



The Future of Computers in Education

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Challenges in Speaking About Education (1)

- There is an Internet joke about the Oxford University Entrance Exam. Verbatim excerpts follow:

- B I O L O G Y

- Create life.

- Estimate the differences in subsequent human culture if this form of life had developed 500 million years earlier, with special attention to its probable effect on the English parliamentary system.

- Prove your thesis.

Challenges in Speaking About Education (2)

- S O C I O L O G Y

- Estimate the sociological problems which might accompany the end of the world.
- Construct an experiment to test your theory.

- P H Y S I C S

- Explain the nature of matter.
- Include in your answer an evaluation of the impact of the development of mathematics on science.

Challenges in Speaking About Education (3)

- Education is a vast and complex subject – like the Oxford University entrance exam
- Education experts do not agree on many issues
- And I am not an expert in education ...
- My purpose
 - Dream some with you
 - Share ideas I have been introduced to
 - Hope some ideas will be useful to you

My Five Questions

- Will computers be the teachers of the future?
- Does using computers result in better learning?
- Should we be spending more or less money for computer technology in education?
- What is constructivist learning and how are computers relevant?
- Do computers enable mastery learning?

Dreaming About Education

- What will the ideal education be like?
- Philosophers, educators, and science fiction writers have ideas
- Many different answers
 - Nostalgic, no technology: teacher and student sit on a log talking
 - Use technology
 - Science Fiction: Computer teaches
- Who is correct?

So Who Is Correct?

- Will not try to answer that
- Instead, a very quick story

A Quick Story About Education

**Mummy, today I taught
the dog to how to
play the piano.**



Impressive Results ...

**Amazing! Our dog
can play the
piano?**



The Actual Outcome

**Of course not. I said
that I taught him.
I did not say that
he learned.**



Constructivism

- “Constructivist learning theory says that
 - All knowledge is constructed from a base of prior knowledge
 - Children are not a blank slate
 - Knowledge cannot be imparted without the child making sense of it according to his or her current conceptions
 - Therefore children learn best when they are allowed to construct a personal understanding based on experiencing things and reflecting on those experiences.”

Constructivism

- “One of the primary goals of using constructivist teaching is
 - that students learn how to learn by giving them the training to take initiative for their own learning experiences.
- Characteristics of a constructivist classroom are as follows:
 - the learners are actively involved
 - the environment is democratic
 - the activities are interactive and student-centered
 - the teacher facilitates a process of learning in which students are encouraged to be responsible and autonomous“

Elements of an Ideal Education

- Each student
 - Learns at his/her own pace
 - Has available as much help as needed, when needed
 - Is able to determine whether his/her understanding is correct
 - Is allowed to follow interests
 - Achieves an appropriate level of mastery
 - Is able to apply the learning to other problems (transference)

No more theory

- For now ...

Examples of Computer-Based Learning

- Basic skills learning (only a mention today)
 - Reader Rabbit: teaches elementary reading & maths
 - Scratch: teaches children how to program by writing multimedia stories
 - Many others exist
- Automated marking and feedback
 - COW: mathematics
 - Maple TA: mathematics
 - Web-CAT: computer programming
- Complex learning environment
 - SimCity Societies: social science/urban planning simulation



Example Application: COW

- COW: Calculus On the Web
- “COW is an internet utility for learning and practicing calculus.”
- Currently supports precalculus, calculus, linear algebra, number theory, and abstract algebra

Example Application: COW

- “The principal purpose of COW is to provide you, the student or interested user, with the opportunity to learn and practice problems in calculus [...] in a friendly environment via the internet.”
- “The most important feature of the COW is that you get to know whether your answer is correct almost immediately. It is as if you had a tutor looking over your shoulder and helping you along as you work.”

Slope of the Line Passing Through Two Points

by

David Hartenstine, Matthias Beck and Molly M. Cow

In this module you can practice computing the slope of the line passing through two given points.

[Hints](#) about writing your answer...

1) Find the slope of the line passing through the points

$$(x_1, y_1) = (3, 0) \text{ and } (x_2, y_2) = (0, 3).$$

First, find the y-coordinate difference

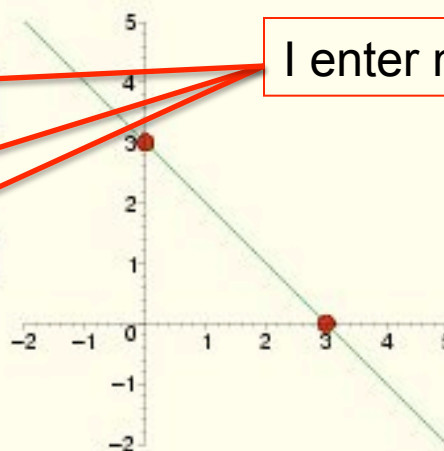
$$\Delta y = y_2 - y_1 = 3$$

And the x-coordinate difference

$$\Delta x = x_2 - x_1 = 3$$

Now compute the slope.

$$\text{slope} = 3/3$$



I enter my answers

[Check your answer](#)

[Next Problem](#)

[Previous Problem](#)

[Go to:](#)

2

[Help](#)

Typing problems? [Expression Interpreter](#) may help.

Slope of the Line Passing Through Two Points

COW Ex: p.2



I'm lost ... Are you lost too?

System response.
Highlighting is my addition
to improve visibility.

Your answer for Δx has the wrong sign, you must have reversed the points.
You were right to calculate the slope as $\Delta y / \Delta x$, but since this data was inaccurate, your answer should be recalculated.

