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<td>Author(s)</td>
<td>Hedberg, John</td>
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Paper No. 13
Technologies for Effective Learning

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University of Wollongong

Changing learning strategies with interactive multimedia

Learning to think critically, to analyse and synthesise information to solve problems in a variety of contexts and to work effectively in teams are crucial skills for modern employees, and yet there is little evidence that our education systems are developing these skills in our children

(Bransford, Goldman and Vye, 1991)
Rethinking taxonomies of learning

- Moving from Bloom to Taxonomies which integrate
  - Types of knowledge
  - Motivations and attitudes
  - Management of learning

Representing ideas in different media forms

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<th>Year</th>
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<td>1996</td>
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Placing learners in open-ended student-centred investigations

Instructors shift to the role of mentor and co-learner
Seven Metaphors

1. All knowledge is constructed: Learning is a construction process.
2. Many worldviews can be constructed: giving multiple perspectives.
3. Knowledge is context dependent, so learning should occur in relevant contexts.
4. Learning is mediated by tools and signs.
5. Learning occurs through social dialogue and negotiated meanings.
6. Learners bring several unique views of the culture and how it operates.
7. Knowing how we know is the ultimate human accomplishment.

Learning Theory Developments
- Constructivism
- Situated Learning
- Everyday cognition
- Cognitive Load theory

Technology Developments
- Desktop audio/video
- Internet
- Multimedia Computing
- Conferencing

Constructive Learning

Computer Supported collaborative work
- Project Management
- Shared workspaces
- EPSS

Computer Supported collaborative learning
- MUDs/MOOs
- Problem-based learning

Learning Environments
- Cognitive flexibility
- Goal-based scenarios
- Anchored instruction

Cognitive Tools
- Databases
- Microworlds
- Spreadsheets
- Expert systems
Current learning strategies concentrate on recall and application of knowledge

Strategies Needed ...

- Learners interacting with and manipulating the exploration environments that we construct.
- Learners exploring and strategically searching through these environments. Intentional learners willingly trying to achieve cognitive objectives.
- Conversational learners engaged in dialogue with other learners and with instructional systems.
- Reflective learners articulating and reflecting on the processes and decisions that were included in the process.
- Ampliative learners who generate assumptions, attributes and implications of what they learn.
Rethinking outcomes

- Declarative Knowledge (knowing that...)
- Structural Knowledge (information networks)
- Cognitive Components (apply rules/principles)
- Situated Problem Solving ("multiple" solutions)
- Knowledge Complexes (mental models)
- Ampliative Skills (information extension)
- Self-knowledge (awareness of learning strategies)
- Executive Control (control internal learning)
- Motivation (conation—ability to self-motivate)
- Attitude (making choices based on values)

(Jonassen & Tessmer, 1996-7)

A Journey in Design
Evaluative Prototyping...

User/Designer

Presentation & Interface Design

Complete Design Brief

Interaction Design

Initial Design Brief

Project Space Information

All information needs and requirements

Learners Tasks

Visual representations of project space

Screen nodes and links

Technology Options

Flexible Modes
Computer-Based Learning

Classic Distance Learning

Distance Learning real-time one- and two-way

Classroom-based Instruction

Groupware Tools

"Virtual" Classroom

Computer-conferencing

Small Large

Place

Same Different

Group Size

Asynchronous Synchronous

Time
Developing Environments...

The learner as user...

Users impacted

Larger user and group size

Single user

Multiple individual users
Web-Based

Quantum increase

Changing forms of interaction

Shared Virtual Learning Environments

Groups located in same space and time

CD-ROM based

Instructivist

Constructivist

Defining paradigm
Problem-based learning

Key stages
- Problem Analysis
- Information Gathering
- Synthesis
- Abstraction
- Reflection

All are employed in technology-based learning environments

Investigating Lake Iluka...

- an ecology simulation employing a number of different interface metaphors
  - authentic context
  - data collection tools
  - construction tools
Investigating Lake Iluka

- Students wanted to:
  - have more access to the information resources to construct their own knowledge
  - be presented with a challenge that was offered up-front and puts the challenge in context
  - have access to the information in multiple forms and modes,
  - have more support for the tasks undertaken
  - have access to what they called experimental tools, such as 'what-if' scenarios or simulations.

Exploring the Nardoo

- rich embedded information landscape based on a geographic metaphor
- learner-driven investigations using embedded data
- templates supporting manipulation of ideas
- simulating hypothesized relationships
Exploring the Nardoo

- Learner-driven investigation supported by cognitive tools
- Cognitive tools empower learners to design their own representations of knowledge rather than absorbing knowledge representations preconceived by others.
- Assist students by providing templates
- Modelled use by walk-through movies in the help system
- Sharing ideas with support tools for constructing of presentations

StageStruck

- Extending information with personal interpretation
- Constructing your own resources
- Support of the free-form creativity
- Comparing products with experts or other students
- Sharing over an Internet learning environment
• working within an environment which mirrors the world
• supports theatrical outcomes with many interpretations of each scene
• each constructed performance can be compared with experts or other students

• learning can occur through the resolution of multiple responses to the same task
• share files between learners

Future Directions

• construction tools to create ideas in textual, visual and dynamic representations
• cognitive tools which scaffold learners as they solve problems in new knowledge domains
• representation of context through 3D models of the "world"
• connection to communities of learners to experience different cultural views and different personal views
• enable their "avatar" to contribute to a interaction with others.
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