# Developing 21st century competencies through disciplines of knowledge[1]

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Business leaders have long expressed concern that employees lack particular general competencies that they say are important in the workplace. In 1988, the council of federal, state and territory education ministers in Australia appointed a committee, chaired by Brian Finn, Chief Executive Officer of IBM Australia, to examine the links between schools and vocational education and training. In its report, the Committee identified six competencies that all young people should develop that went beyond narrow vocational competencies (Finn Committee, 1991).

Further work on the competencies was remitted to another committee appointed by the council of education ministers and also chaired by a senior business leader, Eric Mayer, former Chief Executive Officer of a major insurance company. It produced a list of seven key competencies (Mayer Committee, 1992).

The Australian Chamber of Commerce and Industry and the Business Council of Australia (2002) updated the Mayer Committee's set with eight employability skills. The relationship between the three sets is shown in Figure 1.

| Finn Committee: 1991 **Competencies** | Mayer Committee: 1992 **Key Competencies** | Chamber of Commerce and Industry and Business Council: 2002 **Employability skills** |
|---|---|---|
| Language and communication | Expressing ideas and information | Communication |
| | Collecting, analysing and organising ideas and information | |
| Using mathematics | Using mathematical ideas and techniques | *[Contained in several of the employability skills]* |
| Scientific and technological understanding | Using technology | Technology |
| Problem solving | Solving problems | Problem solving |
| Personal and interpersonal | Working with others and in teams | Teamwork |
| | Planning and organising activities | Planning and organising |
| | | Self-management |
| | | Learning |
| | | Initiative and enterprise |
| Cultural understanding | | |

**Figure 1: Comparisons of general competencies and skills**

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These lists of competencies and skills and the work behind them show that debate about what are now often called *21st century skills* began in Australia before the end of the 20th century.

There have been similar discussions in other parts of the world as well. There have also been significant international efforts to define the skills. One example is the *Definition and Selection of Key Competencies* (DeSeCo) project conducted by the Organisation for Economic Co-operation and Development (OECD). In the project's conceptual framework, there are three broad categories with more detailed competencies within them as shown in Figure 2.

Using tools interactively
    The ability to use language, symbols and text interactively
    The ability to use knowledge and information interactively
    The ability to use technology interactively
Interacting in heterogeneous groups
    The ability to relate well with others
    The ability to cooperate
    The ability to manage and resolve conflicts
Acting autonomously
    The ability to act within the big picture
    The ability to form and conduct life plans and personal projects
    The ability to assert rights, interests, limits and needs

**Figure 2:  Competencies defined in the OECD DeSeCo project**
Rychen & Salganik, (2003).

More recently, three major international technology companies, Cisco, Intel and Microsoft, took the view that, if business and industry want educators to pay attention to particular competencies, it was important to define them clearly and to establish how they might be measured. The three companies funded the *Assessment and Teaching of 21st Century Skills Project*, led from the University of Melbourne with Barry McGaw as the Executive Director in 2009-2010 and, since then, Patrick Griffin, Head of the Assessment Research Centre in the Melbourne Graduate School of Education at the University of Melbourne has been in that role.

In its first year, in 2009, a key task was to develop definitions of the 21st century skills. This work was undertaken by an international team led by Senta Raizen at WestEd in the USA. The team reviewed many sets of definitions and chose not to rule on any one in favour of the others but rather to develop the more general classification into which the various definitions might fit that is shown in Figure 3.

Ways of thinking
    Creativity and innovation
    Critical thinking, problem solving and decision-making
    Learning to learn and metacognition
Ways of working
    Communication
    Collaboration and teamwork
Tools for working
    Information literacy
    ICT literacy
Living in the world
    Citizenship – global and local

**Figure 3:  21st century skills defined in Cisco, Intel and Microsoft project**
Griffin, McGaw, & Care (2012).

All of these attempts to identify important competencies or skills are a product of the task remitted to or understood by the group undertaking the work. They were all intended to define competencies or skills that everyone will need in modern workplaces but also, to some extent, in modern life more generally.

Given the nature of the task, the lists do not include knowledge, understanding and skills required by individuals in particular categories of work. For such categories, e.g. engineering, accountancy, musical performance, there will be position-specific skills that would also be required. They can be too readily lost sight of when discussion and policy development focus too exclusively on competencies or skills that all need.

