Online assessment in first year physics

“Evolution not revolution”
L. McDermott, CAP Congress 2005

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Motivation

Retain a significant coursework component
Improve student’s problem solving skills

Outline

1. Course Structure
2. Online ASsessment and Integrated Study (OASIS) software
3. OASIS Statistics
4. Student Surveys
5. Future
6. Conclusions
Course Structure

- Physics for the Life Sciences (Physics 160)
  - First Semester City Campus 2004 (FC04)
    - ~ 200 students
  - Second Semester City Campus 2004 (SC04)
    - ~ 450 students

- Advancing Physics Courses
  - Physics of Energy (Physics 120FC04)
    - ~ 200 students
  - Physics of Technology (Physics 150SC04)
    - ~ 200 students
Course Structure

Physics for the Life Sciences (Physics160)

- 4 OASIS practice assignments
- 6 questions released one week before assessment
Course Structure

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- 4 OASIS assessments (15 %)
  - 4 questions similar to practice assignment questions
    - assessed over a 24 hour period
    - 1 hour to complete
    - open-book/open-note
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- Laboratories (10 %)
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Similar structure for advancing physics courses
If you were forced to adopt online assessment, ...

but could choose the most important feature ...
If you were forced to adopt online assessment, ...

but could choose the most important feature ...

• What would it be?
If you were forced to adopt online assessment, ...

but could choose the most important feature ...

• What would it be?
• Text your answer to r.kruhlak@auckland.ac.nz
If you were forced to adopt online assessment, ...

but could choose the most important feature ...

• What would it be?

• Text your answer to r.kruhlak@auckland.ac.nz

• Did you know that your cell phone could text to e-mail?
If you were forced to adopt online assessment, ...

but could choose the most important feature ...

- What would it be?
- Text your answer to r.kruhlak@auckland.ac.nz
- Did you know that your cell phone could text to e-mail?
- Online learning tools are only one piece in the puzzle
Advantages/Disadvantages

• List some advantages of online assessment
• List some disadvantages of online assessment
Welcome to Oasis
(version 3.5 - released October 2004)

This is a new upgrade, so some bugs may have sneak ed in. Please report any problems or suggestions you have to oasis@ece.auckland.ac.nz.

Oasis contains several sections:

**News**
The latest news and information about Oasis.

**Assess**
This is where you should go for terms-tests and assignments. Work under this area may contribute to your real coursework marks, so be sure to practice first.

You may also Logout to leave Oasis.

**Practice**
Allows you to practice solving a near endless supply of exercises. Oasis will mark these for you so you know how you are doing.

**Setup**
Here you can change your password. Teaching staff can also set up new questions, administer assignments, and perform related tasks.

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OASIS

- Practice
  - Randomly generated question data
  - Instant feedback
  - Open 24 hours a day
  - No time limit

Select a Subcategory

PHYSICS 160 (Physics for the Life Sciences)

The following categories are available to this course:

PHYSICS 160
- Assignment1(SC04)  (6 questions)
- Assignment2(SC04)  (6 questions)
- Assignment3(SC04)  (6 questions)
- Assignment4(SC04)  (6 questions)

Return to course selection.
OASIS

- Practice
  - Randomly generated question data
  - Instant feedback
  - Open 24 hours a day
  - No time limit

- Assess
  - Timed Assessment
  - Instant feedback
  - Automatic Marking

Available Assessments

- Assessment Two 2004-08-18 08:00 2004-08-19 08:00 60

Past Assessments

- Assessment One 2004-08-04 08:00 2004-08-05 08:00 60

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Oasis Question Types

- Numeric
  - Fixed Units
  - Variable Units

- Multichoice
  - Drop down menu
  - Radio buttons
  - Figures

- Custom †

† – combination of numeric and multichoice
Example Question

Please answer the following questions about the superposition of waves.

(a) Choose the appropriate resultant wave for the addition of the two waves shown above:

- [ ]
- [ ]
- [ ]
Example Question

Please answer the following questions about the superposition of waves.

(a) Choose the appropriate resultant wave for the addition of the two waves shown above:
(b) Two displacement waves with the same period are described mathematically by:

\[ y_1 = A_1 \sin(2\pi \frac{t}{T} + C_1), \text{ and } y_2 = A_2 \sin(2\pi \frac{t}{T} + C_2), \]

where \( A_1 = 7.0 \text{ m} \), \( A_2 = 9.0 \text{ m} \), \( C_1 = 1.5\pi \), \( C_2 = 1.5\pi \), and \( T = 8.0 \text{ s} \).

(i) What is the resultant displacement (i.e. \( y = y_1 + y_2 \)) at time, \( t = 28.0 \text{ s} \)?

