Great expectations: Balancing the risks and benefits of blended learning and e-assessment in Maths and Statistics education

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THE CONTEXT

- Academic reform in Hong Kong
- From 3-4-3 to 3-3-4
- Hong Kong Diploma of Secondary Education
- 4 year undergraduate degrees
- 8 UGC-funded institutions of higher education
- Double cohort entry – begins Sept. 2012
CHALLENGES

- New curriculum
- Larger number of students
- More diversified student body
- Younger students
- Physical space
- Stress on resources
- Unfamiliar entry levels of skill and knowledge
- Demand on staffing
RESPONSES

- Create new courses
- Build more classrooms and lecture theatres
- Develop new approaches
- Employ more staff
- Expand use of e-learning?
Dept of Applied Mathematics (AMA)

Broad Discipline Requirement (BDR) subjects across University (5 Faculties/I School)

Approx 3300 students annually

Largest cohort Engineering students c.800

“Development of blended learning packages to assist learning and teaching of basic Mathematics and Statistics for the 4 year undergraduate curriculum”
THE PROJECT TEAM

- Dept of Applied Mathematics = 4
- Applied Biology & Chemical Technology = 1
- Faculty of Engineering = 1
- Hong Kong Community College = 1
- Educational Development Centre = 2

- Project Associate (Project Manager) = 1
- Project Assistants = 2
DELIVERABLES

- Blended learning packages for basic Mathematics and Statistics
- Focus – e-assessment activities
- Broad approach
- Summative, formative and diagnostic assessment
APPROACHES TO ASSESSMENT

Diagnostic
Assessment of pre-learning and readiness for study.

Formative
Assessment FOR learning which supports the learning process.

Summative
Assessment of learning which measures learning outcomes.
SUMMATIVE E-ASSESSMENT

- Time saving and cost-effective for staff.
- Consistency and quality in standards.
- Rapid processing.
- Requires institutional commitment for large scale implementation.

Summative Assessment of learning which measures learning outcomes
Enables student-centred independent study outside classroom.
Facilitates group learning, peer assessment and self-assessment.
Engaging and challenging. Interactive e-textbook use.
Provides timely feedback at the learning moment.
DIAGNOSTIC E-ASSESSMENT

Will allow rapid assessment of level and range of knowledge of new intake of students.

Can reveal areas of strength and weakness and development of appropriate personal study plans.
THE DIAGNOSTIC PILOT

- **Aim**
  - Test the logistics and the content
  - Also acts as ‘real’ streaming test for FENG students
QUESTION BANK DESIGN

- Over 300 questions
- 4 subjects: Algebra, Linear Algebra, Calculus, Statistics
- 4 levels of difficulty (matching with syllabus)
- Different combinations of subjects and difficulties according to student’s chosen undergraduate course
- Randomised to students
Do at home or on site? All together or ‘come & go’?

Main constraint: inability of Blackboard timer to STOP the test, Save and Submit attempts after allocated time [fixed in later service pack]

All-together on-site tests on mainly 2 days
LOGISTICS PLANNING

- Venue – crowd control; emergency procedures; rearrangement for ordinary users of Student Computer Centre
- Invigilators – recruit from 3 faculties; compulsory briefing
- IT – seed testing; computer facilities; disable internet access; block saving to USB
- Admission & security – invitation letters to students with usernames and passwords
- Contingency & disabled students
## ATTENDANCE RATES

<table>
<thead>
<tr>
<th></th>
<th>ABCT</th>
<th>HKCC</th>
<th>TOTAL DAY 1</th>
<th>FENG (TOTAL DAYS 2 &amp; 3)</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total Invited</strong></td>
<td>31</td>
<td>132</td>
<td>163</td>
<td>257</td>
<td>420</td>
</tr>
<tr>
<td><strong>Present</strong></td>
<td>29</td>
<td>100</td>
<td>129</td>
<td>106</td>
<td>235</td>
</tr>
<tr>
<td><strong>Absent</strong></td>
<td>2</td>
<td>32</td>
<td>34</td>
<td>151</td>
<td>185</td>
</tr>
<tr>
<td><strong>Attendance Rate</strong></td>
<td>94%</td>
<td>76%</td>
<td>79%</td>
<td>41%</td>
<td>56%</td>
</tr>
</tbody>
</table>
## RESULTS

