



Teaching by example, learning by design: Three recent technologies in three learning contexts

Thomas Kerr

Learning and Teaching Centre
Macquarie University

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A strategy sometimes used by educators who are teaching other education professionals is to teach *by example*, using a tool to build an exemplar application or website, and, in so doing, lead the learners through a series of procedural steps that will achieve stated educational objectives and provide an application that can be modified by learners for their own teaching needs. The purpose of using this approach is therefore twofold; to provide an authentic context for learning, and to demonstrate use of the tool to construct an example that can be re-purposed for other educational uses, sometimes in completely different disciplines.

This poster presentation looks at three freely available technologies that can support diverse areas of study:

- *Celestia* version 1.5.1, a free stand-alone open-source, three-dimensional space simulator
- *Google Earth* release 4.3, a free web-based geographic simulator with time-based display, and
- *YouTube* Video, a web-based video display technology that can provide online tutorial resources with rich dynamic content.

Each technology listed above has unique features that allow for disparate teaching approaches, but all give the end-user easy access to the learning resources and the means to create engaging educational applications.

Celestia was chosen because its open-source approach has attracted the development skills of a wide range of contributors, including educators, who have used their own teaching methodology to construct learning plans and modules. These modules range from planetary tours of the solar system to scenarios where the current re-classification of planets such as Pluto can be discussed from an organisational perspective. *Celestia* allows users to build planets and moons in experimental star systems, set their orbital radii and speeds and add land forms, oceans and atmospheres. This *learning by design* functionality hands the initiative for exploration of new concepts to the student and provides for the possibility of rich discussions about a range of topics such as extra-terrestrial life and intelligence, basic astronomy, Newtonian physics and, perhaps, the origin of the universe.

The current release of *Google Earth* adds time-based functionality to the basic geographic simulation application. Researchers have provided time-based data displays such as; instances of avian flu outbreaks around the world over a two year period that can be displayed dynamically in the areas and times where and when they occurred, and weather events such as Caribbean hurricanes that are tracked for position and intensity over time. This tool is particularly powerful for exploring events and concepts where both the timing and location of events are important.

These two applications have different information distribution approaches yet address similar concerns; the accurate display of 3D spaces, though neither has been designed to teach a specific concept or to address a particular aspect of knowledge. For astute educators this is seen as a strength, as both applications invite and encourage contributors to add functionality by way of add-ons, overlays and different approaches to support teaching and learning in a given discipline.

YouTube video display technology provides educators with an opportunity to construct engaging learning resources where an exemplar performance models the learning task. The YouTube website currently lists a large number of piano tutorials that offer students free tuition in a range of piano compositions, playing styles, and genres. Tutorials can be simply a performance on a keyboard captured with a video camera

with voice annotations by the tutor, or can include sophisticated keyboard displays with notes highlighted in real time, dynamic scores and additional text annotations. Learners have full control over the lesson's playback via the standard video controls provided, such as pause, loop and rewind functions. This gives a learner the ability to easily control the pace of the learning and to repeat the lesson as often as required.

Learning can occur on several different levels. At the *performance level*, a learner can watch the tutor play a piano piece in real time, noting the fingering used, attack styles, chord voicings, and how the tutor produces accidentals or slurred notes. At an *analytic level*, the tempo, rhythm and any variable beat changes, such as clave reversals in latin jazz pieces, can be analysed in detail. At a *reproduction level* the learner can work on short passages of a piano piece one hand at a time, determining chords and melody notes along the way. Dynamically scrolling scores available in some YouTube piano tutorials can illuminate notes as they are played; assisting a learner to sight read a score. Text annotations can enrich the learning experience by adding the tutor's suggestions for improvisations, etc.

The poster presentation consists of two levels;

- a *generic learning and teaching level* that discusses the basic elements of a lesson plan, such as first design considerations, key questions to ask, a topic introduction, stimulus (objective, task, outcomes), an exemplar or model of use, a prompt to get learners to reproduce a task sequence, and
- an *applied technology level* which displays a sample use of each technology in a learning context, as an outline of a sample lesson plan. Each plan sets out an objective, poses a task which may consist of finding the answer to a key question, and provides suggested steps to follow. The lesson plan outlines assume that learners already have some familiarity with the technology being used, providing the steps as a simple guide to follow in order to achieve the proposed task.

A summary panel provides a summary of how the technologies are currently being used in learning and teaching, and briefly discusses possible future directions for these types of learning and teaching resources. For example, a "High Definition" Celestia: CD-ROM distribution with high resolution media is planned for future versions.

A references panel is included, and links to further resources such as websites and forums supporting the three technologies are provided.

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Download sites

Celestia 1.5.1: <http://www.shatters.net/celestia/>

Google Earth 4.3: <http://www.earth.google.com/>

YouTube: <http://www.youtube.com/>

Author: Thomas Kerr, Learning and Teaching Centre, Macquarie University, M.Phil.
Candidate, University of Sydney. Email: tkerr@laurel.ocs.mq.edu.au

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