**Simultaneous treatment of disciplines and 21ˢᵗ century sills**

When a curriculum is developed careful consideration needs to be given to the place of both generic competencies or skills and category or domain-specific ones. In some cases, one set can be dominant. In Australia, the curriculum in the state of New South Wales has remained organised around traditional disciplines or domains of knowledge (www.boardofstudies.nsw.edu.au). The state of Queensland took a radically different approach with a *New Basics* framework with which it sought to align curriculum, pedagogy and assessment using a new conception of the domains of knowledge that involved four curriculum organisers, 20 productive pedagogies and 20 rich tasks over nine years of schooling (Education Queensland, 2000a, 2000b).

In the state of Victoria, the Victorian Curriculum and Assessment Authority developed a set of *Victorian Essential Learnings* shown in Figure 4. They include traditional disciplines of knowledge and, alongside them, five domains that are among those often described as 21ˢᵗ century skills, *viz.* Communication, Thinking processes, Interpersonal development and Personal learning. Victoria thus avoided making a choice between these and long-established disciplines of knowledge.

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Discipline-based learning
    The arts
    English
    Economics
    Geography
    History
    Languages other than English
    Mathematics
    Science.
Interdisciplinary learning
    Communication
    Design, creativity and technology
    Information and communications technology
    Thinking processes.
Physical, personal and social learning
    Health and physical education
    Interpersonal development
    Personal learning
    Civics and citizenship.

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**Figure 4: Victorian Essential Learnings**
(www.vcaa.vic.edu.au)

Australia is a federation with six states and two territories and a constitution under which education is a responsibility of the states and territories not the federal

government. The federal government has, nevertheless, played an increasing role in school education (and a dominant role in higher education) over the last 50 years, primarily through its capacity to fund new initiatives and its constitutional capacity to tie conditions to funding.

A national perspective on curriculum began with a declaration by the council of federal, state and territory education ministers setting out 'common and agreed national goals for schooling in Australia' (Australian Education Council, 1989). It led to substantial collaborative work on a common framework for curriculum but, quite deliberately, not a common curriculum. There were steps forwards and backwards on the extent of collaboration over the next 18 years but, by the 2007 federal election campaign, both the federal government and the opposition announce a commitment to a national curriculum, at least in English, mathematics, science and history.

In 2008, an interim National Curriculum Board was established and began work while the formal structure for an ongoing body was negotiated between the federal government and the state and territory governments. In late 2008, the Australian Curriculum, Assessment and Reporting Authority was established, the 'assessment and reporting' in the title signalling additional remits given to the new body.

The new Australian Curriculum pays serious attention to what are referred to as 21st century skills but does not use that nomenclature because the skills are not unique to the 21st century. The skills typically referred to, for example communication, personal and social skills, and problem solving, have clearly been important in previous centuries though, in the technology-rich environment of the 21st century, their shape may be different in some respects.

For the Australian Curriculum, the name 'general capabilities' was chosen for these skills. As work has been done to develop them, the number of them and their names have changed somewhat. There are now the seven shown in Figure 5.

Literacy
Numeracy
ICT capability
Critical and creative thinking
Personal and social capability
Intercultural understanding
Ethical understanding

**Figure 5:  General capabilities in the Australian Curriculum**
www.australiancurriculum.edu.au

The new Australian Curriculum also pays serious attention to traditional disciplines or domains of knowledge for several important reasons. First, the Board of the Australian Curriculum Development and Reporting Authority (ACARA) did not presume to overturn several millennia of thinking about the nature of knowledge as it pursued its work in the early years of the 21st century. The Board well understood that new sub-disciplines and even new disciplines emerge in the boundaries between existing disciplines and also recognised that much rich understanding is developed with multi-disciplinary perspectives. It took the view, however, that these changes emerged from the work of people with deep disciplinary understanding to begin with.

