learning in three dimensions

Three emerging technologies that support active learning and teaching
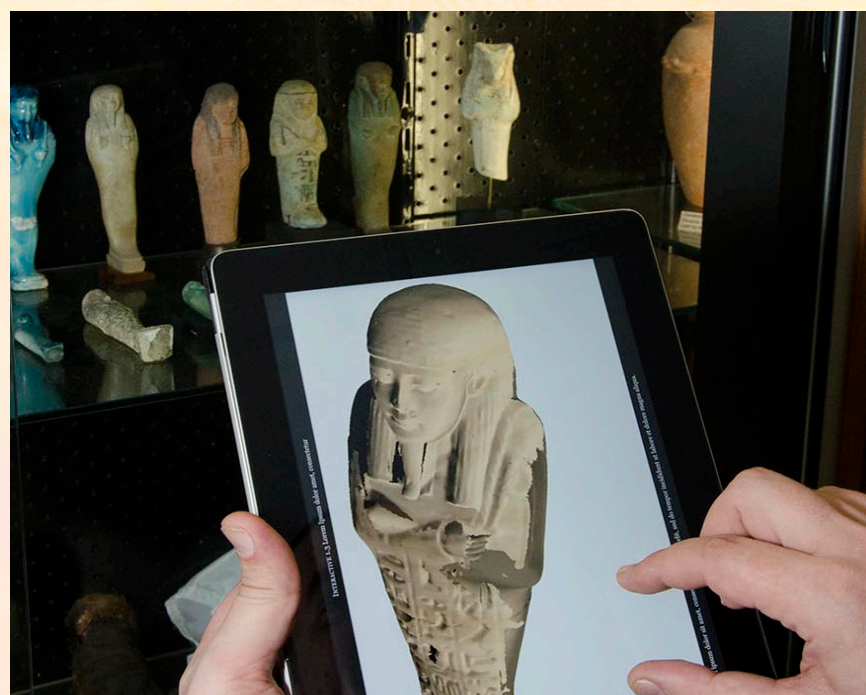
- **augmented reality**
- **3D scanning**
- **3D printing**

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Augmented reality, **3D scanning** and **3D printing** technologies all have the potential to change the way content is made available to learners in both face-to-face and online learning contexts.

Together with an innovative approach to learning design, 3D technologies offer the possibility of extending the blended learning concept by expanding opportunities for truly *interactive* activities.

a museum tour with augmented reality (AR)

On a tour of a museum, photos of objects inside the display cases are attached or placed on the case's exterior. An AR-enabled mobile device with camera focuses on each image and displays detailed information about the object in question, including a rotatable 3D image, sectioned or wireframe image, and supporting text (Dunleavey, Dede and Mitchell, 2008). Links to further information can also be provided, and may include suggestions for viewing other nearby objects in the display area.

3D printing of artefacts

original artefact

3D print of artefact at 125%   3D print at 100%

3D prints can be output in a size larger (left) or smaller than the original, or at the object's exact size (right).

An example of this enhanced interactive approach to activity-based learning is the use of 3D-printed facsimiles of rare artefacts located in **Macquarie University's Museum of Ancient Cultures.** Normally, Roman archaeology students can view rare artefacts located in the museum's glass display cabinets but cannot handle them due to their high fragility or intrinsic value. A close-to-exact replica of an artefact reproduced with a 3D printer can be safely handled by students, allowing them to get a real sense of the size and purpose of the object.

3D scanned artefacts in an online archaeology unit

ACTIVITY 1: Using appropriate terminology, **describe** the object in the viewing pane, mentioning dimensions, materials, unique features, etc.

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The object is a shabti (also called ushabti),
a funerary figurine which represents the body of
an unknown pharaoh. It is quite small, measuring
8.2x3.1x1.9cm. It is made of nile silt clay and
there is no painted surface decoration.
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(Sample TEXT only)
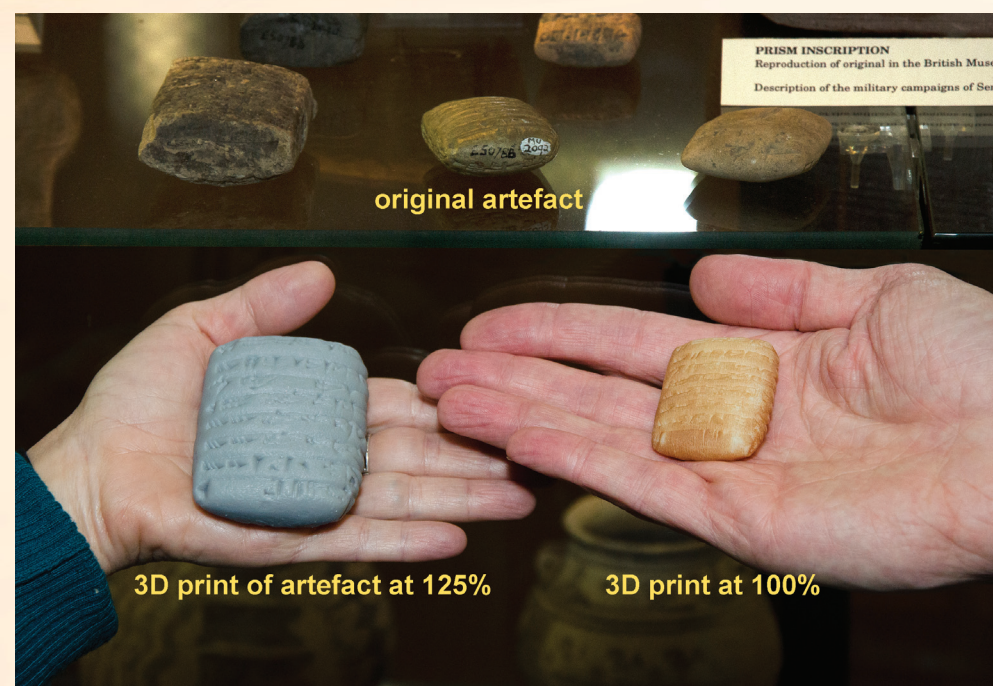
ACTIVITY 2: POST your ideas on the object's provenance to this week's topic Forum.

A rotatable 3D scan of the object embedded in an online unit can allow distance learners to examine it from any angle and, crucially, to engage in the same types of activities about the artefact that campus–based students are expected to carry out for their course assessments. An augmented reality approach that overlays a photo scan of the actual object with the 3D scan mentioned above would give visitors to a museum the same multi-angle view of artefacts locked inside display cabinets together with supporting text content.

references

Dunleavy, M., Dede, C., Mitchell, R. (2008). Affordances and Limitations of Immersive Participatory Augmented Reality Simulations for Teaching and Learning. *Journal of Science and Educational Technology*, Springer, 18:7-22

Yue, C. L., Bjork, E. L., & Bjork, R. A. (2013). Reducing verbal redundancy in multimedia learning: An undesired desirable difficulty? *Journal of Educational Psychology*, 18