<table>
<thead>
<tr>
<th></th>
<th>ABC T</th>
<th>HKCC</th>
<th>TOTAL DAY 1</th>
<th>FENG (TOTAL DAY 2 &amp; 3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Present</td>
<td>29</td>
<td>100</td>
<td>129</td>
<td>106</td>
</tr>
<tr>
<td>Very Good</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Good</td>
<td>10</td>
<td>29</td>
<td>39</td>
<td></td>
</tr>
<tr>
<td>Satisfactory</td>
<td>12</td>
<td>43</td>
<td>55</td>
<td></td>
</tr>
<tr>
<td>Weak</td>
<td>7</td>
<td>25</td>
<td>32</td>
<td></td>
</tr>
<tr>
<td>Very Weak</td>
<td>0</td>
<td>2</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Pass</td>
<td></td>
<td></td>
<td></td>
<td>18</td>
</tr>
<tr>
<td>Fail</td>
<td></td>
<td></td>
<td></td>
<td>88</td>
</tr>
</tbody>
</table>
WORKED WELL

- The 2-hour briefing session enabled most invigilators to handle the system.
- Students admittance check flow was smooth.
- Procedure for solving problems worked well, e.g. students who forgot invitation letters, IT problems, etc.
PROBLEMS ENCOUNTERED

- IT (minor)
  - IP address
  - “Access Denied”
  - Hard disk failure
  - ENTER key submits test
  - Screen resolution
  - Slow login and logout
  - Password choices e.g. l and 1

- 1-2 students submitted early by mistake?
- Wrong use of test passwords by invigilator
STUDENT SURVEY

Main conclusions about computer-based assessment:
- Mostly no technical problems
- Test system is easy to use
- Students prefer computer test to paper multiple-choice test
- More students think they are slowed down by using a computer than speeded up

Likes:
- “Status bar is very useful.”
- Countdown clock is helpful for keeping track of time.

Concerns / improvements:
- Level of difficulty and syllabus
- Test system restrictions, e.g. ENTER key, Save answer pop-up
- “The size of the numbers is not big enough.”
- Should be allowed to leave early
Blackboard test system is easy to use.
The test ran smoothly.
Logistics was smooth, but heavy manpower (~30 invigilators + 4 coordinators + 3 IT).
FUTURE LOGISTICAL IMPROVEMENTS

- Allocate computers on arrival
  - More efficient resourcing in case of high absences
  - Requires bigger question bank
- Allow to leave early
- More than one, or flexible, time-slot
  - Fewer rooms ⇔ fewer invigilators with experience
- Students do Trial Input at home before test?
- Provide Announcements crib sheet to all invigilators
- IT: resolve Blackboard issues + IP address issues
Blackboard does not provide enough analysis according to 4 subjects, 4 levels of difficulty, and 3 student groups

Manually analysed by Excel with self-written macros

Amend the hardest and easiest questions

Increase question bank size
THE DIAGNOSTIC PILOT

- Continue to do computer-based Diagnostic Tests for next academic year(s)
- Work with Blackboard provider for improved functions
- Use another (new) Math browser display technique: Mathjax
  - Work with Blackboard to integrate Mathjax into Bb
PROJECT NEXT STEPS

- BDR prototypes developing
- Interactive e-Textbook
- E-learning packages with formative assessment
- Extension of project – time and funding
STUDENT LEARNING OUTCOMES

- Recognise own level of Math ability through diagnostic e-assessment
- Gain basic Math skills at required level
- Take greater control over own learning → more independent learning
- Become adaptable to new learning and teaching methodologies → more flexible ways of thinking and handling mathematical issues
CONCLUSION

Risks

Benefits

benefits

risks