



*Adding Interactive Components to
a Web-based Chemistry Course*

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Dynamics of a web-based course

Shift in focus

- From reliant on instructor to self reliant
- From passive learning to active learning



Creating the “active learning” course

- Interactive / constructivist approaches
 - questions & immediate feedback
 - instruction that changes with individual student needs
 - puzzles
- Motivation
 - activities must hold the student's interest
- Take advantage of technological abilities
 - randomization, grading, feedback



Assessment of activities

Amount

- Does amount matter?

Enough already!

- distracting
- tedious

Give me more!

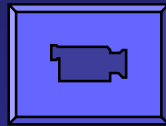
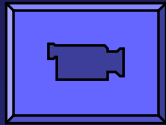
- feel ill prepared

Quality

- What's the role of the activity?
- Can we quantify its effect?
- Is the activity enjoyable?
- Is the activity valuable?

Chem1

Example of lecture material





Activities added

- Flash quiz
- Crossword Puzzles
- Logic Puzzles
- Novellas
- Question Generator



Flash quiz activity

Benefits of flash quizzes

- Provides active response format for students
- Change of pace within instructional material
- Immediate feedback to students
- Allows instructors to emphasize key concepts
- Stores responses for instructors

Flash quiz activity

Examples

Flash Quiz #1

Flash Quiz #2

Flash Quiz #3

Flash Quiz #4

Flash Quiz #5

Student Opinion

“clicky”, cumbersome

Easy/quick

know what will be on the quiz

“cool”, helpful

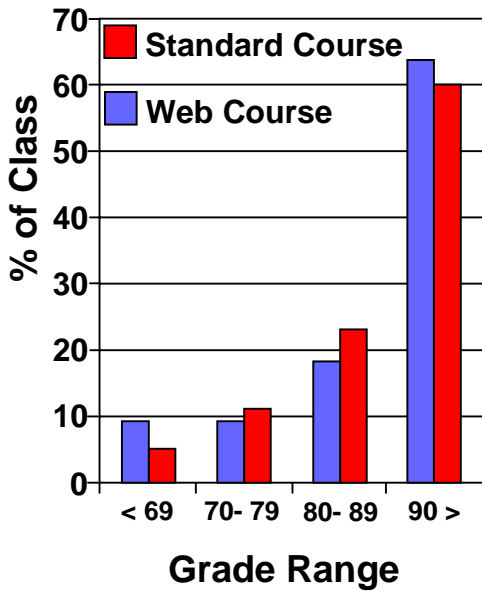
Flash quiz activity

Grade Distributions

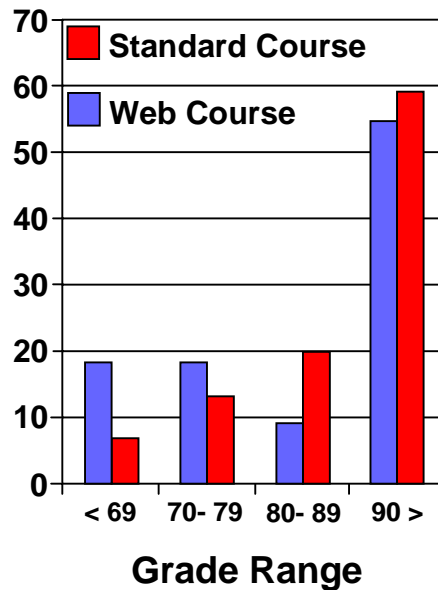


Change in format

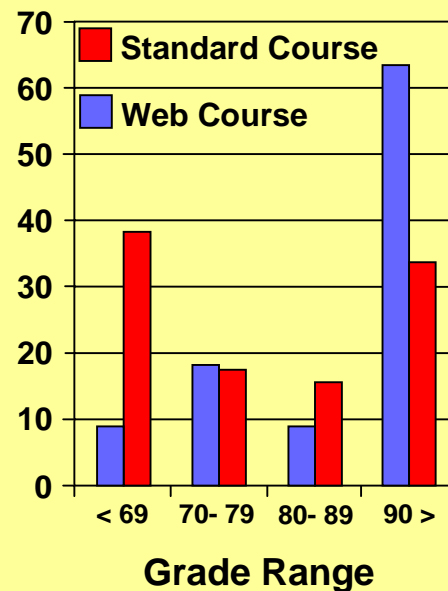
Exam 1 Grade Distribution



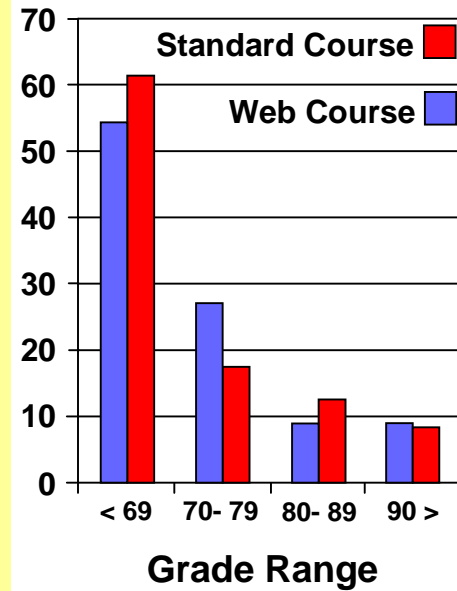
Exam 2 Grade Distribution



Exam 3 Grade Distribution



Exam 4 Grade Distribution





Future work on flash quizzes

- Quantify gains in student understanding
 - Concept map exercise
- Define role of flash quizzes
 - Reinforcement activity
 - Application of concepts
- Create instructor interface
 - Ease construction of flash quizzes
 - Increased flexibility of formats



Crossword puzzles

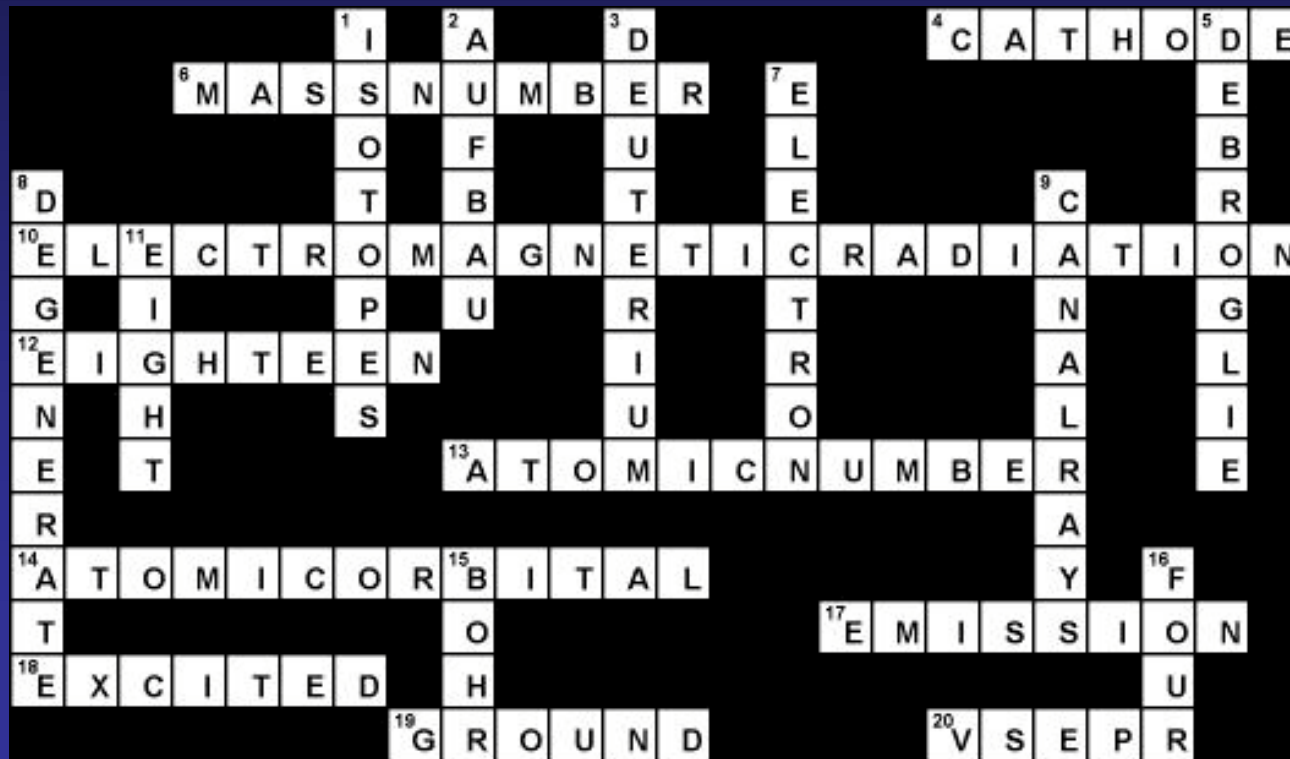
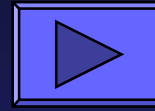
- Technical vocabulary mastery
- Factual knowledge vs. Practical skills

