

USING JAVA APPLETS TO HELP MAKE ONLINE ASSESSMENT INTERACTIVE

Geoffrey Crisp

Learning and Teaching Development Unit
The University of Adelaide, Adelaide, South Australia, AUSTRALIA
geoffrey.crisp@adelaide.edu.au

Abstract

For those involved in designing online environments special attention must be afforded to interactivity. Online tasks should involve students actively engaging with tools and resources they will potentially use in their later employment. Java applets, embedded in course web sites, can enhance educational material with animations, applications that are responsive to student choices, and provide interactivity to engage students in active learning. The interactivity inherent in these applets allows a student to explore, to make errors, and seek their own solutions. They can all be incorporated into online assessment to allow students to interact with real tools.

Keywords

Java applets, interactive assessment, online assessment

Background

A great deal of recent attention has been focused on the constructivist approach to learning environments in which students are engaged in activities that encourage and facilitate learning. The active constructivist approach assumes a teacher will participate in the learning process and not simply provide the scaffolds upon which learners construct their discipline experiences. Students are encouraged to work in groups to complete tasks and to use tools or resources to provide solutions to problems indicative of those in real life situations. Whether a teacher is using a form of Piaget's cognitive theories or Vygotsky's social constructivist approach, they are implicitly assuming that learning occurs in a meaningful context in which people interact with each other and with appropriate resources to solve real problems (McMurray & Dunlop, 1999; Nicholl, 1998).

For those involved in designing online environments special attention must be afforded to interactivity. Online tasks should involve students actively engaging with tools and resources they will potentially use in their later employment (Oliver, 2001). Herrington and Oliver have proposed 10 characteristics to define authentic activities that could enhance student learning (Herrington & Oliver, 1999; Reeves, Oliver & Herrington, 2002). One of these characteristics is that the authentic activities for learning "Are seamlessly integrated with assessment" (Herrington & Herrington, 1998). One of the aims of assessment is to provide staff and students with the necessary information to improve future educational outcomes. Assessment tasks have a direct impact on the future learning strategies that students will adopt and so feedback from both formative and summative assessment is crucial. Irrespective of whether online assessment requires a new epistemology or merely a modification of existing theories, those involved in online learning must move beyond comparing the relative efficacies of online versus face-to-face learning and the associated assessment tasks (Twigg, 2001). Rather the unique advantages that each approach brings to improving student learning should be the focus of attention.

Online assessment can offer such unique opportunities to improve student learning when embedded into a cohesive curriculum plan. Various authors have reported on the pedagogical determination of appropriate questions and overall test design and summaries are available for teachers to use in designing effective tests in a variety of multiple choice and short answer mode (Issacs, 1994; Bull & McKenna, 2001; Whittington, Clark & Danson, 2000; Bull, 1999). The advantages of online assessment include:

- opportunities for distance learning assessment
- the ability to offer interactive testing with appropriate feedback
- data banks of questions can be used for formative and adaptive testing
- detailed analysis of student responses is possible for quality improvement
- reduction in marking time for tests and reporting of student results

Java applets, small applications written using the Java™ code, provide a number of advantages for online use, including interfacing with various media formats (text, graphics, animation and sound) and languages (JavaScript and VRML). On the whole, java applets are platform independent and the most commonly used web browsers are Java-compliant. Java applets, embedded in course web sites, can enhance educational material with animations, applications that are responsive to student choices, and provide interactivity to engage students in active learning.

Many examples of the use of interactive java applets are available on the web (Baker, 2002; Rojiani, Kim & Kapania, 2000; Cartwright et al, 2000). This is not to say that java applets are automatically suited to all topics and all discipline areas. Applets can often complement material presented in other ways by allowing students to interact with the concept being considered. The use of Java applets can be made easier for students by judicious design elements and ready availability of instructor documentation. Nevertheless, adequate time should be allowed for students to become familiar with the applets, especially if they are to be used in assessment. However, there is often a steep learning curve for students using a new java applet, particularly for students with little prior computing or web experience. Many applets are freely available on the web and teachers will not usually find it necessary to write their own applets.