Secondly, the ACARA Board understood the research on problem solving to have established that experts solve problems differently from novices, primarily because they represent the problems differently from the ways novices do. The representations of experts are the product of deep, domain-specific knowledge that novices do not

possess. The experts' different solution strategies flow from their different problem representations. The ACARA Board does not expect that deep, domain-specific knowledge is likely to be developed in the school years but believes that it as important to ensure that a foundation of knowledge and understanding in disciplines of knowledge are well laid by the end of schooling for those who will go on to advanced study and to become expert.

While the work on an Australian Curriculum began with a limited remit to develop curricula for English, mathematics, science and history, the council of education ministers added the rest of the curriculum in two phases. The disciplines, or learning areas, that now constitute the Australian Curriculum are shown in Figure 6.

English
Mathematics
Science
History
Geography
Economics and Business
Civics and Citizenship
The Arts
Languages other than English
Health and Physical Education
Technologies

**Figure 6:  Disciplines/learning areas in the Australian Curriculum**
www.australiancurriculum.edu.au

In addition to the disciplines, ACARA is giving special attention to three current cross-curriculum priorities that have not had sufficient attention in state and territory curricula: Aboriginal and Torres Strait Islander histories and cultures, Asia and Australia's links with Asia and Sustainability. They do not displace other cross-curriculum ideas that are more securely established in the curriculum. They are named to give them a particular salience to ensure that they are attended to. ACARA's Aboriginal and Torres Strait Islander Advisory Group says that the curriculum in Australian schools has provided a window through which Aboriginal and Torres Strait Islander young people see other Australians, not a mirror in which they can see themselves.

The curriculum content is specified in *content descriptions* that set out the knowledge, understanding and skills that are the learning entitlements of students. For teachers who would like more detail, the curriculum includes *content elaborations* that are not formally part of the curriculum but are, rather, suggestions of ways in which the content descriptions could be dealt with.

There are also achievement standards indicating what successful students will be able to do at various levels of achievement and these are illustrated by annotated samples of real student work in response to tasks set by teachers.

The overall structure of the curriculum can be represented with three dimensions as shown in Figure 7. It is important to note that this figure does not provide some sort of heuristic for writing the curriculum. The figure presents a box with 231 (11x7x3) cells. The writing task is not to fill these cells. Many of them will be empty. The crucial question to test the adequacy of the model is not whether all cells can be filled but rather whether all that is needed will be contained within the cells. That is, the question is whether the content descriptions can serve both the disciplines/learning areas and the general capabilities or whether further content would need to be specified for the general capabilities.
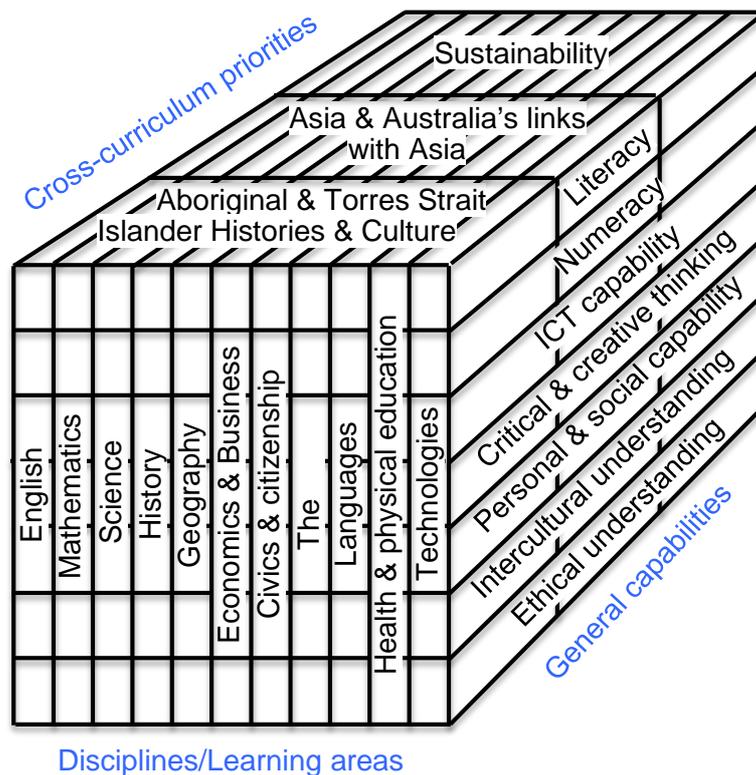
**Figure 7: Structure of the Australian Curriculum**

In schools, both co-curricular and extra-curricular activities could also support students' development of the general capabilities just as they support students' acquisition of the knowledge, understanding and skills in each of the disciplines/learning areas.