1) Find the slope of the line passing through the points

$$(x_1, y_1) = (3, 0) \text{ and } (x_2, y_2) = (0, 3).$$

First, find the y-coordinate difference

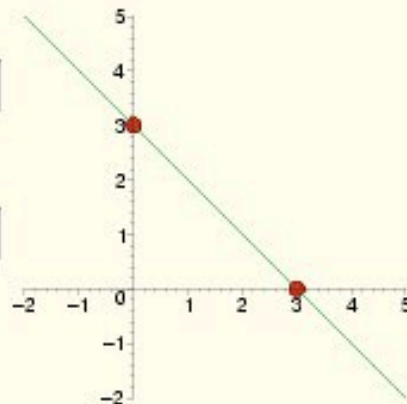
$$\Delta y = y_2 - y_1 = 3$$

And the x-coordinate difference

$$\Delta x = x_2 - x_1 = 3$$

Now compute the slope.

$$\text{slope} = 3/3$$



Check your answer

Next Problem

Previous Problem

Go to:

2

Help

[Expression Interpreter](#)

Slope of the Line Passing Through Two Points

COW Ex: p.3



I'm lost ... Are you lost too?

Your answer for Δx has the wrong sign, you must have reversed the points.

You were right to calculate the slope as $\Delta y / \Delta x$, but since this data was inaccurate, your answer should be recalculated.

1) Find the slope of the line passing through the points

$$(x_1, y_1) = (3, 0) \text{ and } (x_2, y_2) = (0, 3).$$

First, find the y-coordinate difference

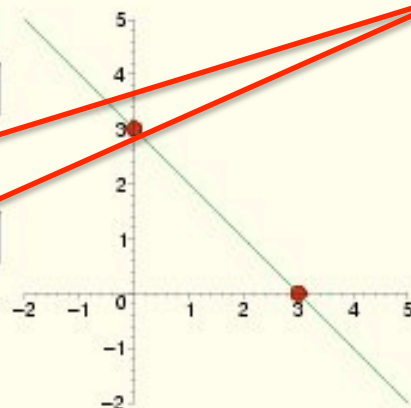
$$\Delta y = y_2 - y_1 = 3$$

And the x-coordinate difference

$$\Delta x = x_2 - x_1 = -3$$

Now compute the slope.

$$\text{slope} = -3/3$$



I fix my answers

Check your answer

Next Problem

Previous Problem

Go to:

2

Help

[Expression Interpreter](#)

Success!

Slope of the Line Passing Through Two Points

COW Ex: p.4



Good work, Ace.

I have the correct answer. Now for the next problem ...

<< Home

<< Books

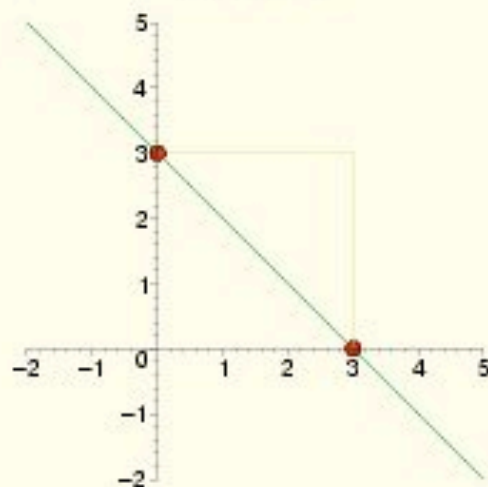
<< Chapters

<< Sections

<< Modules

The slope of the line passing through the points (3, 0) and (0, 3) is $-3/3$.

$$\Delta x = -3$$



$$\Delta y = 3$$

Next Problem

Previous Problem

Go to:

2

[Expression Interpreter](#)



Online Testing and Assessment ... Powered by Maple™

Maple T.A. is an easy-to-use web-based system for creating tests and assignments, automatically assessing student responses and performance. It supports complex, free-form entry of mathematical equations and intelligent evaluation of responses, making it ideal for mathematics, science, or any course that requires mathematics.



ANYTIME • ANYWHERE

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Maple T.A. 4.0

- [Key Features](#)
- [What's New in Maple T.A. 4.0](#)
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- ☒ **When you want confidence in your assessment technology.** Maple T.A. is developed by Maplesoft, a trusted name in education technology with years of experience developing products for technical academics

● [Maple T.A. makes online testing and assessment easy and cost effective](#)

Maple T.A. lets you offer tests anywhere, anytime. It does the marking for you, and makes it simple to analyze the results.

● [The power of Maple brings you the richest, most comprehensive system available for mathematics assessment!](#)

Open-ended free-response questions, 2-D and 3-D plots, and built-in mathematics and randomization tools are just some of the benefits of having Maple built-in.



Web-CAT

- “Web-CAT is a plug-in-based web application that supports electronic submission and automated grading of programming assignments.”
- Developed at Virginia Tech University
- My Fulbright Project was enhancing and introducing Web-CAT at the University of Mauritius
- U of M Department of Computer Science and Engineering is using Web-CAT
 - Used by 347 distinct students since March, 2009

Quick History of Automated Marking of Student Programs

- *Earliest I have found*: J. Hollingsworth, "Automatic Graders for Programming Classes", Communications of the ACM, October, 1960. Used punch cards.
- Papers I have found
 - 1960-1970: 3 papers
 - 1970-1980: 1 paper
 - 1980-1990: 11 papers
 - 1990-2000: 28 papers
 - 2000-present: 41+ papers
- A number of automated program marking systems are currently in use

Time: A Reason to Automate Marking

- Assume 100 students in the class; 1 marked assignment every two weeks; 5 minutes to process each assignment
- $100 \text{ students/assignment} * 5 \text{ minutes/student} = 8.3 \text{ hours/assignment} (\sim 1 \text{ day})$
- $8.3 \text{ hours/assignment} * 7 \text{ assignments/semester} = 14.5 \text{ working days/year}$
- **NOTE:**
 - 5 minutes per student is optimistic
 - For **very** simple assignments
 - Limited assessment by teacher
 - Almost no feedback to students