“Recent developments in science curricula have often tended to adjust the balance between process and content, between knowledge and practical skills. Chemistry is an inherently practical subject, yet it is important that students build up a sound foundation of factual knowledge.”

-Cotton (1998)

The role of crossword puzzles

- Preparatory Activity





Benefits of crossword puzzles

- Interactivity / Active learning
 - student must find answers
- Motivation

“...any other mechanism that would provide students with more nomenclature practice, especially in a way that would remove some of the tedium of the task by making it more of a game, would seem to be useful.”

-Mullin & Courtney (1996)
- Immediate grading & feedback



Future work on crosswords

- Qualitative Assessment

HYPOTHESIS

- Vocabulary mastery leads to better understanding of material
- Crosswords are more interesting than traditional vocab exercises

SAMPLE QUESTION

- How well did the crossword prepare you for the chapter material?
- Did you enjoy completing the crossword?

- Randomize



Activity for practical skills?

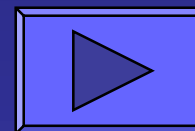
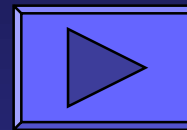
Logic Puzzles

- Application of concepts
- Constructivist approach

Logic puzzles

- Periodic table puzzle
 - elemental properties
 - concepts of periodicity

- Ten Solutions puzzle
 - ‘virtual lab’
 - qualitative analysis





Benefits of logic puzzles

- Interactivity / Active learning
- Motivation
 - interesting / challenging activity
- Collaboration
 - randomized information
 - share 'why' and 'how'
- Immediate grading and feedback
 - monitor learning



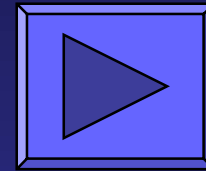
Future work on logic puzzles

- Quantitative Assessment
 - pre-test/post-test
- Qualitative Assessment
 - did you like the logic puzzle?
 - how much did it help your understanding?
- Progression of difficulty

Novella

What is a novella?

- Ill-structured problem
 - Ambiguity
 - Drives group work
- Application of concepts
- Broad in scope
- Provides “real-world” examples
- Keep students from falling behind



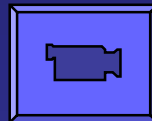


Evaluation of the novella

- Equivalent to standard homework
 - Exam scores
- Make connections between different concepts
 - Concept map scores
- Work in groups to solve larger questions
 - Web board participation

