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A SCHOOL CURRICULUM FOR VISUALISING THINKING

Paula Christophersen
Victorian Curriculum and Assessment Authority, Australia

The Victorian Essential Learning Standards (VELS) is a mandated curriculum framework for the compulsory years of schooling, developed by the Victorian Curriculum and Assessment Authority (VCAA) for schools in Victoria, Australia. It is structured around three core and interrelated learning strands, one of which is Interdisciplinary Learning, and housed within that is the Information and Communications Technology domain. A feature of this domain is standards related to visualising thinking; in essence this means the ability to apply ICT tools such as concept mapping software to support the filtering, refining, reorganising and systematic assessment of content and concepts associated with the domains from the other strands. This paper outlines the nature of the visualising thinking component of the curriculum framework, its potential contribution to enhancing student learning and provides an example of how young learners are using concept maps to support deeper understandings.

1 Victorian Essential Learning Standards

The Victorian Essential Learning Standards (VELS) is a curriculum framework for the compulsory years of schooling (typically for children aged five to 16 years) developed by the Victorian Curriculum and Assessment Authority (VCAA) for schools in Victoria, Australia. Published in 2005, schools use this framework for a whole-school approach to designing and delivering teaching and learning programs that support students to develop capacities to 'confidently manage themselves and their relationships with others, make sense of the world in which they live and effectively participate in that world' (VCAA 2005a).

1.1 VELS structure

Conceptually the VELS is structured around three core and interrelated learning strands that address the processes of physical, personal and social development and growth, the branches of learning reflected in the traditional disciplines, and the interdisciplinary capacities needed for effective functioning within and beyond school, as shown in Figure 1 (VCAA 2005b). Each strand has a number of domains which describe the essential knowledge, skills and behaviours students need to prepare for further education, work and life.

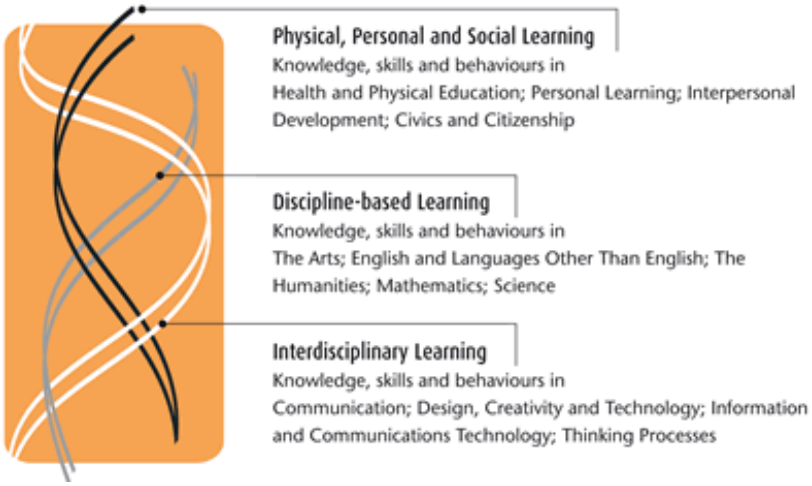

Figure 1: VELS Structure

2 Information and Communications Technology Domain

Within the VELS the Information and Communications Technology (ICT) domain focuses on providing students with the knowledge and skills to change how they learn and to enrich their learning environment. ICT acts as an active agent in supporting students to apply knowledge 'in ways appropriate to context, rather than merely exercising one's memory … and approaching new situations in flexible ways' (VCAA 2005c).

The knowledge, skills and behaviours for this domain enable students to develop new thinking and learning skills, to work productively, to create information and solutions, to express ideas in contemporary ways, to communicate to solve problems and share information, and to act responsibly and critically when using ICT. These knowledge, skills and behaviours are encapsulated in three dimensions, namely ICT for visualising thinking, ICT for creating and ICT for communicating, as shown in Figure 2.