Another Reason to Automate Marking

- Consistent Marking of Assignments
 - Inter-rater and intra-rater reliability is difficult
 - Inter-rater: agreement among different people rating (marking) an artifact (document, program, painting, poem, etc.)
 - Intra-rater: agreement by the one person rating the same or an equivalent artifact at different different points in time

Your Program Is Finally Ready

- Program has been
 - Designed
 - Written
 - Tested
 - It is perfect!
- Submit it to Web-CAT
 - A unit-testing based computer system for marking student assignments
 - Primary development at Virginia Tech University
 - Installed also on the server “seal” at the University of Mauritius
- Go to “<http://seal.uom.ac.mu:8080/Web-CAT>”


Using Web-CAT: (1) Login

Web-CAT: Login

http://seal.uom.ac.mu:8080/Web-CAT/WebObjects/Web-CAT.woa

Apple (99) Amazon eBay Yahoo! News (749)

Web-CAT



Automatic Grading Using Student-written Tests

POWERED BY WebObjects

Welcome to the **Web Center for Automated Testing** (Web-CAT).
Only registered users may use Web-CAT. Please login:

User Name:

Password:

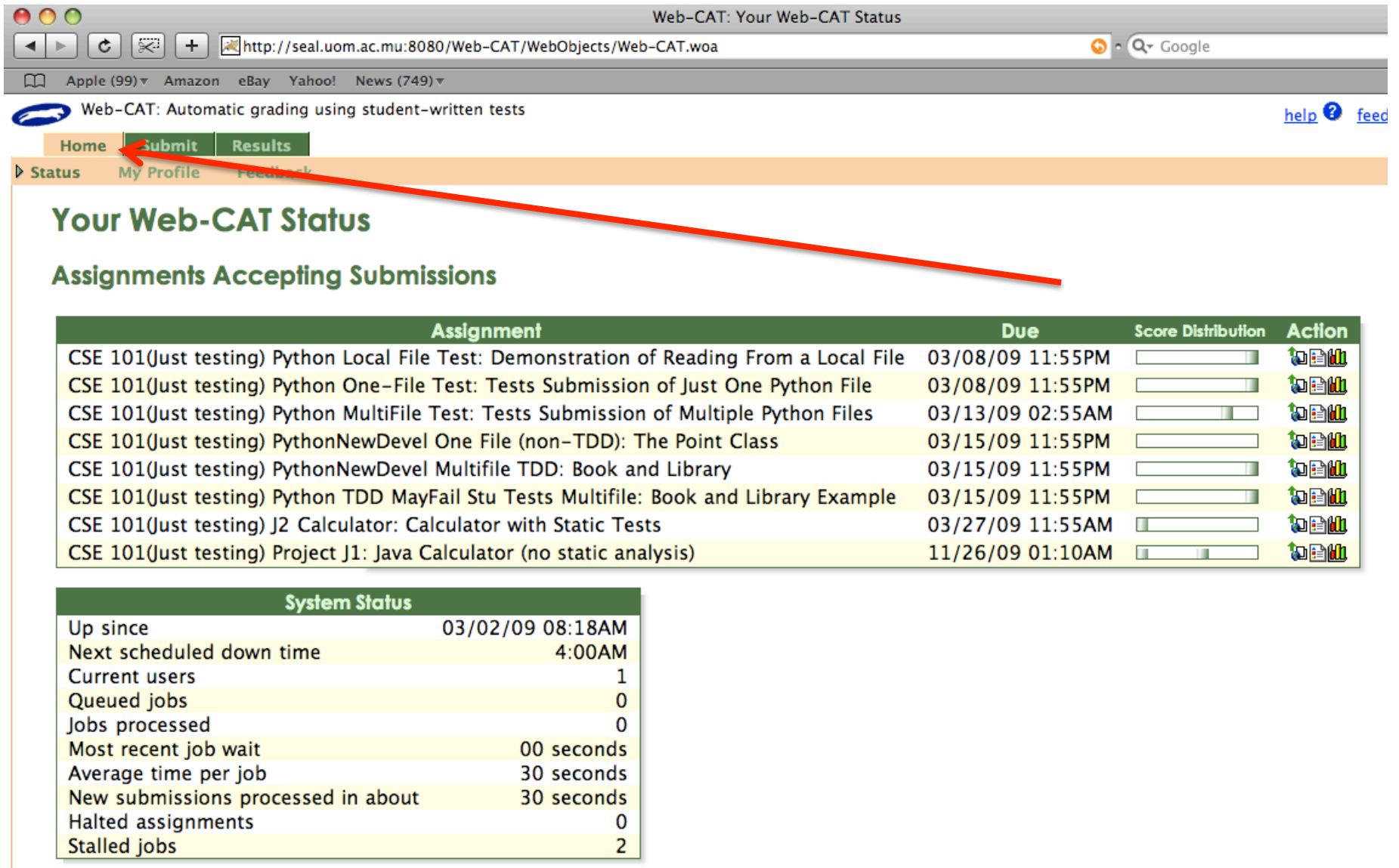
[Forgot your password?](#)

View **system status** using your **Home** tab after logging in.

If you teach at another university and are interested in using Web-CAT, pl
webcat@seal.uom.ac.mu.

[Web-CAT](#) is © 2006–2008 [Virginia Tech](#) | v1.4.0/2.5.19.20081108 | [Comments to webcat@seal.uom.ac.mu](#) | [Privacy statement](#)

Using Web-CAT: (2) Home Page



The screenshot shows a web browser window titled "Web-CAT: Your Web-CAT Status". The address bar shows the URL "http://seal.uom.ac.mu:8080/Web-CAT/WebObjects/Web-CAT.woa". The browser's search bar contains "Google". The page header includes a logo and the text "Web-CAT: Automatic grading using student-written tests". A navigation bar contains links: Home, Submit, Results, Status, My Profile, and Feedback. A red arrow points from the "Submit" link to the "Your Web-CAT Status" section. The main content area is titled "Your Web-CAT Status" and "Assignments Accepting Submissions". It contains a table of assignments with columns: Assignment, Due, Score Distribution, and Action. Below the table is a "System Status" section with a table of system metrics.

