



ASSESSMENT

The Use of Concept Maps for Assessment

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Workbook

The aim of this workbook is to provide a series of resources in the realm of assessment and the use of concept maps to support this.

The workbook is not exhaustive, but attempts to focus on a number of core issues and needs.

Key areas covered include:

- The Psychology of Learning
- Assessment Principles
- An Introduction to Concept Maps
- Assessing Concept Maps

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Further workbooks are available, for information contact David.Jennings@ucd.ie

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How we learn

Learning styles has become a somewhat contentious term used to describe the attitudes and behaviours, which 'may' determine an individual's preferred way of learning. It is the 'may' that draws attention as it is often omitted and hence the concept becomes a deterministic approach to categorising how learners engage with information, their peers, educators and opportunities to learn. Suffice to say it is also an area where so many learning styles / preference models exist, that the marketplace is truly over-crowded (a citation search revealed over 150 articles espousing models), so where does one look to...? And how may we use them to our benefit?

If we merely take note of the range of styles and/or preferences available, we may begin to address a number of key issues that impact student interaction. The idea of learner malaise, lack of motivation, misinterpretation is not down to recalcitrant individuals alone. By adapting the way in which we teach and provide learning opportunities to reflect the potential 'learning styles' apparent in any cohort, we may begin to offer an open and engaging process that is directed to their (the learners) preferred style / method of interaction and engagement.

The following three tables elaborate the details of their respective models (Rose, Honey & Mumford and Gardener) and the interpretation of the implied learning styles on the individual.

Rose 1985

Visual: Learners prefer to learn with visual reinforcement such as charts and diagrams

Auditory: Learners prefer to learn by listening

Kinaesthetic: Learners prefer to learn through, moving, doing and touching

Honey and Mumford 1996

Theoretical: Learners prefer to learn by reading and listening to the experts

Pragmatic: Learners like to be able to see the practical application of theory. They like to use deductive reasoning to focus on problems and they prefer situations where there is a single correct answer or solution

Reflective: Learners tend to be imaginative and emotional. They work well in group discussions

Activist: Learners are action oriented. They learn by doing

Gardener 1993

Visual/Spatial Intelligence: Puzzle building, reading, writing, understanding charts and graphs, a good sense of direction, sketching, painting, creating visual metaphors and analogies (perhaps through the visual arts), manipulating images, constructing, fixing, designing practical objects, interpreting visual images.

Verbal/Linguistic Intelligence: Listening, speaking, writing, story telling, explaining, teaching, using humour, understanding the syntax and meaning of words, remembering information, convincing someone of their point of view, analysing language usage.

Logical/Mathematical Intelligence: Problem solving, classifying and categorising information, working with abstract concepts to figure out the relationship of each to the other, handling long chains of reason to make local progressions, doing controlled experiments, questioning and wondering about natural events, performing complex mathematical calculations, working with geometric shapes.

Bodily/Kinaesthetic Intelligence: Dancing, physical co-ordination, sports, hands on experimentation, using body language, crafts, acting, miming, using their hands to create or build, expressing emotions through the body.

Musical/Rhythmic Intelligence: Singing, whistling, playing musical instruments, recognising tonal patterns, composing music, remembering melodies, understanding the structure and rhythm of music.

Interpersonal Intelligence: Seeing things from other perspectives (dual-perspective), listening, using empathy, understanding other people's moods and feelings, counselling, co-operating with groups, noticing people's moods, motivations and intentions, communicating both verbally and non-verbally, building trust, peaceful conflict resolution, establishing positive relations with other people.

Intrapersonal Intelligence: Recognising their own strengths and weaknesses, reflecting and analysing themselves, awareness of their inner feelings, desires and dreams, evaluating their thinking patterns, reasoning with themselves, understanding their role in relationship to others.

Task :

Take a moment to undertake one of the following online tests to assess your preferred 'learning style', are they applicable? How might you use them to inform practice?

