Metrics for Interactivity

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Abstract

A study of the properties of virtual laboratories to design interactivity metrics for an engineering digital library will be described. An Interactive Checklist to help select the best resources for educational contexts and describe them objectively will be demonstrated.

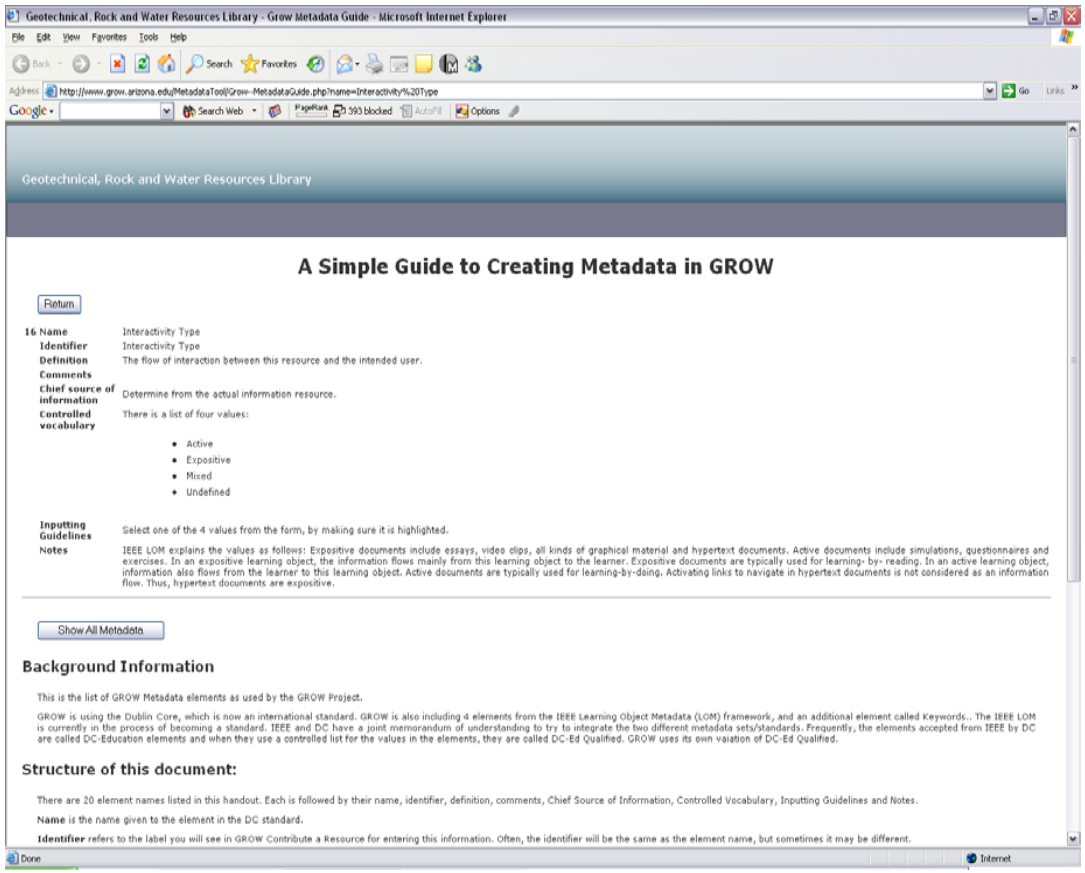
Virtual laboratories are an important genre of interactive multimedia objects. Interactivities are complex objects and new digital genres or forms, with no print equivalent. A prototypical example of an interactive is the 3-d simulation virtual laboratory in GROW (Budhu & Coleman, 2002). This type of virtual laboratory provides links to prerequisite material, supplementary readings, uses multimedia formats, and different types of user interaction to motivate, engage, challenge, facilitate, and test learning. It has conceptual and physical components that can be objectively identified on which metrics for interactivity can be developed.

Interactivity type and interactivity level are elements for resource description in educational metadata frameworks such as the IEEE LOM (2004). However, interactivity is hard to describe in a way that is useful as an access point or for making relevancy choices about resources in educational tasks such as teaching and learning and hence the need for objective measures. The currently available vocabularies for interactivity type are inadequate and include: active, expositive, mixed, and undefined. Similarly the values for interactivity level are equally limited and ambiguous: very low, low, medium, high, very high. The Interactive Checklist, tested with GROW, allows the metadata creator and the collection developer to easily and quantitatively measure interactivity and assign the corresponding level to learning resources of all types.

