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CHRISTINE PRESTON provides a straightforward guide to teaching Science and Technology in the primary years…

Primary teachers in NSW have been implementing the new NSW Syllabus for the Australian Curriculum, Science K-10 (Incorporating Science and Technology K-6). The new syllabus has invigorated teachers who want to ensure that science and technology learning is authentic and effective. It provides an excellent opportunity for teachers to reflect on the status and quality of this KLA in their schools. Now, more than ever principals are prioritising teacher professional development in science and technology. Whilst Science and Technology has been a mandatory component of the primary curriculum since the early eighties this KLA has not always been given the attention it deserves.

Schools that are focusing on science and technology are implementing whole school change by revising their scope and sequence plans and running in-school professional development. Teachers are also being supported to attend outside courses. Representatives then return to their school enthused and ready to lead curriculum improvement in science and technology. There are positive aspects to new syllabus implementation including the opportunity to make science and technology a prominent part of the primary curriculum.

CHANGES TO THE NEW SYLLABUS

Significant changes have been made to both the structure and content of the syllabus compared to the previous version. Structurally, the syllabus is organized by two knowledge and understanding strands, Natural Environment and Made Environment; and two skills strands, Working Scientifically and Working Technologically. Content wise the outcomes are specific and explicitly outlined with suggested activities for students. This makes it very unlikely that schools can continue using exactly the same teaching program as before.

The syllabus retains its dual focus on science *and* technology. Considering this some schools now realize that the technology component was previously overlooked in previous teaching program. Schools using various resources, including *Primary Connections* need to ensure that technology as well as science outcomes are adequately addressed.

K-10 FRAMEWORK

Reading the aims (pages 14 & 79) and rationale (pages 12 & 77) of the K-6 and 7-10 syllabuses lets you compare the underlying intentions of primary versus secondary science and technology. First primary learning experiences ought to be wonderful, intriguing, engaging and related to children's interests. We must make learning science and technology in all primary schools enjoyable (not boring or arduous). The schools that already have effective teaching programs engage children in relevant learning experiences that make them think and understand more about their world. This happens when teachers help children link everyday experiences with scientific phenomena and technological applications.

Placing the K-6 syllabus within a K-10 framework provides a learning continuum and enables you to easily check the level of content. Gravity, for example, occurs in both stage 2 and stage 4. In stage 2, gravity is taught as an example of a non-contact force. Students drop things to observe how gravity pulls them down. Science toys that take advantage of gravity are fabulous resources for this. In stage 4 students learn that the pull of gravity is towards the centre of Earth and they focus on unbalanced forces and mass and weight. This means you are not expected to teach facts about gravity but rather organise learning experiences for children to observe its natural effects. Using the syllabus like this helps ensure primary learning is appropriate. The K-10 framework then reinforces the quite different aims of K-6 and subsequent 7-10 parts of the syllabus.

CONTENT - KNOWLEDGE AND UNDERSTANDINGS

Most teachers find the new syllabus is well documented and easy to follow. You will be familiar with many of the names of the content sub-strands from the previous syllabus. The science content reflects the key disciplines of physics (Physical World), geology (Earth and Space), biology (Living World) and now chemistry (Material World). The technology content includes previous topics (Built Environments, Information, Products) and a new one (Material World). Material World relates learning to both the natural and made environment.

As well as changes to the organization, changes to the concepts or topics have also been made. Key concepts are emphasized, some topics have changed stages and some is no longer taught in K-6. The content of the specific outcomes are elaborated by using dot points (bullets), making it easy to work out exactly what you have to teach. This enables teachers to prepare for specific topics where their background knowledge may need to be developed. All of the outcomes *and* the dot points that elaborate the content are mandatory. The examples at the end of the dot points are *not* compulsory. If you can think of more interesting or relevant examples for children then use them. This element of the syllabus provides you with the flexibility to do what primary teachers do best – be creative.

