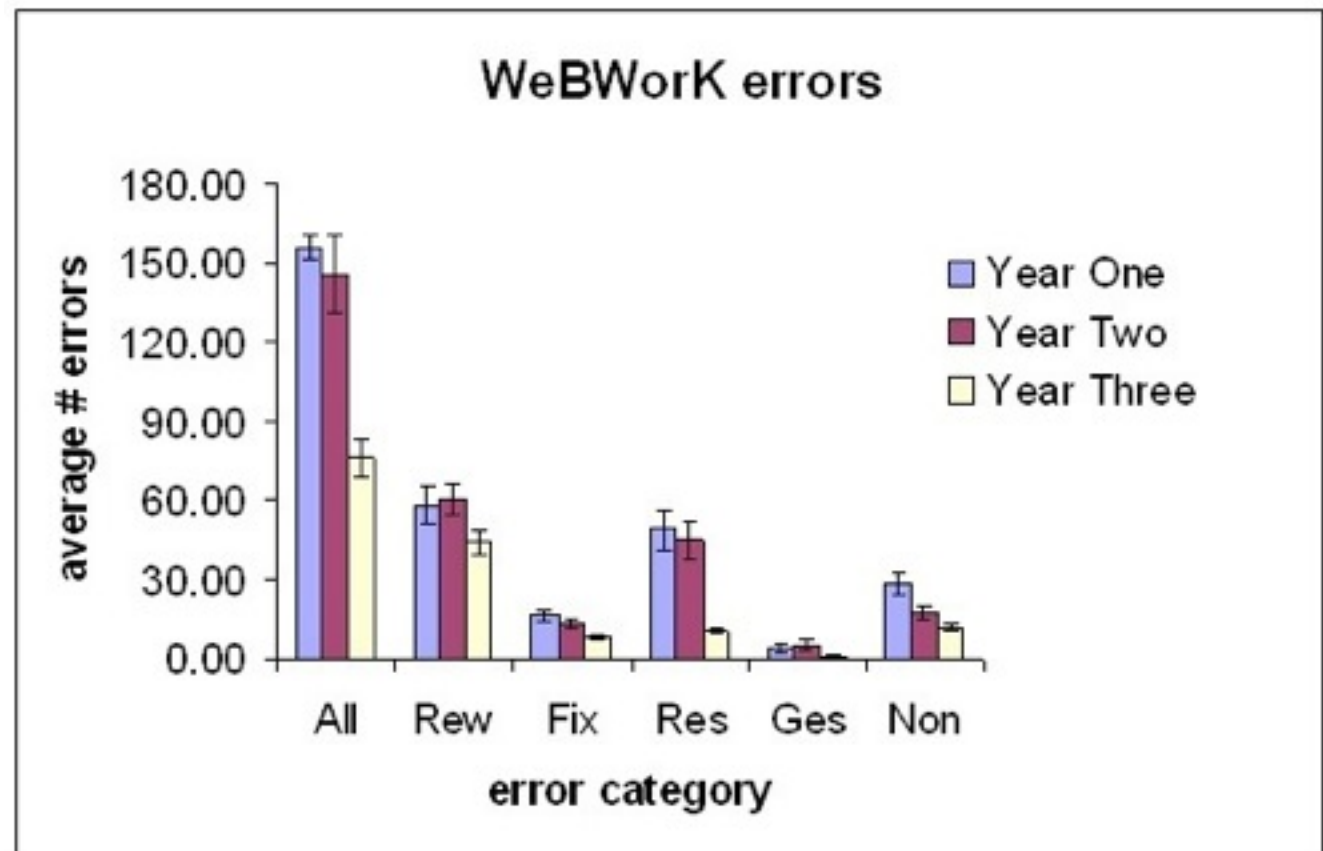
WeBWorK works with others

Display mathematics with

jsMath, MathJax, mathML, gif and png images

Interact with applets:

Goegebra, javaScript, Flash applets, Java applets, HTML5

Integrates as a component of Moodle -- soon Blackboard

Moodle: model Calculus site

http://hosted.webwork.rochester.edu/moodle/

15 September - 21 September

Text	Topic	Supplementary Problems	Recitations	WeBWorK
1.6	Inverse Functions and Logarithms	**1.6** 21, 23, 25, 35, 38, 49	App. D, 1.3, 1.5	WeBWorK Set 1 due Mon, Sept 22, 6:00 AM
2.1	Tangents, Velocity, Limits	**2.1** 3, 5		
2.2	The Limit of a Function	**2.2** 1, 3, 5, 9, 15, 25, 27		