What types of applets are available and how does a teacher use them in a course or assessment? We are collating applets for teachers to use in their own course sites. The approach we have taken is to allow staff to try the applet first, then provide simple instructions for them to incorporate the applet into their own material. The applets are all freely available from the web and the *.class or *.jar files are stored locally (with permission and attribution) on a server dedicated to their use. Instructions have been written for staff so they only have to copy and paste the html code into their own appropriate web site and the applet is called from the server. In this way only one copy of the applet is required and it can be readily embedded into course content, tutorial or workshop materials or assessments. These applets and the associated instructions can be viewed at <http://ajax.chemistry.adelaide.edu.au>.

What types of applets are useful for students? There are applets that provide information to students with no, or minimal, interactivity. Such applets can be used as Help menus or to provide course content for use in tutorials, workshops or assessment. An example is a simple slide show showing information and allowing students to use an index to find relevant material. Since applets can be made to open in a second window, students may toggle between an activity window and an information window, as appropriate. This is useful in formative assessments since the purpose of the task is to assist student learning. Thus allowing students to have ready access to information during an assessment exercise would encourage them to use the information to help solve the problem. This model closely matches authentic, real world problem solving whereby a variety of sources of information would be used by a professional to assist in solving a problem. The idea here is to encourage students to use information. Other examples would be tables of data, or a Periodic Table of the elements, or spectral data that could be read online.

There are applets that illustrate a basic concept and allow students to explore how the underlying principles can be derived from the examples provided. The discipline areas of chemistry, biology, physics and mathematics are well represented in this class. Examples of such an applet would be titration in chemistry, simple harmonic motion in physics, polynomial equations and their graphical displays in mathematics, statistics displays, geographic information systems for geology or geography, translating a sequence of nucleic acids to generate the corresponding amino acid sequence in biology. A non-science example would be in music where keys on a piano can be related to notes on a staff or played by the speakers on the computer. The interactivity inherent in these applets allows a student to explore, to make errors, and seek their own solutions. They can all be incorporated into online assessment to allow students to interact with real tools. The advantage of using such applets is that teachers are not limited to a particular online assessment product. The applets can be called from separate servers, opened in a

separate window on the web and thus incorporated into any commercial or individual assessment application.

There are applets that allow computations or manipulations of physical data or forms with a built-in graphical user interface to facilitate student experimentation by manipulating various parameters. This also allows teachers to provide data sets for students to use as part of the exercises. Students are actually dealing with 'real' data and drawing inferences from the results generated by the applet. This is quite a powerful tool for online assessment. Such examples include drawing chemical structures and reaction sequences for chemistry, manipulating three dimensional objects or structures, drawing graphs and plotting data for statistics. Once again the discipline areas of chemistry, biology, physics and mathematics are well represented in this class of applets.

If teachers required java applets to pass data from the applet to the assessment package this increases the complexity involved in using the applets. We have not endeavoured to undertake this next level of complexity as it requires writing application program interfaces between the applet and proprietary software. For most situations the student does not need an automatic transfer of data from the applet to the assessment package, they are able to copy and paste or type in the relevant information.

How does a teacher who knows little, or nothing, of java programming incorporate an applet into their web page or online assessment module? If the *.class and *.jar files are served from a specific directory on a dedicated server then they need only copy and paste preformed html into their web page or commercial application (such as WebCT or Blackboard). An example would be:

```
<applet code="JME.class" name="JME"
archive="http://ajax.chemistry.adelaide.edu.au/applets/jme/JME.jar" width=360 height=335>
<param name="options" value="list of keywords">
Enable Java in your browser !
</applet>
```

Some applets require parameters to be set and so instructions should be provided for teachers to be able to do this. Alternatively, if a standard set of parameters was appropriate, this could also be incorporated into the html code for staff to simply copy and paste.

A simple example of how applets might be incorporated into online assessments can be viewed at <http://quiz1.science.adelaide.edu.au/tp/gcrisp/test01/test01.tp3> (no userID required, just click Request). This example does not attempt to frame sophisticated questions, rather it provides an example of how interactivity might be incorporated into an assessment exercise.

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