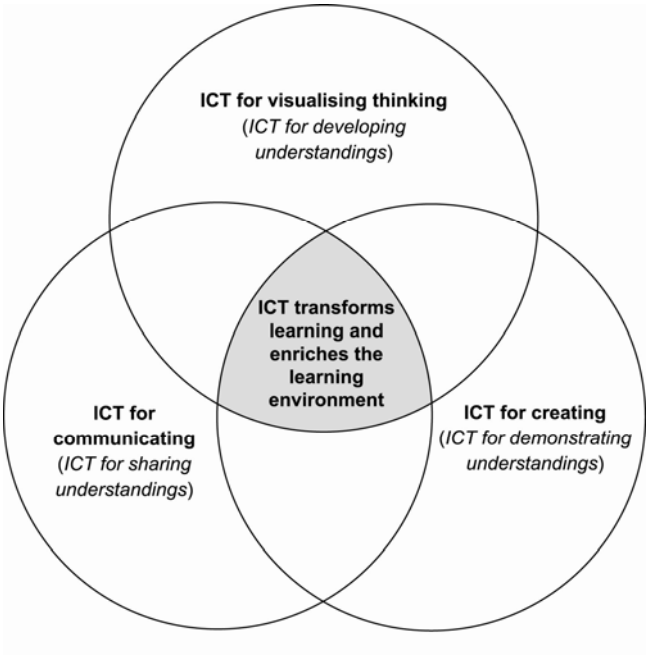

Figure 2: Dimensions of ICT Domain

While the standards are organised around these dimensions, in practice their boundaries are usually seamless with students drawing on ICT knowledge and skills relevant to the task rather than to the dimension.

Historically, the ICT curriculum in Victoria focused primarily on content similar to the ICT for creating and the ICT for communicating dimensions, however, it was silent about how ICT could be used to organise ideas and relevant information to foster effective thinking. Based on writings by authors such as David Jonassen, (Jonassen, 1998) David Whitehead (Whitehead, 2005) and Tim van Gelder, (van Gelder, 2002) the conceptual underpinnings of the visualising thinking dimension emerged – at its heart was the premise that making thinking visible (explicit) is a powerful framework for understanding content and nurturing intellectual development.

2.1 ICT for Visualising Thinking Dimension

The focus of this dimension is on students using ICT to assist their thinking strategies and to reflect on the suitability of their visualising thinking strategies for different learning situations. It is intended that this dimension act as a real lever to change how students learn.

Students use ICT tools and techniques to assist in developing their understandings of domain-specific content. These tools can complement other thinking routines such as artful thinking espoused by Project Zero (Perkins 2003).

The flexibility, speed and capacities of ICT supports the drafting, filtering, reorganising, refining and systematic assessment of ideas, content and concepts in order to structure thinking processes and construct knowledge. Text and image representations of ideas, content and concepts can be created using tools such as concept maps, graphic organisers, ICT-generated simulations and models.

In the VELS, visualising thinking is defined as ‘The process of using ICT tools and editing techniques to visually code and represent thinking (for example, classifying data by colour coding; using a graphic organiser such as a concept map to discover links between data; using simulation software to model a process). It is a process that allows students to clarify thought, and to identify patterns and form relationships between new and existing knowledge’ (VCAA 2005d).

Visualising thinking tools such as concept maps are 'frameworks that help students structure their thinking processes … and help students make connections between existing knowledge and new information, and make visible their thinking processes (VCAA 2005e). Typical concept mapping software used by students in Victoria includes *Inspiration, Kidspiration*, *Rationale*, Intel visible thinking tools, *2Simple*, Cmap.

2.1.1 Visualising Thinking Standards

Standards exist for five levels in ICT and they state what students should know and be able to do at the end of grades 2, 4, 6, 8 and 10 (students are typically 8 years at the end of grade 2 and 16 years at the end of grade 10).

In broad terms the ICT standards for visualising thinking are connected to the following key concepts and skills: using ICT tools to visualise thinking; visualising thinking strategies; modifying visualising thinking strategies and reflecting on visualising thinking strategies. Table 1 identifies the VELS standards (VCAA 2008) linked to one of these skills, *using ICT tools to visualise thinking*, for levels 3 (10 year olds) to 6.

Level 3	Level 4	Level 5	Level 6
Use ICT tools to list ideas, order them into logical sequences, and identify relationships between them.	Apply ICT tools and techniques to represent and explore processes, patterns and cause-and-effect relationships.	Select and apply ICT tools that support the filtering, classifying, representing, describing and organising of concepts, issues and ideas. Use editing functions of the ICT tools when visualising thinking.	Use a range of ICT tools and data types to visualise their thinking strategies when solving problems and developing new understandings. Use appropriate ICT tools and editing techniques efficiently and effectively for assisting in visualising thinking.