- Myers-Briggs
<http://www.humanmetrics.com/cgi-win/JTypes2.asp>
- David Keirse's 'Sorter' to discover one's personality type
<http://keirse.com>
- Soloman & Felder Online test
<http://www.engr.ncsu.edu/learningstyles/ilsweb.html>

- Rose's VARK Online test
<http://www.vark-learn.com/english/page.asp?p=questionnaire>
- Honey and Mumford's 80 item questionnaire
<http://www.peterhoney.com/>

An Introduction to Assessment

Some of the key purposes of assessment are; to enable the communication of the achievement and subsequent status of students during their programme of learning; to provide a means of self-evaluation and information pertaining to such; to identify student placement within educational paths and/or programmes; to address the evaluation and effectiveness of instructional programmes; and to simply motivate the learner.

Student Learning	Certification	Quality Assurance
Provide feedback to improve student learning	To pass/fail a student	Provide feedback to lecturers
Motivate students	To grade/rank	Improve teaching
Diagnosis students strengths, weaknesses	To license to proceed/practice	Monitor standards over time

Figure 1: Three Purposes of Assessment¹

Type and Rationale

Formative Assessment - **Assessment for learning**

Is the assessment that provides feedback to learners in order to help them learn, and feedback to teachers to enable them to decide how a student's learning should be taken forward

Summative Assessment - **Assessment of learning**

¹ Mutch A, Brown G (2002) *Assessment Series No 2: A Guide for Heads of Department*. York: Learning and Teaching.

Is the assessment which provides overall and finite evidence of the achievement of students and of what they know, understand and can do, by assigning a value (often quantitative) to what the student achieves

Trends in Assessment

Written exams are being replaced by more continuous assessment and coursework. There is a move towards more student involvement and choice in assessment. Course outlines have become more explicit about the expectations in assessment.

Group assessment is more frequently used (in line with the shift in emphasis within the curriculum from competition between students towards collaborative learning between students.) An understanding of process is now seen as, at least, equally important to a knowledge of facts. (In line with the general shift towards a process-based, rather than product-based curriculum.) Student focused 'learning outcomes' have begun to replace more teacher orientated 'objectives'. The focus is more on what the student will learn rather than what the teacher plans to teach. (This is in line with more student led approaches in the curriculum generally).²

From	Towards
Written Exam	Coursework
Tutor led	Student Led
Implicit Criteria	Explicit criteria
Competition	Collaboration
Product assessment	Process
Objectives	Outcomes
Content	Competencies

Figure 2: Trends in Assessment

² Brown G., Bull J., Pendlebury M (1997) *Assessing Student Learning in Higher Education*. London: Routledge.

Matching Learning Outcomes To Assessment Types

Different assessments drive different types of learning, this table offers a selection of alternative modes of assessment enabling students to work to their strengths, thus providing an inclusive approach to the assessment regime.

Types of Learning: Learning outcomes	What is required from students?	Examples of Assessment
Thinking critically and making judgments	Development of arguments, reflection, judgment, evaluation	Essay Report Book review
Solving problems / developing plans	Identify problems, define problems, analyse data, review, design experiments, plan, apply information	Problem scenario Group Work Work-based problem Analyse a case Conference paper (or notes for a conference paper plus annotated bibliography)
Performing procedures and demonstrating techniques	Take readings, use equipment, follow laboratory procedures, follow protocols, carry out instructions	Demonstration Role Play Make a video (write script and produce/make a video) Produce a poster Lab report
Demonstrating knowledge and understanding (can be assessed in conjunction with the above types of learning)	Recall, describe, report, identify, recognise, recount, relate, etc.	Written examination Oral examination MCQs Essays Reports Short answer questions Mini tests
Managing / developing yourself	Work co-operatively and, independently, be self-directed, manage time, manage tasks	Learning journal Portfolio Learning Contracts Self-evaluation Group projects Peer assessment
Designing, creating, performing	Design, create, perform, produce, etc.	Design project Portfolio Presentation Performance
Assessing and managing information	Information search and retrieval, investigate, interpret, review information	Annotated bibliographies Use of bibliographic software Library research assignment Data based project
Communicating	Written, oral, visual and technical skills	Written presentation Oral presentation Discussions /Debates/ role plays Group work

(Adapted from Nightingale et al.,1996)

Task :

Perform a spot check on the modes of assessment above;

- How many do you use?
- Are you over assessing?
- What else is used at a programme level (is there a broad range of modes, is it distributed reasonably)?
- Do you offer a range of assessment to account for student preference (learning style)?
- Finally review your assessment protocol [what do students avoid, from what do they learn (engage with) most, what concepts are still problematic?