**Electronic presentation of the curriculum**

The Australian Curriculum is provided only in electronic form on a public website, www.australiancurriculum.edu.au. At present the site contains only English, mathematics, science, history and geography from F (Foundation year before Grade 1) to Grade 10. Progress on the other learning areas can be seen on the Australian Curriculum, Assessment and Reporting Authority's website www.acara.edu.au. All of the F-10 curricula are due to be completed by the end of 2013.

Work on the curricula for Grades 11-12 is proceeding more slowly because of substantial differences among the states and territories in the way in which they assess, report and certify student achievement at the end of Grade 12.

The site enables the curriculum to be viewed through the each of the dimensions of the curriculum: learning areas, general capabilities and cross-curriculum priorities as well as by year (grade) level. This gives considerable flexibility in the way in which the content of the Australian Curriculum is viewed by applying various filters.

In any display of the content description and content elaborations for a particular learning area and year level, icons are shown to indicate which, if any, general capability or cross-curriculum priority could be dealt with through the content. Clicking on an icon opens a window that gives details on the particular elements of the general capability or cross-curriculum priority that are addressed by the particular content described. The icons used are shown in Figure 8.

**General capabilities**

- Literacy
- Intercultural understanding
- Personal and social capability
- Information and communication technology capability
- Critical and creative thinking
- Numeracy
- Ethical Understanding

**Cross-curriculum priorities**

- Sustainability
- Aboriginal and Torres Strait Islander histories and cultures
- Asia and Australia´s engagement with Asia

**Figure 8: Icons used for general capabilities and cross-curriculum priorities**

If a year (grade) 4 teacher were interested in giving particular attention to *critical and creative thinking*, the teacher can set relevant filters to focus on this general capability.

Figure 9 shows the result if filters have been set to display the *science understanding* strand in the science curriculum for year (grade) 4 and the general capability *critical and creative thinking*. The only content descriptions displayed will be those that could contribute to the development of students' general capability, *critical and creative thinking*. Where other general capabilities could be dealt with as well, the relevant icon will indicate that. In the cases of the two content descriptions shown in the screen shot in Figure 9, there are three icons shown, one is for *critical and creative thinking*, the other two in each case being for the general capability, *literacy*, and the cross-curriculum priority, *sustainability*.

If the teacher wished to develop a unit of work for students that focused on *critical and creative thinking* in an integrated way across several learning areas, the teacher could apply the *critical and creative thinking* filter to other learning areas at year (grade) 4 to identify all the curriculum content that deals with *critical and creative thinking*.

There are separate descriptions of the general capabilities on the Australian Curriculum website. They can be accessed via the 'General capabilities' tab on the Australian Curriculum website home page. Under that tab, there is a 'General Capabilities Overview' as well as separate descriptions for each that provide a description of the scope of the capability, the organising elements for its conceptualisation and a developmental continuum for student development.

**Figure 9:  Year 4 science: filters set for *science understanding* and *critical and creative thinking***

Taking the general capability, *critical and creative thinking*, as an illustration, the organising elements used for it in the Australian Curriculum are those shown in Figure 10. In the early planning stages for the Australian Curriculum, *critical thinking* and *creativity* were treated as separate draft general capabilities. As the work progressed, it became difficult to maintain the distinction with the combined capability the result. The organising elements in Figure 10 make clear how both are contained in the final version of the *critical and creative thinking* general capability.

Inquiring – identifying, exploring and organising information and ideas
Generating ideas, possibilities and actions
Reflecting on thinking and processes
Analysing, synthesising and evaluating reasoning and procedures

**Figure 10:  Organising elements for critical and creating thinking**

The first components of the developmental sequence for the *critical and creative thinking* general capability can be seen in Figure 11.