Set 1

22 September - 28 September

Text	Topic	Supplementary Problems	Recitations	WeBWorK
2.3	Limit Laws	**2.3** 1, 5, 7, 10, 11 - 23 (odd), 35, 37, 57	1.6, 2.1, 2.2	WeBWorK Set 2 due Tue, Sept 29, 6:00 AM
2.5	Continuity	**2.5** 3, 17, 20, 39, 45, 47, 60		
2.6	Limits at Infinity, Horizontal Asymptotes	**2.6** 3, 5, 13 - 31 (odd)		

Set 2

Moodle: Probability course Fall2009

WeBWorK | Meliora Mathematica
University of Rochester

MAA — MATHEMATICAL ASSOCIATION OF AMERICA

MTH201 Probability (Fall 2009)

You are logged in as Michael Gage (Logout)

mathmoodle ▶ math201-fa09

[?] [Switch role to... ▼] (Turn editing on)

People
- 👥 Participants

Activities
- 🏷️ Assignments
- ❓ Choices
- 🗨️ Forums
- 📄 Resources
- 🔷 WeBWorK Problem Sets
- 📊 Wikis

Search Forums
[   ] (Go)
Advanced search ?

Administration
- ✏️ Turn editing on
- 📋 Settings
- 👥 Assign roles
- 📊 Grades
- 👫 Groups
- 💾 Backup
- 🔁 Restore
- ➡️ Import
- ↩️ Reset
- 📈 Reports
- ❓ Questions

Weekly outline

MTH201 -Probability - Fall 2009
- 📄 MTH 201 Textbook, Policies, Office hours
- 🔷 Class announcements
- 🔷 Orientation

You MUST do the Orientation webwork. (You will get free credit for doing it.)
We use this to make sure that you are correctly signed up for the course in
Moodle and WeBWorK. Make sure that you click the "enrol me in course"
label in the left hand margin of this page.

---

31 August - 6 September   ☐
- ❓ Make your workshop choice here -- SOON

Lectures:
Sections 1.1,
1.2 Basic principles of counting;
1.3 Permutations
- 🔷 WeBWorK1 -- combinatorics
- 📊 If you can't attend any existing workshops leave a note here

---

7 September - 13 September   ☐

Lectures:
Sec: 1.4,Combinations
1.5, Multinomial cormefficients
1.6 (skim) Integer solutions of equations
- 📅 workshop 1

Print out a copy of workshop 1 and bring it with you to your first workshop
this week. It is a good idea to have worked as many problems as possible in

Latest News
Add a new topic...

17 Dec, 18:44
Michael Gage
grade cutoffs -- more...

17 Dec, 14:17
Michael Gage
and more grade adjustments .... :-
) !!!! more...

17 Dec, 11:57
Michael Gage
grades are really up? more...

17 Dec, 10:41
Michael Gage
Grades are up more...

16 Dec, 18:33
Michael Gage
grades will be ready Thursday --
probably around noon more...
Older topics ...

Upcoming Events
There are no upcoming events

Go to calendar...
New Event...

Cool projects

- Gamification -- MathAchievements -- Geoff Goehle
- Embed sage interacts -- John Travis, Jason Aubrey, et. al.
- Embed flash applets -- Barbara Margoulis, et. al.
- Embed Geogebra --
- Embed CalcPlot3d
- HTML5 applets
- Google Drive apps: power point, docs, spreadsheets, etc.
- Connect with Moodle, Blackboard, and LTI capable CMS's
- ---------------- coming soon
- EssayQuestions -- Geoff Goehle
- More robust versions of embedding.

Full Geogebra applet with debugging window

State is preserved from one viewing to the next!   local   internet cloud

Features to look for in demo:

- **Download a typeset copy of the entire homework set**

- Use gateway quiz or homework set mode

- Each student's homework set is different

- 'Email instructor' button aids communication

- Create homework sets from library with more than 12,000 problems.