Web-CAT: Your Web-CAT Status

http://seal.uom.ac.mu:8080/Web-CAT/WebObjects/Web-CAT.woa

























Web-CAT: Automatic grading using student-written tests

Home Submit Results

Status My Profile Feedback

Your Web-CAT Status

Assignments Accepting Submissions

Assignment	Due	Score Distribution	Action
CSE 101(Just testing) Python Local File Test: Demonstration of Reading From a Local File	03/08/09 11:55PM	<div><div></div></div>	  
CSE 101(Just testing) Python One-File Test: Tests Submission of Just One Python File	03/08/09 11:55PM	<div><div></div></div>	  
CSE 101(Just testing) Python MultiFile Test: Tests Submission of Multiple Python Files	03/13/09 02:55AM	<div><div></div></div>	  
CSE 101(Just testing) PythonNewDevel One File (non-TDD): The Point Class	03/15/09 11:55PM	<div><div></div></div>	  
CSE 101(Just testing) PythonNewDevel Multifile TDD: Book and Library	03/15/09 11:55PM	<div><div></div></div>	  
CSE 101(Just testing) Python TDD MayFail Stu Tests Multifile: Book and Library Example	03/15/09 11:55PM	<div><div></div></div>	  
CSE 101(Just testing) J2 Calculator: Calculator with Static Tests	03/27/09 11:55AM	<div><div></div></div>	  
CSE 101(Just testing) Project J1: Java Calculator (no static analysis)	11/26/09 01:10AM	<div><div></div></div>	  

System Status

Up since	03/02/09 08:18AM
Next scheduled down time	4:00AM
Current users	1
Queued jobs	0
Jobs processed	0
Most recent job wait	00 seconds
Average time per job	30 seconds
New submissions processed in about	30 seconds
Halted assignments	0
Stalled jobs	2

Using Web-CAT: (3) Submit Tab



Web-CAT: Automatic grading using student-written tests

Home

Submit

Results

▶ New Submission

New Submission

▶ Step 1

Pick the course

Step 2

Pick the assignment

Step 3

Upload your file(s)

Step 4

Confirm your submission

Step 5

View your results

Pick the Course

Show courses for:


You are **enrolled in** these courses:

Course		Name
<input checked="" type="radio"/>	CSE 101(Just testing)	Test Class

Next >

Cancel

Using Web-CAT: (4) Choose Assignment

 Web-CAT: Automatic grading using student-written tests [help ?](#)

[Home](#) [Submit](#) [Results](#)

▶ New Submission

New Submission

Step 1
Pick the course

▶ Step 2
Pick the assignment

Step 3
Upload your file(s)

Step 4
Confirm your submission


Step 5
View your results



Pick the Assignment

For: **CSE 101(Just testing): Test Class**

	Assignment	Due
<input type="radio"/>	Python Local File Test: Demonstration of Reading From a Local File	03/08/09 11:55PM
<input type="radio"/>	Python One-File Test: Tests Submission of Just One Python File	03/08/09 11:55PM
<input type="radio"/>	Python MultiFile Test: Tests Submission of Multiple Python Files	03/13/09 02:55AM
<input type="radio"/>	Python TDD MayFail Stu Tests Multifile: Book and Library Example	03/15/09 11:55PM
<input checked="" type="radio"/>	PythonNewDevel Multifile TDD: Book and Library	03/15/09 11:55PM
<input type="radio"/>	PythonNewDevel One File (non-TDD): The Point Class	03/15/09 11:55PM
<input type="radio"/>	J2 Calculator: Calculator with Static Tests	03/27/09 11:55AM
<input type="radio"/>	Project J1: Java Calculator (no static analysis)	11/26/09 01:10AM

Using Web-CAT: (5) Read Instructions

 Web-CAT: Automatic grading using student-written tests

[help](#)  [feedback](#)  [login](#)

[Home](#) [Submit](#) [Results](#)

▶ New Submission Wilma Flint

New Submission

Step 1
Pick the course


Step 2
Pick the assignment

▶ Step 3
Upload your file(s)

Step 4
Confirm your submission

Step 5
View your results

Upload Your File(s)

For: **CSE 101(Just testing) PythonNewDevel Multifile TDD: Book and Library**  [Perma](#)

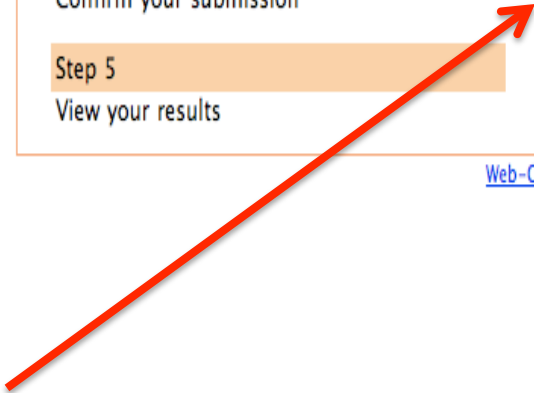
This is your first submission for this assignment.

Upload zip with 'book.py', 'booktests.py', 'library.py' and 'librarytests.py'. All of your tests MUST PASS before any other marking activities will take place.


Choose the file to upload:

no file selected

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Using Web-CAT: (6) Attach File(s)

 Web-CAT: Automatic grading using student-written tests

[Home](#) [Submit](#) [Results](#)

▶ New Submission

New Submission

Step 1

Pick the course

Step 2

Pick the assignment

▶ Step 3

Upload your file(s)

Step 4

Confirm your submission

Step 5

View your results

Upload Your File(s)


For: **CSE 101(Just testing) PythonNewDevel Multifile TDD: Book and**

This is your first submission for this assignment.