(ii) What is the resultant amplitude, \( A \)?

(iii) What is the resultant intensity, \( I \)?

(For simplicity, assume the proportionality constant is 1 W m\(^{-4}\).)
Example Question

(b) Two displacement waves with the same period are described mathematically by:

\[ y_1 = A_1 \sin(2\pi \frac{t}{T} + C_1), \text{ and } y_2 = A_2 \sin(2\pi \frac{t}{T} + C_2), \]

where \( A_1 = 7.0 \text{ m}, A_2 = 9.0 \text{ m}, C_1 = 1.5\pi, C_2 = 1.5\pi, \text{ and } T = 8.0 \text{ s}. \)

(i) What is the resultant displacement (i.e. \( y = y_1 + y_2 \)) at time, \( t = 28.0 \text{ s} \)?

Choose

(ii) What is the resultant amplitude, \( A \)?

16.0

Choose

(iii) What is the resultant intensity, \( I \)?

(For simplicity, assume the proportionality constant is 1 W m\(^{-4}\).)

Choose

\[ \text{s, Hz, m, W m}^{-2} \]

Mark Now
OASIS

Additional Features

- Author-defined marking schemes
  - Model answer ± tolerance
  - Consequential (follow-on) marks
  - Partial marks
  - Smart Comments
- Embedding
  - Java applets
  - Audio/Video clips
  - Flash Media
- Direct linking from LMS or course website
Are the students using OASIS?

- Physics 160FC04 (213 students)
- 6 questions per practice
- 4 questions per assessment
- Dramatic increase in attempts the day before an assessment
- Significant usage before tests and exam

![Graph showing student attempts over time](image-url)
Are the students using OASIS?

- Physics 160FC04 (213 students)
- 6 questions per practice
- 4 questions per assessment
- Dramatic increase in attempts the day before an assessment
- Significant usage before tests and exam

Similar trend for Advancing Physics courses but half the magnitude!
# Practice Assignment Data

## Physics 160

<table>
<thead>
<tr>
<th>Question</th>
<th>Attempts</th>
<th>Students</th>
<th>Mean</th>
<th>Std.Dev</th>
<th>Max</th>
<th>Min</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2548</td>
<td>445</td>
<td>5.3</td>
<td>4.0</td>
<td>10.0</td>
<td>0.0</td>
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<tr>
<td>2</td>
<td>2064</td>
<td>442</td>
<td>5.6</td>
<td>4.1</td>
<td>10.0</td>
<td>0.0</td>
</tr>
<tr>
<td>3</td>
<td>1440</td>
<td>411</td>
<td>4.9</td>
<td>4.1</td>
<td>10.0</td>
<td>0.0</td>
</tr>
<tr>
<td>4</td>
<td>2006</td>
<td>437</td>
<td>5.5</td>
<td>4.0</td>
<td>10.0</td>
<td>0.0</td>
</tr>
<tr>
<td>5</td>
<td>2308</td>
<td>438</td>
<td>5.4</td>
<td>3.9</td>
<td>10.0</td>
<td>0.0</td>
</tr>
<tr>
<td>6</td>
<td>1976</td>
<td>394</td>
<td>3.3</td>
<td>3.7</td>
<td>10.0</td>
<td>0.0</td>
</tr>
</tbody>
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> 4 attempts per student per question!
> 90 % participation

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Individual Question

- Physics 160SC04 (453 students)
- Large number of zeros
- Large number of 10's
- Similar to other practice questions
- Many zeros are due to print and take-away.

![Histogram of marks](chart.png)

Mean = 5.4
Example Assessment Data

Physics for the Life Sciences (160SC04)

<table>
<thead>
<tr>
<th>Question</th>
<th>Class Mean</th>
<th>Std.Dev</th>
<th>Max</th>
<th>Min</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>8.4</td>
<td>2.2</td>
<td>10.0</td>
<td>0.0</td>
</tr>
<tr>
<td>1</td>
<td>8.7</td>
<td>2.3</td>
<td>10.0</td>
<td>0.0</td>
</tr>
<tr>
<td>2</td>
<td>8.5</td>
<td>2.4</td>
<td>10.0</td>
<td>0.0</td>
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<td>3</td>
<td>8.5</td>
<td>2.1</td>
<td>10.0</td>
<td>0.0</td>
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Physics of Technology (150SC04)

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<thead>
<tr>
<th>Question</th>
<th>Class Mean</th>
<th>Std.Dev</th>
<th>Max</th>
<th>Min</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>6.9</td>
<td>3.5</td>
<td>10.0</td>
<td>0.0</td>
</tr>
<tr>
<td>1</td>
<td>5.0</td>
<td>3.7</td>
<td>10.0</td>
<td>0.0</td>
</tr>
<tr>
<td>2</td>
<td>6.5</td>
<td>2.6</td>
<td>10.0</td>
<td>0.0</td>
</tr>
<tr>
<td>3</td>
<td>7.2</td>
<td>3.4</td>
<td>10.0</td>
<td>0.0</td>
</tr>
</tbody>
</table>

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Example Assessment Data

Physics 160SC04 – Question 3

- Large number of full marks
- Similar impressive outcomes for other Physics 160 questions

![Histogram showing the distribution of marks with mean = 8.5]
Physics 150SC04 – Question 2

- Poorer than expected outcomes in advancing Physics courses...