- Precalculus, calculus 1 and 2, multivariable calculus

- Linear algebra, differential equations, statistics, classical physics

Universal design and other projects

- Localization -- WeBWorK in many languages
- Universal accessibility for all web pages

- Exploring joint projects with publishers - MAA, Wiley, Freeman
- PREP workshops developing "model courses" -- turn-key courses for WeBWorK
- BigData analysis of student learning?
- XSS -- cross site scripting security

Challenge: The Problem Library

Now called the WeBWorK Open Problem Library (OPL) because it has questions in languages other than English

Curating this library is an enormous task
  Not every question is the best question.
  There are duplicate or near duplicate questions.
  It should be easier to find the question you want. (indexing)

John Jones and Jeff Holt have a separate grant devoted to this issue.

Cost

- **WeBWorK is free and open source.**

  - The software can be downloaded from http://www.openwebwork.org or http://webwork.maa.org

  - Hosting for moderate size classes can be arranged with MAA -- go to http://webwork.maa.org

  - Setting up a server at your own institution costs less than 3000 USD for a small server and the time for setting up and configuring a unix server

  - Installing WeBWorK on a server running Apache with mod_perl, perl, TeX, mySQL and some other standard modules is fairly easy.

  - Depending on your experience installing the unix server initially might take a day.

Thank you

- Practice courses are at:
  - http://hosted2.webwork.rochester.edu/webwork2/maa101
  - http://hosted2.webwork.rochester.edu/webwork2/maa102
  - http://hosted2.webwork.rochester.edu/webwork2/maa103
  - ...

- Student login:
  - login: student1   password: student1

- Instructor login:
  - login: profa   password: profa

The End

- Finding information

- Getting involved

- http://webwork.maa.org/wiki

Demo

- To view a demo WeBWorK course as a student go to
  https://hosted2.webwork.rochester.edu/webwork2/maa101

  - use *student1* as a login and *student1* as password

- To view a demo WeBWorK course as an instructor go to
  https://hosted2.webwork.rochester.edu/webwork2/maa101

  - use *profa* as a login and *profa* as password

- Other copies of the course are available at
  maa102, maa103 and maa104

Community

- WeBWorK is open source (GPL) and is freely available.

- There are more than 12,000 questions available in the NPL (National Problem Library) + many more contributed.

- We can host (medium) courses on our servers at U of R. (email gage at math.rochester.edu)

- The community forums, documentation wiki, and links to software download sites are at

<u>http://webwork.maa.org</u>

Participation

- An open source community needs a small stream of participants to maintain the software and community.

- Specific tasks:

  - (Re)-organization, completion and improvement of documentation and tutorials so that the learning curve for newcomers is minimal and that institutional knowledge is not lost as "maintainers" are replaced.

  - Organization and distribution of questions. Make it easier to find the right existing question than to write your own from scratch.

  - Maintaining cohesive community -- help desk, emails, coordinating projects, coding, testing and releases.

  - Continued advocacy for new users and institutionalization.

  - New features and interoperability.

partial solutions

- ## Documentation: wiki

  - Good infrastructure: We still need more participation in updating/correcting/expanding docs.

- ## Community contact -- forum/bulletin board

  - (perhaps some newer social networking is called for? linkedIn, Facebook, ...??)

- ## Organizing library of questions:

  - We have a procedure for submitting new material but it's not well published yet. -- and still needs tweaking.

  - Editing and refereeing material not really addressed yet.

  - Maintaining metadata is not easy long term.

New Faces

- How to bring new faces into the "maintainer" group?

  - Identify incremental pathways for helping out and create frameworks that make it possible but still effective to just "help a little".

  - Invent a support mechanism for encouraging sustained effective participation despite separation across the world and the press of other commitments.

Ease of use

- Students

    - Requires only a browser and internet access. Easy to use.

    - Biggest complaint is about entry of complicated formulae -- ameliorated by the typeset preview feature

- Instructors

    - Requires only a browser and internet access. Easy to setup homework sets and to administer the class

    - Easy to tweak and customize problems

    - Moderate -- creating new problems similar to old ones.

    - Harder - creating new macros and response evaluators

    - Easy things are easy, harder things are still possible -- there are no artificial limits.