Table 1: Standards for the key skills of using ICT tools to visualise thinking

2.1.2 Example of Learning Progress

Teachers are required to make regular assessment judgments and report to parents on a semester basis. To assist in making informed assessment decisions, the VCAA provides samples of student work, published on the VELS website, that illustrate what work might typically look like at a varying levels of performance.

Figure 3 (VCAA 2006) shows evidence of a student progressing towards the Level 4 standard statement identified in Table 1. Students were asked to develop their understandings of a range of farm animals and their product derivatives in an integrated studies program focusing on life on a farm. This work was originally written in French and the students were required to add a sound wave recording (in French) to support their text.

The commentary accompanying this work sample identifies that the student has used different shapes to clearly show hierarchy, however, this would have been enhanced through the use of different colours in the bubbles (subsets). Some relationships were shown through text, arrows and lines, however, additional dialogue is needed to connect the animals and their product derivatives.

A range of other examples at varying levels in the early years of schooling are available on the VELS website (Assessment Maps).

3 Conclusion

The VCAA values the role that ICT plays in supporting student learning and has identified rigorous standards for the ICT domain. How students progress from 'being novice to more expert learners' (VCAA 2005f) is of importance and it is acknowledged that tools and techniques that support 'noticing features and meaningful patterns of information' (VCAA 2005g) contribute to this development. As yet no formal evaluation has taken place regarding the impact of the ICT domain (in particular the ICT for visualising thinking dimension) on learning. The domain is in its infancy, hence opportunities abound. On the positive side, anecdotally the news is good for those schools that have teachers who are not only experts in their field, but who are also confident and competent in using ICT as a teaching and learning tool. Victorian schools are technology rich so a solid foundation exists for the ICT domain, and in particular the visualising thinking dimension to make an important and unique contribution to student learning. Some schools and teachers are grappling with the idea that

'polished' work is not the only output expected from students when using ICT. A legacy of the pre-VELS curriculum is a continuing focus of students mainly using ICT for presentation purposes – for some teachers to acknowledge that ICT tools can be used as workhorses is a challenge for schools and the VCAA.

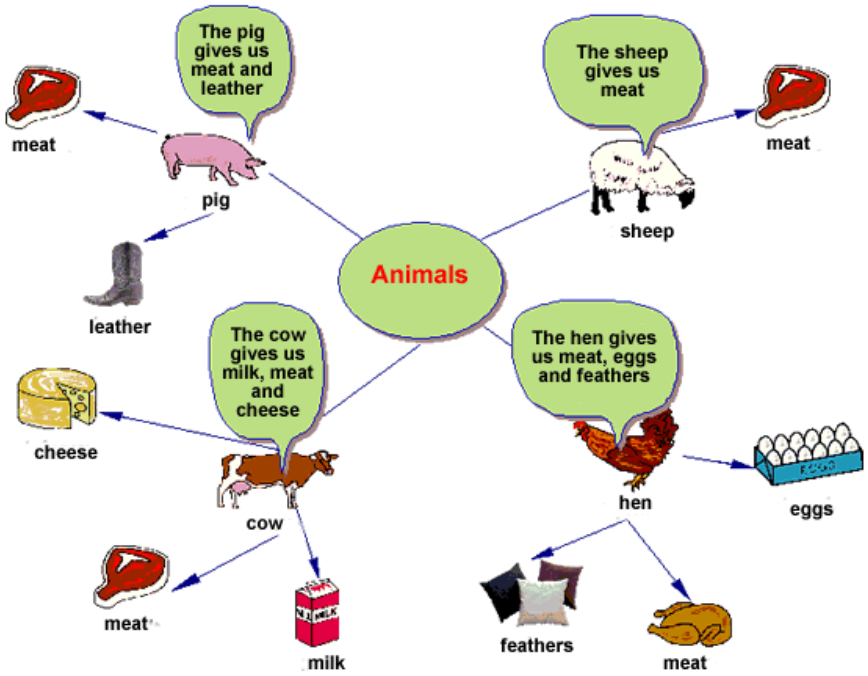

Figure 3: Using a concept mapping tool to explore the relationship between animals and product derivatives

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