![Bar Chart]

Mean = 6.5

Students

Mark

0 2 4 6 8 10

0 10 20 30 40 50 60
# OASIS Student Survey (multichoice)

<table>
<thead>
<tr>
<th></th>
<th>The instructions for accessing, using, and being assessed by the OASIS system were satisfactory.</th>
<th>Very poor</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th>Very good</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>The OASIS system (on-line practice followed by assessment) gives a better method of course-work assessment than take-home assignments.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>OASIS measured my learning in this course fairly.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>OASIS helped me improve my problem solving skills.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>I had sufficient time to complete the assessments in one hour.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>The final grade I reasonably expect for this course is (DNS? means &quot;I seriously consider not sitting&quot;)</td>
<td>DNS?</td>
<td>D</td>
<td>C</td>
<td>B</td>
<td>A</td>
<td></td>
</tr>
</tbody>
</table>
OASIS Student Survey (Open-ended)

• What did you LIKE most about the OASIS system?

• What did you DISLIKE most about the OASIS system?

• Please write any other comments you wish to make below. Continue on the back of the sheet if necessary.
What the students said ...

- 1 – satisfactory instructions
- 2 – better than take-home assignments
- 3 – measured learning fairly
- 4 – improved problem solving skills
- 5 – sufficient time
- 6 – estimated grade

OASIS survey results: Physics 160(FC04)

Question #

# of Students

Total Students = 89
What the students said ...

<table>
<thead>
<tr>
<th>Mean</th>
<th>Q1</th>
<th>Q2</th>
<th>Q3</th>
<th>Q4</th>
<th>Q5</th>
<th>Q6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physics160FC04</td>
<td>4.2</td>
<td>4.3</td>
<td>3.8</td>
<td>3.9</td>
<td>4.5</td>
<td>4</td>
</tr>
<tr>
<td>Physics160SC04</td>
<td>4.1</td>
<td>4.0</td>
<td>3.7</td>
<td>3.9</td>
<td>4.2</td>
<td>4.1</td>
</tr>
<tr>
<td>Physics120FC04</td>
<td>4.0</td>
<td>3.3</td>
<td>3.3</td>
<td>3.3</td>
<td>3.7</td>
<td>3.6</td>
</tr>
<tr>
<td>Physics150FC04</td>
<td>3.9</td>
<td>3.2</td>
<td>3.2</td>
<td>3.3</td>
<td>3.9</td>
<td>3.7</td>
</tr>
</tbody>
</table>

- Question 1 (Q1) – satisfactory instructions
- Question 2 (Q2) – better than traditional
- Question 3 (Q3) – measured learning fairly
- Question 4 (Q4) – improved problem solving
- Question 5 (Q5) – sufficient time
- Question 6 (Q6) – est. course grade
What the students said ... 

- Students liked ...
  - instant feedback,
  - practicing,

- Students disliked ...
  - sig. figs. (tolerances)
  - no working,
  - incorrect answers and network failures,
  - cheating.

- Comments ...
  - more questions
  - better instructions with regards to tolerances/sig. figs,

† – either no marks for working, or no solutions given
Consolidation

- What would the most important feature be?
- List some advantages of online assessment
- List some disadvantages of online assessment
- Was your mobile phone on at the beginning of this talk?
Conclusions

- The marking of 1000’s of scripts has been eliminated
- Tutors enjoy creating questions more than marking scripts
- Students are happy with OASIS as a fair method for assessing their learning
- Fast formative feedback for both students and lecturers

Acknowledgment
This work partially supported by a teaching improvement grant.
Anecdotes

“I wrote an exam question, dealing with the charging and discharging of RC circuits, which was covered in an OASIS practice but not on the assessment. ... The majority of the students actually did well on the exam question.”

“It is interesting that the students who come to the tutorial room have different numbers in their OASIS questions ... they end up doing the question several times with each others numbers to make sure they are doing it correctly.”

“If you could design this into an OASIS question the students would surely benefit.”

“We can do that!”