Upload zip with 'book.py', 'booktests.py', 'library.py' and 'librarytests.py'.
other marking activities will take place.

Choose the file to upload:

Choose File

 lib-student...D-good.zip

< Back

Next >

Cancel

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Using Web-CAT: (7) Confirm Submission



Web-CAT: Automatic grading using student-written tests

[Home](#)

[Submit](#)

[Results](#)

▶ [New Submission](#)

New Submission

[Step 1](#)

Pick the course

[Step 2](#)

Pick the assignment

[Step 3](#)

Upload your file(s)

▶ [Step 4](#)

Confirm your submission

[Step 5](#)

View your results

Confirm Your Submission

For: **CSE 101(Just testing) PythonNewDevel Multifile TDD: Book and Library**

Please make sure that these files constitute your full submission, and that you have not a incorrect file.

File	Size
book.py	324 bytes
library.py	986 bytes
booktests.py	1.3kb
librarytests.py	1.7kb

Click the **Next** button to confirm your submission.


You cannot take back a submission once you have clicked **Next**. If you wish to make any button instead.

[< Back](#)

[Next >](#)

[Cancel](#)


Using Web-CAT: (8) Wait for Results

 Web-CAT: Automatic grading using student-written tests [help](#) [feedback](#) [logout](#)

[Home](#) [Submit](#) [Results](#)

▶ [Most Recent](#) [Past Results](#) [Graphs](#) Wilma Flintstone

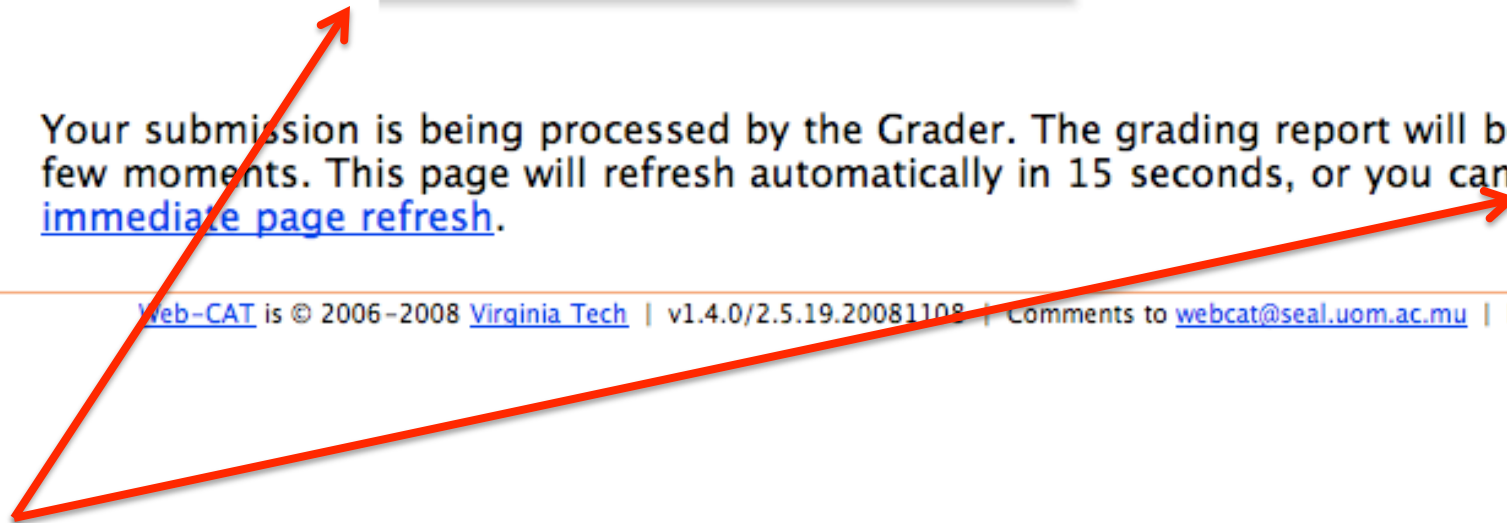
Your Assignment Submission Results



Submission Status	
Queued jobs	1
Most recent job wait	03 seconds
Your queue position	1
Your estimated wait	02 seconds

Your submission is being processed by the Grader. The grading report will be generated in a few moments. This page will refresh automatically in 15 seconds, or you can [request an immediate page refresh](#).

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Using Web-CAT: (9) Overview of Results



Web-CAT: Automatic grading using student-written tests

[Home](#)[Submit](#)[Results](#)[▶ Most Recent](#)[Past Results](#)[Graphs](#)

Your Assignment Submission Results

[Submit Again](#)

Assignment Name	CSE 101(Just testing): PythonNewDevel Multifile TDD try #1 Wilma Flintstone (flinstone2)
Submitted	03/02/09 08:43AM, 13 days, 15 hrs, 11 mins early
Total Score	0.0 / 100.0

[Full Printable Report](#)

[+ Results From Running Your Tests \(85.7%\)](#)

[+ Interpreting Your Correctness/Testing Score \(0/100\)](#)

[Your original submission](#)[Download Selected File](#)

Using Web-CAT: (10) Examine Details

Assignment Name	CSE 101(Just testing): PythonNewDevel Multifile TDD try #3
Submitted	Wilma Flintstone (flinstone2)
Total Score	03/02/09 08:46AM, 13 days, 15 hrs, 8 mins early
	0.0/100.0

[Full Printable Report](#)

[-] Results From Running Your Tests (85.7%)

Summary: 7 cases (1 failure, 0 errors)

```
Testing module 'book'
...
-----
Ran 3 tests in 0.000s
OK

Testing module 'library'
.F..
-----
FAIL: getBook: Test getting an invalid book from library
AssertionError: Book incorrectly found
-----
Ran 4 tests in 0.001s
FAILED (failures=1)
```

[+] Interpreting Your Correctness/Testing Score (0/100)

Using Web-CAT: (11) Interpret Score

Submit Again

 [Permalink](#)

Assignment Name	CSE 101(Just testing): PythonNewDevel Multifile TDD try #3
Submitted	Wilma Flintstone (flinstone2)
Total Score	03/02/09 08:46AM, 13 days, 15 hrs, 8 mins early
	0.0 / 100.0

Full Printable Report

+ Results From Running Your Tests (85.7%)

- Interpreting Your Correctness/Testing Score (0/100)

This assignment requires that all student tests pass before any other results are computed.

