Integrating On-line Formative Assessment for Data Analysis

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Overview

<table>
<thead>
<tr>
<th><strong>Title</strong></th>
<th>Data Analysis (Spring Term 2006)</th>
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</thead>
<tbody>
<tr>
<td>Pedagogic theme</td>
<td>Formative assessment activities for the enhancement of data analysis instruction (blended approach)</td>
</tr>
<tr>
<td>Keywords</td>
<td>Formative assessment; statistical analysis</td>
</tr>
<tr>
<td>Subject area</td>
<td>Psychology</td>
</tr>
<tr>
<td>Student level &amp; profile</td>
<td>A first year core module, which provides an introduction to experimental design and statistics, which is needed to understand all the other courses within the undergraduate curriculum</td>
</tr>
<tr>
<td>No. of students</td>
<td>145</td>
</tr>
</tbody>
</table>
| Key conclusions  | 1. The VLE served as an effective wrapper for course resources, activities and data files, presenting materials in an accessible format for class-based activities and independent study. Course materials were released at appropriate milestones during the module, and the accumulated resources for the course were available for students to review in preparation for the final exam – presenting a well organised set of revision resources.  
2. The availability of demonstration video files and formative assessment activities with automated feedback within the VLE enabled students to work at their own pace in the class sessions, and helped them to review key concepts in their own time after class. The resources provided scope for differentiated learning, and encouraged students to problem solve without calling on the instructor for assistance. The VLE materials covered the basic concepts of the course, freeing up time in the class sessions for experimental work.  
3. The development of reusable instructional materials required an upfront investment of development time, but will pay off in the future with a wide range of students able to refer to them to support data analysis activities. |
Background

Data Analysis is a core module which all first year Psychology undergraduates take during the spring term, and has been running for the last ten years. It provides an introduction to experimental design and statistics, a mastery of which is required to understand all the other courses within the undergraduate syllabus. The module focuses on the relevance of data analysis in experimental psychology and introduces students to the different type of experiments, data and tests which may be employed in this field.

Students are expected to attend 14 classes, which are timetabled as two-hour sessions within a PC classroom, incorporating demonstrations and problem sessions. It is a very practical course, based around the computer program Excel (a spreadsheet) and SPSS (a statistical package), with students using the software to conduct relevant statistical tests for a given set of data. Previously, students followed a continuous summative assessment pathway for this module, with grading counting towards their final degree classification.

The introduction of an online set of resources for the module was intended to complement the class-based teaching and consequently help student prepare effectively for the summative assignments.

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The Course Materials Content Area of the Data Analysis course

The module provided here represents just the tip of the iceberg. Students can also be provided with access to a collection of free online resources, such as the Data Analysis video tutorials, which cover a wide range of topics from basic statistics to advanced data analysis techniques. These resources are designed to complement the class-based teaching and provide additional support for students as they work through the module. Additionally, the course team has developed a series of formative assessment activities, which are designed to help students evaluate their understanding of the key concepts and apply them in practical contexts.
The formative assignments were designed so that they were directly related to the materials taught in the preceding lectures, providing support for students who felt unsure about their skill level in using SPSS/Excel and required additional practice. The exercises, which were based around the use of the SPSS software package to analyse a range of data sets, afforded students the opportunity to apply the techniques taught in the classes and test their understanding of how to use the software to analyse research results. A series of revision activities, based on a multiple choice question template format, were also introduced, which invited students to select an appropriate research design and distinguish between a range of variables for a data analysis problem. The submission of a response triggered automated feedback on a student's performance.

Rob Stone, the module organizer and lecturer describes the rationale for the blended course design as follows:

"The first priority was for students to get comfortable with SPSS – the technology and application. The aim for the module was to move away from rote learning, instil confidence and encourage students to explore how to use the application and figure things out for themselves."

The introduction of online activities and reference materials in the revised course design also aimed at allowing greater differentiation in the learning process, with students able to follow the course at their own pace.
"Those students who tend to struggle can go over the materials again and have another bite of the cherry. In class, students either don’t pay attention, get behind or are simply distracted. These materials help to keep the pace up in class and enable students to go over the materials again."