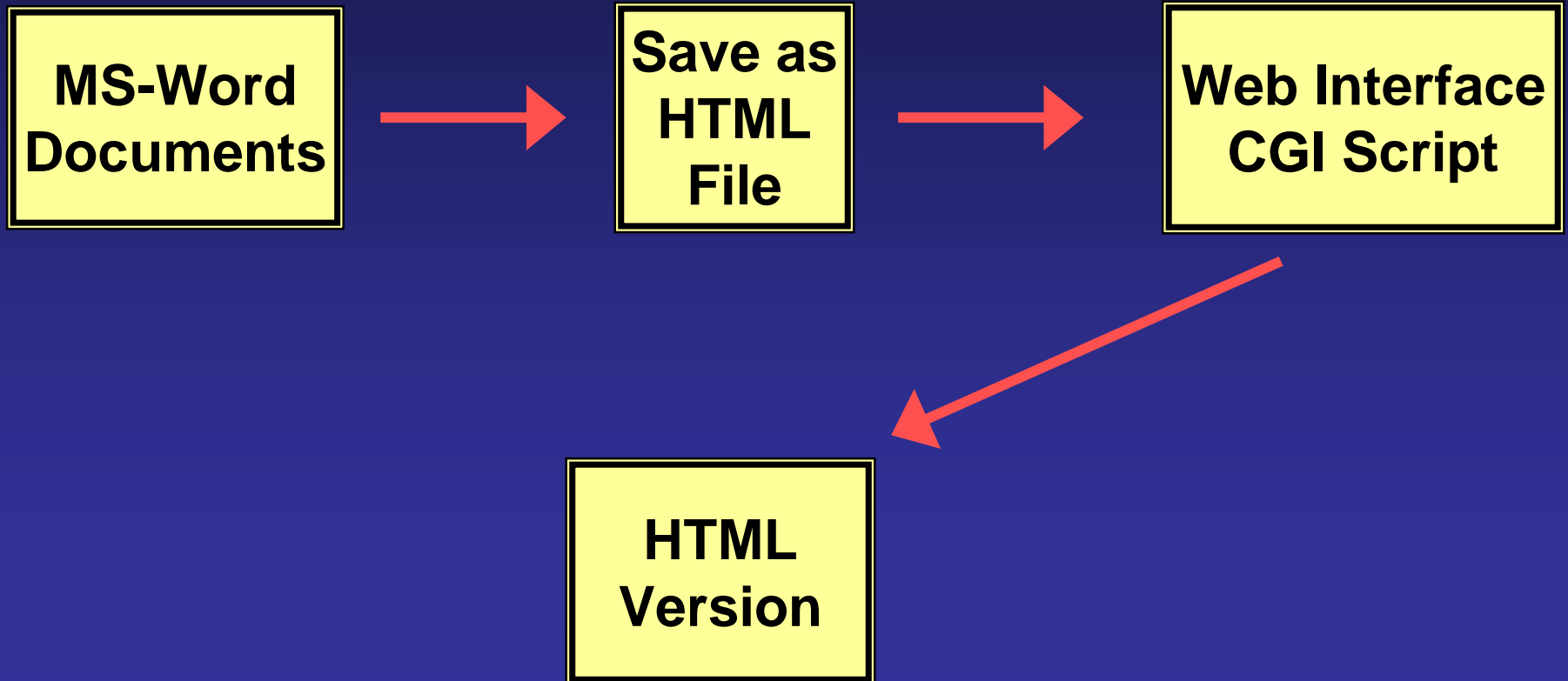
Concept Map Assessment Tool

- Concept maps represent structured knowledge
- Online concept map activity for assessment
- Grading algorithms prepared by instructor
- Example



Question generator

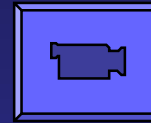
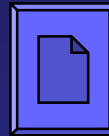
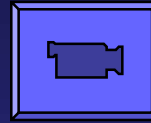
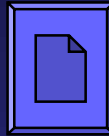
Basic Idea



Question generator

Uses

- Review sheets
- Exam review
- Homework





Concluding thoughts

- **Activities can add interactivity to a course**
- **Quality of activities must be assessed**
 - **Pedagogy**
 - **Student Enthusiasm**



References

- Cotton, Simon (1998). Extended Wordsearches in Chemistry. Journal of Chemical Education. v75 n4, p.489-90
- Mullin, J. & Courtney, P. (1996). Using Inexpensive “Find & Circle” Word Search Software in the Study of Chemical Nomenclature. Journal of Chemical Education. v73 n6, pA130