Research Questions asked and Methods Used

- **Research Questions:**
  - **What are the elements of interactivity that facilitate learning and how can they be easily identified by metadata creators for the purposes of metadata creation of learning objects?**
  - **What are the metadata values (controlled vocabularies) for the Interactivity Type and Level elements in the IEEE LOM that facilitate effective pedagogic use?**
- **Methods Used**
  - **Conceptual Definition of Interactivity**
    - **The various elements of interactivity and their impact on learning – I.e. those that have a positive, neutral or negative effect on learning – were identified**
  - **Interactive Resources from GROW examined and checklist derived**
    - **Learning objects that had been designed and developed with sound instructional practices for GROW were analyzed for the presence or absence of the various elements of interactivity previously identified and an Interactive Checklist constructed**
  - **Checklist validated with other DLs**
    - **The Checklist was validated by the first and a second indexer/metadata creator by using 'interactives' (learning object resources) in other digital libraries such as DLESE and NSDL. Revisions are in progress.**

Interactivity Type – Metadata (IEEE LOM)



Definitions of Interactivity

- “Mutual or reciprocal action or influence” (Webster Collegiate Dictionary, Ninth Edition)
- “A reciprocal relationship of some kind between two elements in a system” (Littlejohn 1989, 175)
- “When people can participate as agents within a representational context” (Laurel 1993, 112)
- The ability to intervene in a meaningful way within the representation itself, not to read it differently (Cameron 1995)

Definitions of Interactivity (contd.)

From Ed. Tech./Instruct. Design

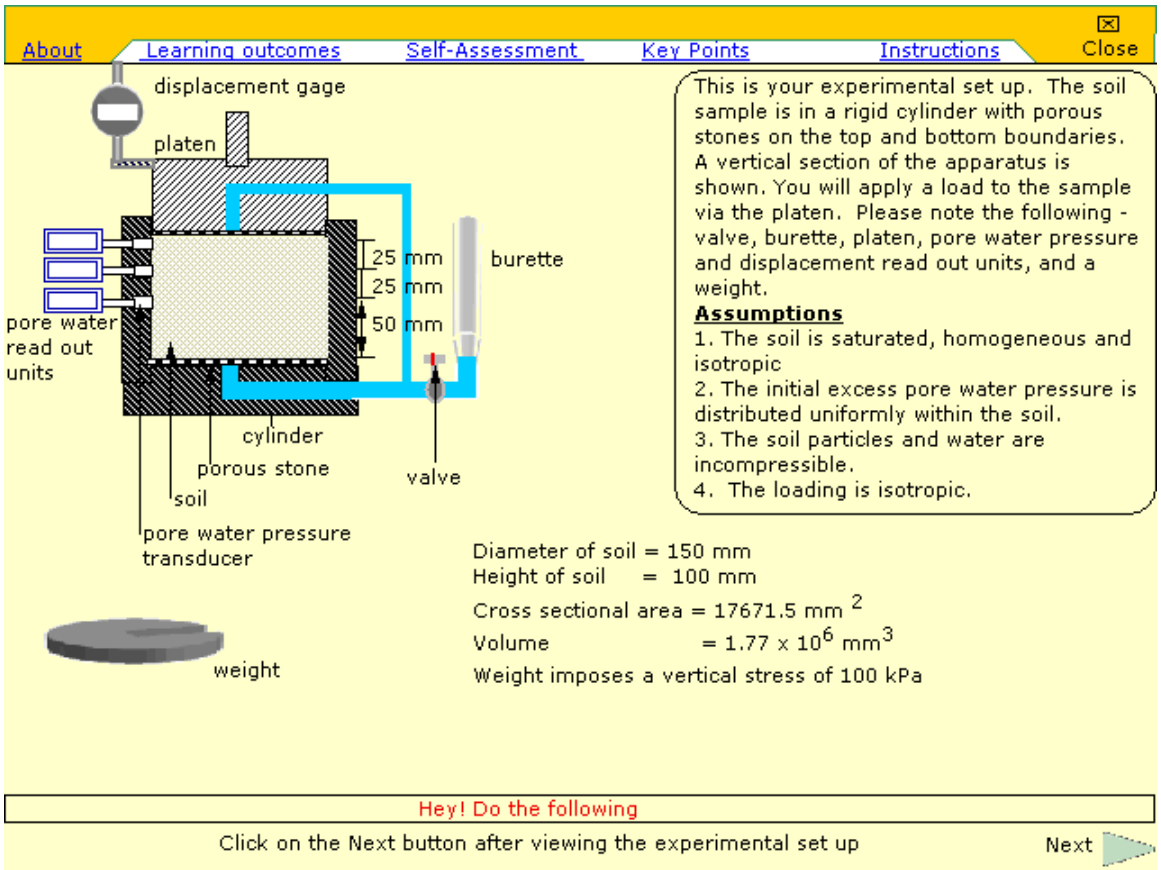
- "The manner in which the learner dialogues with computer" (Baker-Albaugh 1993, 36)
- "The things people do on computers have always been interactive" (Kristof & Satran 1995, 1)
- "Access to a range of input devices…which can activate technology being used" (Sims 1997, 159)

Example of Taxonomies of Interactivity

Zazelenchuk (1997) distinguishes six ingredients or components of interactive multimedia:

- *Active learning environment*
- *Learner control*
- *Feedback*
- *Multiple media*
- *Learner response option*
- *Adaptability*

Interactives



Attributes Categorizations

Learning environment – *glossary, statement, document*

Learner control – *control, top nav, side nav, base nav*

Feedback – *dialog, components*

Multiple media – *autoplay, manplay, image, sound*

Navigation – *layer, e-link, i-link*

1) Geo-Technical, Rock and Water Resources Engineering (GROW) – Digital Library (NSDL)

2) Digital Library for Earth System Education (DLESE)

3) National Science Digital Library (NSDL)

Interactive Checklist

Variables in four areas:

1) Learning environment (guidelines for use of the tools)

2) Learner control (ability for users to manipulate the tools)

3) Feedback (reactive responses from the computer programs)

4) Multiple media (animations, sounds, etc.)

5) Navigation (ability for users to maneuver among external and internal resources)

Interactive Checklist used with GROW Interactives

GROW File	Glossary	Doc	State	E-Link	I-Link	Layer	TopNav	SideNav	BaseNav	Control	Dialog	Com	AutoPlay	ManPlay	Image	Sound
Phase	yes	yes	yes	no	no	no	yes	no	no	yes	yes	no	no	yes	yes	no
Drilling	no	yes	yes	no	no	no	no	no	no	no	yes	no	yes	yes	yes	no
Foundation	no	no	yes	no	no	no	no	no	no	yes	no	no	yes	yes	yes	no
Mudslide	yes	no	yes	yes	no	no	no	yes	no	yes	no	no	yes	yes	yes	yes
Sieve	yes	yes	yes	no	no	no	yes	no	yes	yes	yes	no	yes	yes	yes	no
Soil	yes	yes	yes	no	no	no	no	no	no	yes	no	no	yes	yes	yes	no
Content	yes	yes	yes	no	no	yes	yes	no	no	yes	yes	yes	yes	yes	yes	no
Acre Foot	yes	yes	yes	no	no	no	no	no	no	no	yes	yes	no	no	yes	no
Density	yes	yes	yes	no	no	no	no	no	no	yes	no	no	yes	yes	yes	no
Pressure	yes	yes	yes	no	no	no	no	no	no	yes	yes	yes	yes	yes	yes	no
Concentration	yes	yes	yes	no	no	no	no	no	no	yes	yes	yes	yes	yes	yes	no
Submarine	yes	yes	yes	no	no	yes	no	no	no	yes	yes	yes	yes	yes	yes	no
Log	yes	yes	yes	no	no	yes	no	no	no	no	yes	yes	yes	yes	yes	no
Velocity	yes	yes	yes	no	no	no	no	no	no	yes	yes	yes	yes	yes	yes	no
Basin	no	no	yes	no	no	no	no	no	no	no	yes	yes	no	no	no	no
Blended	yes	no	yes	no	no	no	no	no	no	yes	no	yes	no	yes	yes	no
Catchment	yes	yes	yes	no	no	yes	no	no	no	yes	yes	no	yes	yes	yes	no
Melting Ice	no	no	yes	no	no	no	no	no	no	no	no	no	no	no	yes	no
Condensation	no	no	yes	no	no	no	no	no	no	no	no	no	yes	no	yes	no
Stream	no	no	yes	no	no	no	no	no	no	no	no	no	no	no	yes	no
Weight	no	yes	yes	no	no	no	no	no	no	yes	yes	yes	yes	yes	yes	no
Iceberge	yes	yes	yes	no	yes	yes	no	no	no	yes	yes	yes	yes	yes	yes	no
Dew Point	no	no	yes	no	no	no	no	no	no	no	no	yes	no	no	no	no
Temperature	no	no	yes	no	no	no	no	no	no	no	no	no	no	no	yes	no
Viscosity	yes	yes	yes	no	no	no	no	no	no	yes	no	no	yes	yes	yes	no
Sponge	no	yes	yes	no	no	no	no	yes	no	yes	no	no	no	yes	yes	no
Air Pillow	no	no	yes	no	no	no	no	no	no	no	yes	yes	no	no	no	no
Evaporation	yes	no	yes	no	yes	yes	no	no	no	no	yes	yes	yes	no	yes	no
Floating Boat	yes	yes	yes	no	no	yes	no	no	no	yes	no	no	yes	yes	yes	no

References

- Budhu, M. and Coleman, A. 2002. The Design and evaluation of interactivities in a digital library. D-Lib Magazine, 8 (11), November. Available online. URL: http://www.dlib.org/dlib/november02/coleman/11coleman.html
- GROW. 2004. http://www.grow.arizona.edu/
- IEEE LOM. 2004. IEEE LTSC LOM. URL: http://grouper.ieee.org/LTSC/wg12/20020612-Final-LOM-Draft.html