Because some of your tests failed, only the results of your testing are shown and your score will be zero until your code passes all your tests.

Results from running your tests: 85.7%

No other tests attempted 0%

score = 85.7% * 0% * 100.0 points possible = 0

Full-precision (unrounded) percentages are used to calculate your score, not the rounded numbers shown above.

Oops! Your code was not quite perfect

- There are a number of possible problems
 - Your code does not pass your own tests (optional marking)
 - Your tests do not test all of your code (optional marking)
 - Your code does not pass the instructor's tests
- The assignment can also be set up to
 - Check your code style
 - Require that your code passes your tests before any other marking is done
- If you did your own testing before submitting and examine your code, a number of these problems can be avoided

Fix, Test, and Resubmit

- Repeat until perfect

- Examine test results

- Look at your code

- Find the errors

- Fix them

- Test your code

- Resubmit

```
def __init__(self, tests=()):  
    self._tests = []  
    self.addTests(tests)
```

```
def __repr__(self):  
    return "%s(%s)" % (self.__class__, self._tests)
```

```
def countTestCases(self):  
    cases = 0  
    for test in self._tests:  
        cases = cases + test.countTestCases()
```

```
def addTest(self, test):  
    self._tests.append(test)
```

```
def addTests(self, tests):  
    for test in tests:  
        self.addTest(test)
```


Iteration Does Make Perfect

Your Assignment Submission Results

[Submit Again](#)

 [Permalink](#)

Assignment Name	CSE 101(Just testing): PythonNewDevel Multifile TDD try #4 Wilma Flintstone (flinstone2)
Submitted	03/02/09 09:02AM, 13 days, 14 hrs, 52 mins early
Total Score	100.0/100.0

Score Summary		
Correctness/Testing:	100.0/100.0	<div><div></div></div>
Final score:	100.0/100.0	<div><div></div></div>

Position in class: [Show Graphs](#)

[Full Printable Report](#)

[+ Results From Running Your Tests \(100%\)](#)

[+ Code Coverage from Your Tests \(100.0%\)](#)

[+ Results From Running Your Instructor's Tests \(100%\)](#)

[+ Interpreting Your Correctness/Testing Score \(100/100\)](#)

Benefits of Automated Marking

- Students
 - Have an always available tutor
 - Receive fast, reasonable quality, and consistent feedback
 - Have support to achieve mastery
 - Know at all times how well they are doing
- Teachers
 - More likely to assign the quantity of work that students need
 - Are freed to use their time for individual attention at school
 - Can reallocate much of time spent marking, to lesson preparation and personal learning

Quality of Automated Marking

- Cite three examples
 - RUReady: “Online parsing system that produces partialcredit scoring of students’ constructed responses to mathematical questions”
 - Educational Testing Service: “Comparing The Validity Of Automated And Human Scoring Of Essays”
 - Automatic Essay Assessor: “Move from fully automatic grading towards semi-automatic assessment”

RUReady

- Paper title: “Can Automated Scoring Surpass Hand Grading of Students' Constructed Responses and Error Patterns in Mathematics?”
 - Immediate error analysis for each student response.
 - The parser scoring was validated against human scoring of 207 realworld student responses
 - Software generates more consistent scores than teachers in some cases.
- Overall, the parser’s total scoring closely matched human scoring, but the machine was found to surpass humans in systematically distinguishing between students’ error patterns.

Educational Testing Service (ETS)

- Paper title: “Comparing The Validity Of Automated And Human Scoring Of Essays”
- “Automated, or computer-based, scoring represents one promising possibility for improving the cost effectiveness (and other features) of complex performance assessments (such as direct tests of writing skill) that require examinees to construct responses rather than select them from a set of multiple choices. Indeed, significant advances have been made in applying natural language processing techniques to the automatic scoring of essays.”
- Overall: Interesting and impressive, but not quite ready.

Automatic Essay Assessor (AEA)

- “While an automatic grading module forms the backbone of any essay assessment system, recent research on automatic assessment has been directed toward more transparent and detailed measures of essay quality. The idea in AEA is to move from fully automatic grading towards semi-automatic assessment.”
- “Provides scores for different components of the essay such as the content, the writing style, and the structure of argumentation.”
- “Support teachers during the evaluation process”
- “Help students to reflect on their learning process as early as possible and point out the strong and weak aspects of an essay.”