The following shows where a more appropriate and an additional example could be used. Stage 1 Material World suggests making concrete as an example for children to explore how people at home or work change and combine different materials for a particular purpose. This is unlikely to interest year 1 or 2 children and not safe for a practical task. It is also a misleading example of a physical change (concrete setting involves a chemical reaction). What other context could you use? Interior decorators mix different pigments with white paint to create tonal variations. Children could investigate this by adding crushed rock fragments to paint. Early stage 1 Natural Environment suggests tennis balls and blocks as examples for children to identify that size and shape affect how objects move. These are certainly useful but you could also use toy parachutes (open and closed) to further engage children in learning about this idea.

Looking at Living Things illustrates how changes are embedded throughout the syllabus and where content has changed stage level. Early Stage 1 focuses on the basic needs of living things, a change from identifying their differences. Life cycles are now in stage 2; in stage 1 children compare differences between offspring and adults and measure and record growth of actual living things. A big change is that the human body previously taught in stage 2 has been removed. Differences between living and non-living things are now taught here focusing on distinguishing characteristics. Stage 3 now specifies structural features (external not internal) as adaptations that enable particular species to survive in certain environments. Australian animals and plants are to be observed and existing adaptations described. Don't forget you can use your own examples. This is an excellent opportunity to feature local area organisms and make learning more relevant for your children.

The new syllabus also indicates the type of learning activities children should be doing. Words like: explores, uses, identify, research, communicate, sketch, model, group, describe, compare, etc. signify the nature of children's learning. A good example of this is Earth and space stage 2. Children are required to *describe* local seasonal changes due to Earth's movement around the sun. This means focusing on observable changes such as day length and weather effects, e.g. temperature change. It does not mean children are expected to *explain* why seasons occur, which is secondary level content. Much of the content implies active learning by children which can be supported by modern teaching strategies and productive use of science and technology skills processes.

CONTENT – SKILLS

The new syllabus includes two skills - Working Scientifically and Working Technologically making it similar to the mathematics syllabus. In the new syllabus the skills outcomes include more explicit statements about the practical learning expectations. The syllabus clearly states children *must* do practical work. There is a clear trajectory of sub-skills development along the stages from ES1 to Stage 3. Following research into effective teaching of Science and Technology, the syllabus is designed so that children will develop understanding of content through active engagement in these two skills areas.

WORKING SCIENTIFICALLY

This skills area is concerned with developing the process of science inquiry. Reflecting the work of real scientists the actual method used for investigations can be varied. As you guide children to identify and pose questions they will learn a variety of ways to collect data and realize the importance of evidence in forming scientific explanations.

Opportunities exist for integration with other KLAs as children communicate their findings. The syllabus clearly states children must conduct first-hand investigations aimed at developing deep understanding.

Working Technologically

The new syllabus specifies technology learning will involve the design process. Through active engagement in problem solving children learn about the applications of technology in a range of real

world contexts. Encouraging children to be creative in designing solutions and justifying decisions builds their thinking capacity. Children must engage in hands-on design tasks. Your role is to support children's active learning culminating in thoughtful discussion.

Opportunities and challenges

The new syllabus situates teachers as learning supporters rather than knowledge providers. The practice of developing children's understanding through meaningful hands-on experiences is supported by research. This may present a challenge for teachers who have traditionally relied on textbooks, worksheets and videos. Learning shaped by the key processes of science inquiry and technological design will necessitate resource acquisition in some schools. Whole school plans may need to be adjusted to allow science and technology a fairer share of time in the school curriculum. At least one hour per week for the whole year should be devoted to the science and technology KLA in teaching programs from K-6 in the primary curriculum.

The challenge is to make all Science and Technology learning interesting and engaging for children. We need to organize authentic learning contexts that allow children to find patterns in the world and foster curiosity and surprise. Try beginning lessons with a puzzle or challenge to intrigue children and get them thinking. Allow time for sharing their ideas about the question. Involve children in inquiry where they can explore and collect evidence. Revisit children's ideas about the novel situation discussing any advances in their thinking. As a class generate a scientific explanation and use drawing to visually represent understanding. Have children apply their understanding through a related design task. Providing creative and interesting learning experiences that are relevant for children will make Science and Technology learning in primary schools exemplary.

The new syllabus signals the time for primary teachers to make Science and Technology a prominent part of the primary curriculum. Through purposeful, sustained teaching incorporating engaging learning experiences, NSW teachers can significantly elevate the status and quality of Science and Technology in primary schools.

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