Enabling Effective Feedback³ (in three Steps...⁴)

Prepare Students to Receive Feedback

Helps clarify what good performance is

Facilitates development of self-assessment in learning

Delivers high quality information to students about their learning

Encourages teacher and peer dialogue around learning

- Aligning their expectations with yours
- Identifying multiple channels of feedback
- Modeling the application of feedback
- Encouraging its application
- Supporting processes of self-assessment

Reduce Emphasis on Written Feedback

Encourages teacher and peer dialogue around learning

³ Nicol D and Macfarlane-Dick D. 2006. *Formative assessment and self-regulated learning: a model and seven principles of good feedback practice*, Studies in Higher Education, 31.2, pp 199-218

⁴ Centre for Excellence in Teaching and Learning (CETL) 2005. *How to make your feedback work in three easy steps!* Business School at Oxford Brookes University. Accessed 01.09 www.business.brookes.ac.uk/aske.html

Encourages positive motivational beliefs and self-esteem

- Explicit, written feedback is important, however...
- Written feedback rarely communicates tacit understandings
- Student engagement is enhanced if written feedback is supplemented with dialogue

Provide Timely Feedback

Provides opportunities to close the gap between current and desired performance

Provides information to teachers that can be used to shape teaching

Students engage with (and apply) feedback if they can foresee ways to apply them

- Feedback on draft assignments may engage students more effectively
- Consider giving generic feedback as soon as possible
- New technologies may reduce the time required to prepare feedback

Designing Assessments⁵

Seven questions that lecturers might ask when designing an assignment are:

1. What are the outcomes to be assessed?
2. What are the capabilities/skills (implicit or explicit) in the outcomes?
3. Is the method of assessment chosen consonant with the outcomes and skills?
4. Is the method relatively efficient in terms of student time and staff time?
5. What alternatives are there? What are their advantages and disadvantages?
6. Does the specific assessment task match the outcomes and skills?
7. Are the marking schemes or criteria appropriate?

Common weaknesses to avoid

The tasks do not match the stated outcomes;

The criteria do not match the tasks or outcomes;

The criteria are not known to students;

Students do not understand the criteria;

Overuse of one mode of assessment such as written examinations, essays, or closed problems;

Overload of students and staff;

Insufficient time for students to do the assignments;

Too many assignments with the same deadline;

Insufficient time for staff to mark the assignments or examinations;

Absence of well defined criteria so consistency is difficult to achieve;

Unduly specific criteria which create a straitjacket for students and make marking burdensome for lecturers;

Inadequate or superficial feedback provided to students;

Wide variations in marking between modules and assessors and within assessors (self-consistency);

Variations in assessment demands of different modules

⁵ Brown G., Bull J., Pendlebury M (1997) *Assessing Student Learning in Higher Education*. London: Routledge.

Impact of Concept Maps

Learning

Reduce the high volume impact / information overload. Approach study, revision and exams with confidence. Refine your learning abilities.

Overview

Visualise entire concepts, gain oversight of complex issues, capture a global view. Define and synthesise links, connections, approaches, diagnosis etc.

Concentration

Provide focused study, review, reflection and learning.

Memorisation

Aids easy recall of key concepts, structures and approaches.

Organisation

Provides clear pathways / plans for essays, projects, presentations etc.

Presentation

Offers focused elements, free form approach, natural aid to speech.

Communication

Provides clarity and conciseness.

Planning

Orchestrate all details and aspects – from beginning to end – on one piece of paper.

Meetings

Initiates and captures effective structure.

Reflection

Provides a method to analyse one's thoughts.

Negotiation

Highlights issues, dilemmas and pathways for discussion and decision

Brain Storming

Assessing Concept Maps

A concept map is a visual representation of knowledge. The process enables one to organize and structure information and the relationships between them. This may be done in a wholly graphical manner i.e. using images, photos, colour etc. to highlight differing concepts and their linkages or by identifying key the concepts by name or title and enclosing them in a visual box then providing connecting navigation to lesser concepts. A traditional concept provides a hierarchical representation of the information from top down, whereas a mind map may radiate from a central single concept only. Suffice to say, when creating a spider map, systems map, concept map, mind map, flow chart, visual plan etc each performs a task that no ordinary collection of notes may encompass in a single sheet – a personal visualization of knowledge – and for our and the students perspective their key 'learning gaps' i.e. what it is they may wish to focus on, reflect, review and develop. In this way they may be used for as a tool to support and enhance learning.