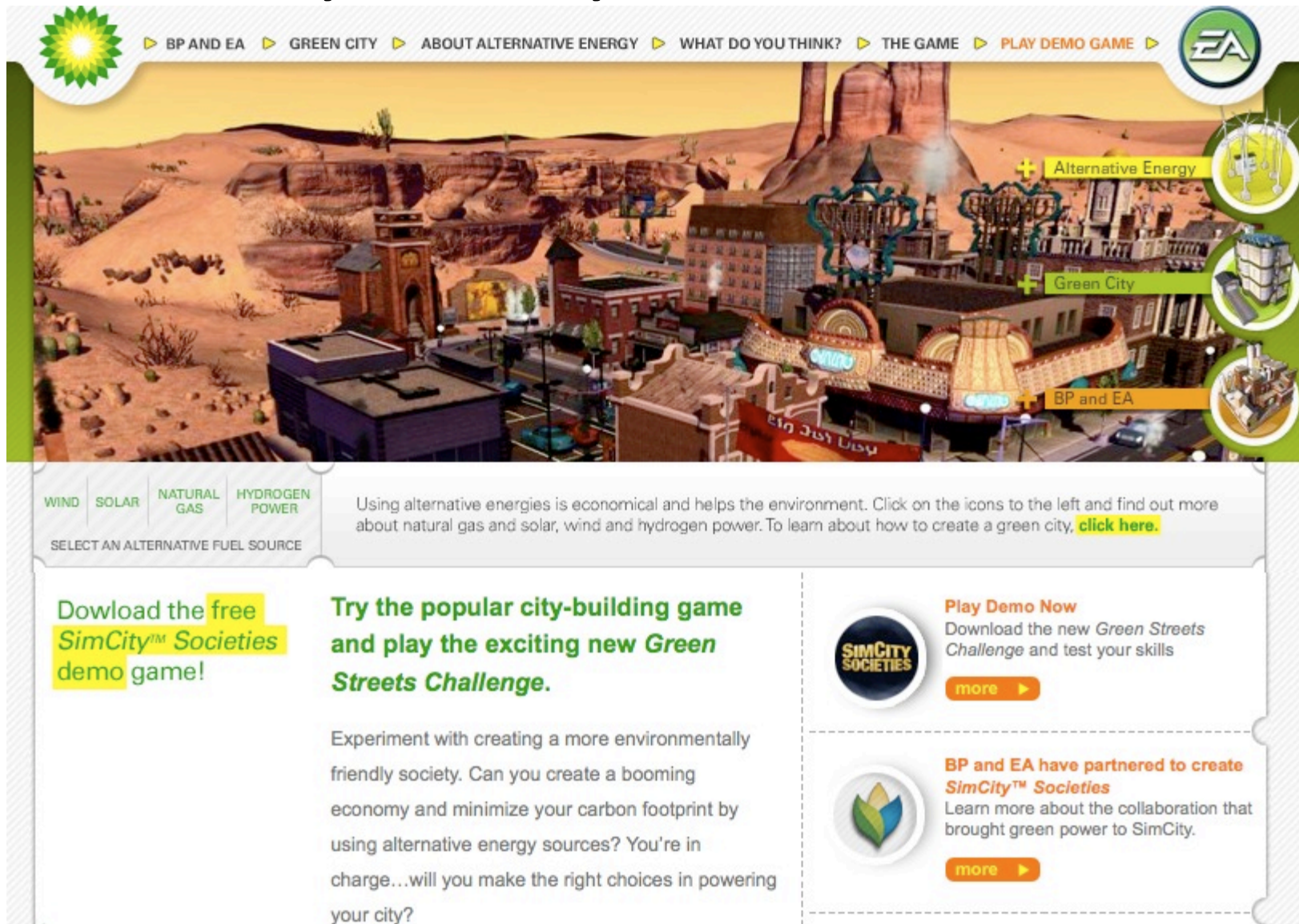
Automatic Essay Assessor (AEA)

- “NLP techniques, such as automatic summarization, the detection of rhetorical structure and writing style, are applied in state-of-the-art assessment systems.”
- “This paradigmatic shift from teacher-centered assessment towards learner-centered process evaluation offers interesting challenges to educational technologists and NLP researchers. We are currently developing following methods that enable semi-automatic assessment:
 - Automatic feedback generation
 - Plagiarism detection
 - Visualization of evaluation results”

SimCity Society



SimCity Society + BP = Green Streets



BP AND EA ▶ GREEN CITY ▶ ABOUT ALTERNATIVE ENERGY ▶ WHAT DO YOU THINK? ▶ THE GAME ▶ PLAY DEMO GAME ▶

Alternative Energy

Green City

BP and EA

WIND SOLAR NATURAL GAS HYDROGEN POWER

SELECT AN ALTERNATIVE FUEL SOURCE

Using alternative energies is economical and helps the environment. Click on the icons to the left and find out more about natural gas and solar, wind and hydrogen power. To learn about how to create a green city, [click here](#).

Download the free **SimCity™ Societies** demo game!

Try the popular city-building game and play the exciting new Green Streets Challenge.