With less class time dedicated to the teaching of the basics in using the statistical software packages, Rob hoped that the practical sessions could focus more on experimental work.

"Students are usually presented with a clean data set, which they analyse using SPSS. We wanted students to do this, but then collect their own data, which would be relevant to their own research topic. The clean data sets have strange values and oddities removed. When students collect their own data, the sets can be quite messy. This provides a more realistic view of a real life data set.

We could only do this if free time had been created in the course. The process we adopted was for the class as a whole to conduct an experiment, with individuals uploading results to a central database. This involved 60 students uploading results and downloading the combined data set. The VLE helped to coordinate the processes and provide a wrapper for the activity."

**Description of approach**

The blend for this module was based on weekly practical sessions for the face-to-face component, and related activities and resources for the online component. The learning objectives for the online component were to:

- Help students to master the key techniques involved in using the SPSS software package.
- Encourage students to explore the wider functions of the package and to apply the correct data analysis tests for their own empirical studies.
- Facilitate collaborative work, with students sharing data and analysing a combined data set.
- The online resources were also intended to serve as a revision aid. After the completion of the module students tend to forget some of the basics, and the materials were made available as a useful refresher for this and other modules.
Learning activities & tools

The online component of the module included:

- QuickTime movies, demonstrating how to perform statistical analysis operations using SPSS. The data files for some of the video demonstrations were also available for students to have a go and replicate the analysis, as demonstrated on the video.

- Data files and documents relating to the weekly practicals, including Excel spreadsheets for use in the practicals as well as general handout documents.

- Quizzes and revision questions for the Data Analysis examination, with automated feedback and correct answers, made available upon completion of the revision test. The questions were intended to test understanding of the use of the SPSS software and its correct application for data analysis activities.
Student profile

During the induction training for the module, students were asked to complete an ‘entry’ questionnaire, focusing on their experiences of computers and expectations towards on-line learning. The survey was completed by 92% of the cohort, with 134 responses recorded.

Experience with computers

The entry survey results revealed that students were established users of computers for information search activities, with 88% of the cohort accessing information from the web on a daily basis. Just under half of respondents declared that they could confidently upload files / resources to a website. 98% of respondents possessed a personal computer at home or in their study room, with 87% using a broadband connection.

Experience with computers for learning

The cohort was familiar with using computers for study purposes. 68% of respondents indicated that they had followed courses in which course materials and resources were delivered online, with 74% indicating that they had attempted self-assessment quizzes online. 64% of respondents had also followed courses which involved the use of a discussion forum.

Expectations towards the VLE

Expectations towards the VLE were quite positive, with 76% of respondents agreeing that a VLE provides flexibility to learners in terms of their study needs. A similar number of respondents felt that the VLE would enable instructors to provide a wider variety of learning resources for students, and that it would also increase opportunities for discussion and debate amongst students outside class. Half of respondents also felt that the introduction of the VLE would help students to prepare well before class sessions.
Outcomes of the pilot

The module was delivered over the spring term 2006 (weeks 1 to 9), with students attending a two-hour practical class each week. Feedback was collected from the instructor and students on the learning outcomes from the module at the end of term.

Activity statistics

Of the 145 students enrolled on this course, 65% were active users of the VLE, logging in 10 or more times over the duration of the module, with a quarter of the cohort logging in less than 10 times and 9% showing no log-ins at all. Student log-in patterns were consistent across the module, with no major peaks or troughs. The content resources accounted for the overwhelming majority of hits, with 52% of the total module hits recorded for the data analysis exercises. Students used the department’s ‘Psychboard’, a forum hosted outside the VLE for discussion purposes, and this appears to have been used regularly by students and the course instructor across the time frame of the module. A link was created from the module site to the discussion board, giving it the appearance of an integrated tool within the VLE.