Screenshots

Code

```perl
 "MathObjects.pl",
 "PGcourse.pl" # should always be imported last
);

TEXT(beginproblem());
$showPartialCorrectAnswers = 0;

####################
#
#  Setup

Context("Interval");

$a = random(2,5,1);
$b = $a*random(-5,5,1);
$c = $a*random(3,10,1);

$answer = Compute("( -($b)/$a-$c/$a,-($b)/$a+$c/$a)");

####################
#
#  Text

Context()->texStrings;

BEGIN_TEXT
The interval described in set notation by the inequality$BR
\( |$a x + $b | < $c \) has interval notation: $BR $BR
\{ans_rule(20) \}
$BR
END_TEXT

Context()->normalStrings;

####################
#
#  Answers

ANS( $answer->cmp );

ENDDOCUMENT();          # This should be the last executable lin
```
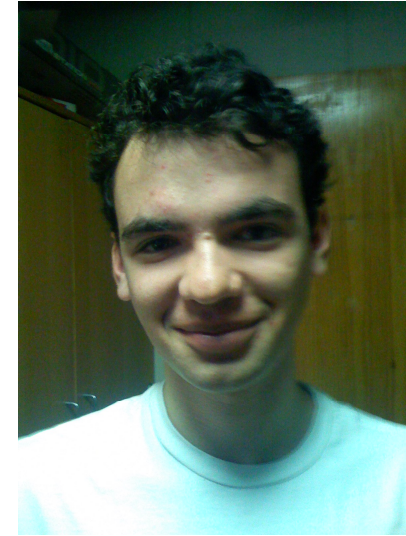
Community

some developers:

Sam Hathaway Davide Cervone Matt Leventi
Gavin LaRose   John Jones   Jason Aubrey

Community
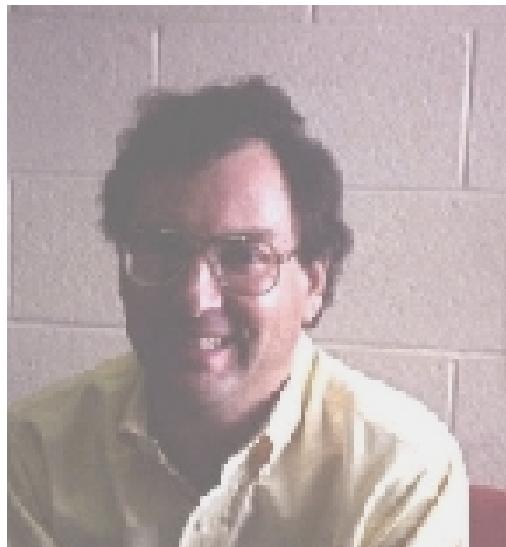

Co-PIs

Mike Gage   Arnie Pizer   Vicki Roth   Michael Pearson

University of Rochester   MAA

Timeline

- Fall 1996 - WeBWorK first used in classes at U of R
- Spring 1999 - NSF support for WeBWorK at U of R NSF
- Fall 1999 - WeBWorK received ICTCM award for Excellence and Innovation with the Use of Technology in Collegiate Mathematics ICTCM
- Spring 2003 - WeBWorK2 is first released
- Summer 2004 - MSRI sponsors WeBWorK programming workshop
- August 2007 - American Institute of Mathematics sponsors workshop on WeBWorK development and outreach
- 2009 -- WeBWorK 2.4.7 released
    - Moodle interoperability
    - flash, java and geogebra API's in beta
- Sept 2009 -- 5 year NSF dissemination grant to MAA for WeBWorK

Strengths

- ## WeBWorK is flexible and easily extensible

  - **Few limits: Ask the questions you *should*, not just the questions you can!**

  - Response evaluators can be written or customized for each problem.

  - A large number of standard response evaluators already exist -- ready to use.

  - WeBWorK's structure imitates TeX and LaTeX: There is an underlying basic and powerful language and an overlying collection of macros that make authorship of problems and response evaluators easier.

  - Math formulas are written using LaTeX. The algorithmic portions are written in PG which is a subset of Perl with customized macros (subroutines).

Why instructors like WeBWorK

Andrew Knightly, University of Maine

"WebWork combines the best features of these other programs in a very usable package. WebWork is the ONLY system that allows 1) Individualized (dynamic) Problems 2) Web Delivery 3) Grade and User Management 4) Extensive and useful problem sets and 5) User ability to create additional problems."