A method of assessing Concept Maps proposed by Novak and Gowin in 1984 is based on the components and structure of the map. This system awards points for:

- Valid Propositions (1 Point Each),
- Levels Of Hierarchy (5 Points For Each Level),
- Number Of Branchings (1 Point For Each Branch),
- Crosslinks (10 Points For Each Valid Cross-Link),
- And Specific Examples (1 Point For Each Example).

A less formal approach to grading Concept Maps is to use and provide a set of assessment criteria within a rubric such as the following:	Exemplary	Good	Acceptable	Unacceptable
Breadth	Map includes the important concepts and describes domain on multiple levels	Map includes most important concepts; describes domain on limited number of levels	Important concepts missing and/or describes domain on only one level	Map includes minimum concepts with many important concepts missing
Interconnectivity	All concepts interlinked with several other	Most concepts interlinked with other concepts	Several concepts linked to other concepts	Few concepts linked to other concepts

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	concepts			
Use of descriptive links	Links succinctly and accurately describe all relationships	Links are descriptive and valid for most relationships	Some links unclear or vague; some invalid or unclear	Links are vague; show inconsistent relationships
Efficiency of links	Each link type is distinct from all others, clearly describes relationship; used consistently	Most links are distinct from others; discriminate concepts; present variety of relationships; used fairly consistently	Several links are synonymous; don't discriminate concepts well; don't show a variety of relationships; used inconsistently	Most links synonymous or vaguely describe relationships and aren't distinct from other links
Layout	Map is contained in a single page, has multiple clear hierarchies, is well laid out and provides a sufficient number of relevant examples with links	Map is contained in a single page, has several clear hierarchies, is fairly well laid out and provides a sufficient number of fairly relevant examples with links	Map is not contained in a single page, has unclear hierarchies, is poorly laid out and provides some fairly relevant examples with links	Map is not contained in a single page, is confusing to read with no hierarchical organization
Development over time (for concepts maps where a "base map" is constructed at the beginning of the course and a corresponding "final map" at the end of the course)	Final map shows considerable cognitive progression from Base map and a significantly greater depth of understanding of the domain	Final map shows some cognitive progression from Base map and a somewhat greater depth of understanding of the domain	Final map shows minimal cognitive progression from Base map and a slightly greater depth of understanding of the domain	Final map shows no significant cognitive progression from Base map and no increase in the understanding of the domain

Based on http://cte.uwaterloo.ca/teaching_resources/tips/rubric%20for%20concept%20maps.html

Products

This table provides a brief collection of the most commonly used programs for creating concept maps, there are divided by those that one might opt to purchase and those that re free to use.

Company	Program	Platform	Web Address
Mindjet	MindManager	PC, Mac	http://www.mindjet.com
Buzan Online Limited	iMindMap	PC, Mac	http://www.imindmap.com
INSPIRATION	Inspiration	PC, Mac	http://www.inspiration.com
SMART Technologies	SMART Ideas	PC, Mac	http://smarttech.com
Mind Technologies	Visual Mind	PC	http://www.visual-mind.com
IHMC	CmapTools	PC, Mac	http://cmap.ihmc.us
ConceptDraw	MINDMAP	PC, Mac	http://www.conceptdraw.com
CoCo Systems Ltd.	VisiMap	PC	http://www.visimap.com
Mind Genius	MindGenius	PC	http://www.mindgenius.com/
IdeasonCanvas	Mindnode	Mac	http://www.mindnode.com/
Free / Open / Educational License			
Freemind	Freemind	PC, Mac	http://freemind.sourceforge.net/
IHMC	CMAP	PC, Mac	http://cmap.ihmc.us/conceptmap.html
Bubblus	Bubblus	PC, Mac	http://www.bubbl.us/edit.php
Gliffy	Gliffy	PC, Mac	http://www.gliffy.com/
Xmind	Xmind	PC	http://www.xmind.net/
TUFTS	VUE	PC, Mac	http://vue.tufts.edu/about/
Compendium Institute	Compendium	PC, Mac	http://compendium.open.ac.uk/institute/

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Notes:

End of Workbook