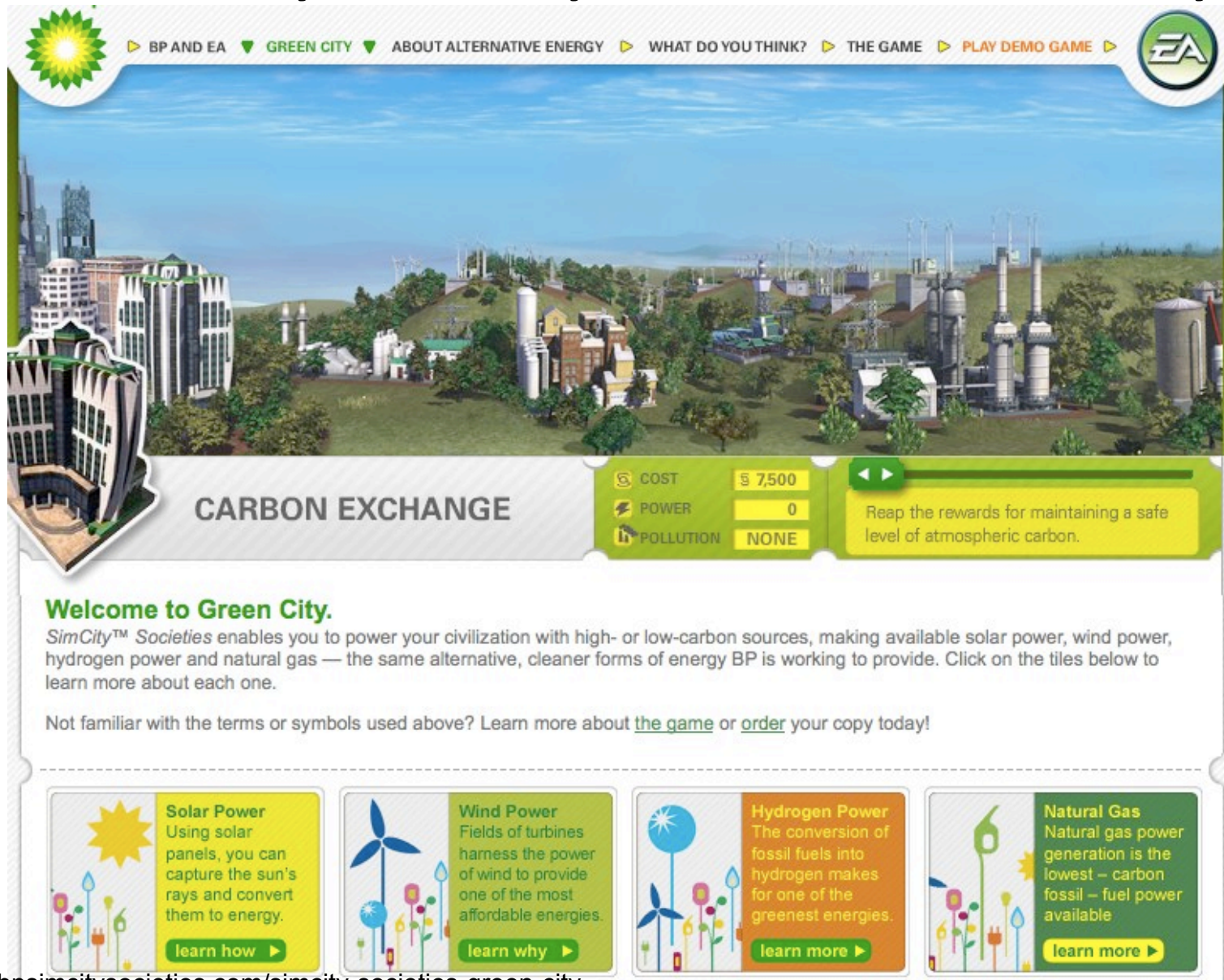
Experiment with creating a more environmentally friendly society. Can you create a booming economy and minimize your carbon footprint by using alternative energy sources? You're in charge...will you make the right choices in powering your city?

Play Demo Now
Download the new *Green Streets Challenge* and test your skills
[more ▶](#)

BP and EA have partnered to create SimCity™ Societies
Learn more about the collaboration that brought green power to SimCity.
[more ▶](#)

<http://bpsimcitysocieties.com>

SimCity Society + BP = Green City



BP AND EA GREEN CITY ABOUT ALTERNATIVE ENERGY WHAT DO YOU THINK? THE GAME PLAY DEMO GAME EA

CARBON EXCHANGE

COST	\$ 7,500
POWER	0
POLLUTION	NONE

Reap the rewards for maintaining a safe level of atmospheric carbon.

Welcome to Green City.

SimCity™ Societies enables you to power your civilization with high- or low-carbon sources, making available solar power, wind power, hydrogen power and natural gas — the same alternative, cleaner forms of energy BP is working to provide. Click on the tiles below to learn more about each one.

Not familiar with the terms or symbols used above? Learn more about [the game](#) or [order](#) your copy today!

Solar Power
Using solar panels, you can capture the sun's rays and convert them to energy.

[learn how](#)

Wind Power
Fields of turbines harness the power of wind to provide one of the most affordable energies.

[learn why](#)

Hydrogen Power
The conversion of fossil fuels into hydrogen makes for one of the greenest energies.

[learn more](#)

Natural Gas
Natural gas power generation is the lowest – carbon fossil – fuel power available.

[learn more](#)

<http://bpsimcitysocieties.com/simcity-societies-green-city>

SimCity Society “Trailer 1”



SimCity 4: Rush Hour Demo

The logo for SimCity 4: Rush Hour Expansion Pack is displayed against a black background. The word "SIMCITY" is in large, yellow, 3D block letters. The number "4" is in a large, red, 3D block font. Below "SIMCITY4", the words "RUSH HOUR" are written in white, bold, sans-serif capital letters. At the bottom, the words "EXPANSION PACK" are written in a smaller, white, sans-serif capital font.

SIMCITY4
RUSH HOUR
EXPANSION PACK

Challenges in Education

- Cost
 - Access
 - Methods
 - Results
-
- Many more
 - Not insurmountable obstacles

Example: Cost of Computers

- One Laptop Per Child (\$200)
 - laptop.org/en
- Amazon Kindle 2 (US \$350)
 - <http://www.amazon.com/Kindle-Amazons-Wireless-Reading-Generation/dp/B00154JDAI>
- Netbook computers (US \$300+)
 - The Netbook Effect: How Cheap Little Laptops Hit the Big Time,
http://www.wired.com/gadgets/wireless/magazine/17-03/mf_netbooks

Amazon Kindle 2 e-Reader



Sample Online Digital Resources

- Online textual material
 - eGranary Digital Library: over 10 million resources
www.widernet.org/digitallibrary
 - Google Books: books.google.com
 - Project Gutenberg: www.gutenberg.org
- Online video material
 - YouTube: astounding numbers of educationally useful short and long video clips
<http://youtube.com>

My Thoughts About Computer Resources

- Just providing equipment + software is not good enough
 - Must be integrated into curriculum
 - Teachers must truly know how to use it
 - Teachers must have proper support
- Properly done => Hard work and money
- Collaboration is necessary
- Properly done => Greatly enhanced learning

Return to the Five Questions

What do you think?

- Will computers be the teachers of the future?
- Does using computers result in better learning?
- Should we be spending more or less money for computer technology in education?
- What is constructivist learning and how are computers relevant?
- Do computers enable mastery learning?

Questions or Comments

- Your chance ...
- P.S.: This presentation is available at <http://seal.uom.ac.mu/Brandle>
- My email: sbrandle@cse.taylor.edu

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