Focus group feedback

A subset of the cohort (four students) was interviewed at the end of term on learning experiences using the module site. Usage patterns varied between students (1-2 hours per week), but the VLE was used both in the practical sessions and outside class, and specifically for revision purposes in preparation for the summative assessment activities. The consensus view was that the module site and resources were easy to access and well organised, with data files and resources all available within one place. The video and revision exercises were the most useful resources, which could be consulted both in class and when students went home to review what had been covered in the practical session. The feedback from the quizzes was valued, which supported the revision process. The discussion forum was not so widely used however for course related queries, with only a few students daring to post questions on ‘Psychboard’.

Exit survey feedback

The exit survey attracted a much lower response rate than the entry survey, with only 23% of the cohort (34 students) completing the instrument. Although restricted in scope, the feedback reflected a strong level of agreement (98%) amongst respondents that the VLE provided flexibility to learners in terms of their study needs, as well as enabling instructors to provide a wider variety of learning...
resources for students. Table 1 (below) illustrates the increased support in the exit survey results for these statements and the view that the VLE helps students to prepare well before class, with 84% of respondents agreeing with this view.

<table>
<thead>
<tr>
<th>Survey question</th>
<th>SA</th>
<th>A</th>
<th>N</th>
<th>D</th>
<th>SD</th>
<th>NA</th>
<th>Mean</th>
<th>Standard deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>A VLE provides flexibility to learners in terms of their study needs.</td>
<td>10</td>
<td>66</td>
<td>22</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>3.86</td>
<td>0.60</td>
</tr>
<tr>
<td></td>
<td>74</td>
<td>24</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>4.71</td>
<td>0.52</td>
</tr>
<tr>
<td>A VLE enables instructors to provide a wider variety of learning resources for students.</td>
<td>4</td>
<td>70</td>
<td>22</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3.76</td>
<td>0.58</td>
</tr>
<tr>
<td></td>
<td>61</td>
<td>36</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>4.58</td>
<td>0.56</td>
</tr>
<tr>
<td>A VLE helps students to prepare well before class.</td>
<td>4</td>
<td>49</td>
<td>39</td>
<td>7</td>
<td>0</td>
<td>1</td>
<td>3.50</td>
<td>0.69</td>
</tr>
<tr>
<td></td>
<td>39</td>
<td>45</td>
<td>9</td>
<td>3</td>
<td>0</td>
<td>3</td>
<td>4.25</td>
<td>0.76</td>
</tr>
<tr>
<td>A VLE makes individual students’ contributions more transparent to the instructor.</td>
<td>3</td>
<td>33</td>
<td>53</td>
<td>11</td>
<td>0</td>
<td>0</td>
<td>3.28</td>
<td>0.70</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>41</td>
<td>37</td>
<td>9</td>
<td>0</td>
<td>6</td>
<td>3.47</td>
<td>0.78</td>
</tr>
<tr>
<td>A VLE increases opportunities for discussion and debate among students outside class.</td>
<td>7</td>
<td>66</td>
<td>26</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>3.80</td>
<td>0.57</td>
</tr>
<tr>
<td></td>
<td>9</td>
<td>39</td>
<td>42</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3.50</td>
<td>0.84</td>
</tr>
</tbody>
</table>

SA = Strongly Agree  A = Agree  N = Neutral  D = Disagree  SD = Strongly Disagree  NA = Not Applicable

In particular, students highlighted the value of the exercises and video resources in supporting their learning on the module, ensuring that they grasped the key concepts covered in the practical sessions and prepared effectively for the summative assessment activities:
"I have been able to use the VLE to understand areas of the course I had not understood in practical classes."

"The VLE has been really useful in completing the data analysis assignments...The exercises mean you can learn and practise the statistical tests before you do the assignments and so you know if you can do them correctly and if not you can keep practising until you can, or then ask for help from lecturers."

The ease with which students could access course materials, work independently and at their own pace in reviewing the course materials was also identified as a strong feature of the module:

"The resources on the VLE were easy to access, improving the quality of studying and revision. The exercises and tutorials were particularly useful."