**Figure 11: Developmental sequence for critical and creative thinking**

The developmental sequence is not divided into 11 levels for years (grades) F to 10. Rather, it is divided into six broader categories, called 'levels'. The first level corresponds to Foundation and the next five to pairs of school years, 1-2 and so on to 9-10. The display in Figure 11 that correspond typically to Years (Grades) in the manner shown in the red box in the slide above.

In the viewing mode shown in Figure 11, three levels, 1-3 or 4-6 can be shown at a time. In the example shown, levels 1-3 have been selected.

The substance of the sequence is shown under the four *organising elements*. For each there are four subdivisions. In the display shown, the first two subdivisions for the first organising element, *Inquiring – identifying, exploring and organising information and ideas can be seen.* The two subdivisions shown are *Pose questions* and *Identify and clarify information and ideas*. The development anticipated in student from level 1 (Foundation) to level 2 (years/grades 1-2) and level 3 (years/grades 3-4) can be seen in the descriptions. The *Show examples* link under each description provides helpful suggestions of the kind of question that would be relevant at each level.

At level 1 under *pose questions*, the suggestion is *asking why events make people happy or sad*. At level 3, the suggestion is *asking who, when, how and why about a range of situations and events*.

**Linking resources to the curriculum for teachers**

Implementation of the Australian Curriculum remains in the hands of state and territory education authorities and the non-government school sector but there is a major national development that is producing an important resource on which teachers can draw.

Education Services Australia (ESA) has developed a substantial database of resources for teachers. ACARA and ESA have collaborated to apply common meta-tags to content descriptions in the Australian Curriculum and resources in ESA''s database which is accessible through a website www.scootle.edu.au.

On the Scootle home page, there is now an option for a teacher to 'Find [resources] by Australian Curriculum'. To display resources of interest, the resource database can be filtered to focus on only some learning areas, some years (grades), some general capabilities and some cross-curriculum priorities in exactly the same way Australian Curriculum website content can be filtered.

If a teacher were to select year (grade) 4 science and *critical and creative thinking* and the content description *Living things have life cycles*, the webpage shown in Figure 12 would appear. The *content description* and the associated *content elaborations* would be shown. This information is drawn from the same database that the Australian Curriculum website draws from so there are no problems with version control.



**Figure 12: Access to supporting resources for the Australian Curriculum**

In the top right of the page there would be an indication of which of the general capabilities could be dealt with using this content. In this case, it would be two of the seven, *critical and creative thinking* since it was filtered for but also *literacy*. There would also be an indication of which of the cross-curriculum priorities could be dealt with. In this case, it would be only one of the three, *sustainability*.

In the middle of the page, there is a report on how many resources are available in the Scootle database. In this case, there are 182, of which 162 are classroom resources and 20 are teacher reference materials.

Further down the page there is a the full list of resources that are one click away. (Access is password restricted because some of the material has been provided for inclusion on the basis that access will be granted only to teachers.) Resources are

being obtained from many sources, both in Australia and overseas. Within Australia, many of the cultural institutions, such libraries, museums, galleries and the Australian Broadcasting Corporation are providing digitised materials for inclusion. With one national curriculum instead now linked to the resources, the incentives to provide are and the benefits to users of the provision are much greater.

With this kind of access to resources by teachers and students, the possibilities for personalising student learning are greatly increased.

**Summary and conclusion**

Within the Australian Curriculum, 21st century skills are called *general capabilities* to avoid any unnecessary implication that they are unique to the 21st century while still recognising that they are important in the 21st century.

The Australian Curriculum is also, very importantly, organised by *disciplines/learning areas*.

The content in the curriculum serves the development of students' general capabilities as well as their knowledge, understanding and skills in the disciplines/learning areas. Electronic presentation of the curriculum allows users to filter the content to display only the elements of particular interest at the time. This allows a user, for example, to view only the content relevant to a particular general capability of interest and to do so for several disciplines/learning areas in order to develop some integrated units of work for students.

The provision of developmental continua for the *general capabilities* helps teachers conceptualise, measure and report on student progress in developing their general capabilities.

Finally, the systematic electronic connection of the Australian Curriculum with an electronic database of resources for teachers and students gives teachers and students much readier access to appropriate resources directly connected to the curriculum than they have had before.

It is a powerful confluence of developments that is supporting a major curriculum change in Australia.

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