"The VLE has been beneficial with regard to accessing central documents that we needed for practical classes etc. The VLE videos are very good as they are short, quickly accessible and good to jog memories if we forget how to perform a certain function on SPSS etc. The revision exercises were very useful for revision for the DA1 exam and the feedback given online was excellent, together with the opportunity to repeat exercises. However, the practice questions were more computational, which was dissimilar to the real exam questions."

"Online exercises helped me to work out some of the stats theories that we covered in class without having to physically go and see a tutor, this meant that my studies could be a considerable amount easier."

This helped to reinforce their understanding of the class-based learning conducted in the practical sessions:

"The VLE helps reinforce key concepts and provides the opportunities to test and build upon our understanding of them."

"The tasks act as reinforcement of the skills taught in the practicals, making me feel more secure in what I was doing when it came to the assignments."
**Instructor’s feedback**

The introduction of the video resources and formative assessment activities was successful in engaging students, but Rob noted that the role of the VLE did not work out quite as envisaged within the practical sessions. The availability of the video files resulted in students looking at their PC screen, rather than observing the instructor demonstrating the software.

“Students used the material in a way that we didn’t expect, but the materials did help to free up time for other parts of the module. Students followed the video demonstrations at different paces in class and the bright students moved ahead and completed the activities, while others were still getting to grips with the basics. The key thing is that all students become comfortable with the technology, and know that they can use SPSS and are not scared of it. The less confident require a lot of hand-holding.”

In Rob’s view, the results of the pilot were “very highly positive”, in the sense that students used the resources on a weekly basis, although they left the VLE after the module had been completed, only going back to the exercises in their revision work before the final exam.

“Students are very goal oriented. Once they have completed their weekly assignment, they won’t do anymore, but will use the VLE for revision. One of the advantages for instructors in using the VLE is that you can release materials on a weekly basis, and you won’t need to provide additional materials during the revision period.”

**Student skills required & developed**

Training for students was focused on their use of the VLE, with a dedicated induction session introducing them to the module site and how to access the materials. Due to the intuitive structure of the module site and the organisation of materials, students were soon able to locate resources and navigate their way around the site.

“Training was quite rushed and assumed the knowledge of some things, but the layout was simple enough to pick up when using the VLE by myself for the first time.”
Staff skills required & developed

Rob and his assistant Chris Longmore are confident users of web technologies, which enabled them to develop the video demonstration files. They followed the generic VLE training delivered by the E-Learning Development Team, to help them with the development of the module site and assessment activities, which provided an overview of why the hosted tools work in the way that they do. Rob observed that the VLE involves a lot of clicking to get to where you want to go, and the assessment tool suite is restricted in scope, but with a lot of thought you can get what you want out of the platform.

In terms of preparation time in the development of the module, Rob and Chris invested a lot of time upfront in designing the VLE resources, but this was done with the aim that a wide range of students use these resources in years to come, assuming that SPSS does not change too much!
### Actions for further development

Immediate next steps will involve the development of statistical materials, which may be broadened out to other departments, addressing common core teaching requirements (e.g. generic guidance materials on how to use SPSS). There is an opportunity to work with Computing Service and build relationships in delivering statistical training in this area. The VLE has a role in bringing departments with common teaching needs together, especially those departments which work on collaborative MSc teaching programmes.

As a follow-up to this module, a Data Analysis II course was delivered over the summer term. Having “upped the game”, Rob notes that it will be necessary to provide a level of online support for future courses.

“The expectations of the current set of students have been raised and they will expect to use the VLE in their second year. Otherwise we will revert to talking to first year students. We need to start providing other materials and courses.”

One possible development could be the introduction of podcasting and the recording of lectures for the ‘Introduction to Psychology course’, focusing on difficult subjects which will encourage students to go back over the lecture and review the topic.

![Screen shot of Podcast deployment configuration form within Yorkshare](image)

*Just record some audio and then make it available to your students*