Scientific Literacy in the Primary Curriculum

The focus of teaching science in primary schools has become centered on processes and applying concepts rather than simply knowledge acquisition. While teaching key content is important, developing scientific literacy has been determined as more important to equip students as they are confronted with issues and problems requiring scientifically-based decisions and solutions in an ever-changing world (Board of Studies NSW, 2012, p.11; Kaya, Bahceci, Altuk, 2012; Martin, 2006, p.55). Teachers of science in the primary curriculum are able to promote scientific literacy in their students through imparting knowledge as well as encouraging interpretation and development of science-based ideas.

# Scientific Literacy Defined

Historically the concept of scientific literacy has been identified as a means for providing the general public with “a broad understanding of the natural world and the way it affects people's personal and social lives” (DeBoer, 2000, p.52). More specifically, this term broadly designates one’s ability to employ understanding of science-based knowledge and processes in order to make informed choices about issues and problems arising in society (Hurd, 1958, as cited in Bybee, McCrae, & Laurie, 2009, p.866; Kaya, Bahceci, & Altuk, 2012, p. 495; NSW Department of Education and Communities, 2011). Because of this, the process of developing scientific literacy in students has been labeled as the crux of science education (Board of Studies NSW, 1993, p. 13; Hodson, 2009, p. 4), and is fostered through a process of inquiry rather than knowledge acquisition (Martin, 2006, p.55). Furthermore, beyond simply applying science, scientific literacy is said to involve aptitude in interpreting and developing scientific as well as technological ideas, values and skills to achieve societal aspirations (Bybee, Powell, & Trowbridge, 2008, p. 86; Cavagnetto, 2010, p.338). Scientific literacy has also been more contemporarily defined and assessed within the components of scientific contexts, competencies, knowledge and student attitudes toward science (Bybee, McCrae, & Laurie, 2009, p.866).

# Justifying Science’s Inclusion in the Primary Curriculum

The development of scientific knowledge, skills and attitudes during primary school is paramount for preparing people for life in a complex and continually evolving society dominated by science and technology, as it develops the ability to make informed decisions through becoming investigative rather than naïve about such issues (Board of Studies NSW, 1993, p. 13; Hodson, 2009, p. 4). Fundamental skills such as “gathering evidence, thinking creatively, reasoning rationally, responding critically, and communicating conclusions” (Bybee, McCrae, & Laurie, 2009, p.870) emerge as from scientific literacy, which indicates its importance for developing students’ proficiency in problem solving and knowledge construction as they confront real world situations and shape sustainable futures (Board of Studies NSW, 2012, p.11; Kaya, Bahceci, & Altuk, 2012, p.496).

Furthermore, a recent study conducted by Dr Cathy Foley, president of the Australian Scientific and Technological Societies, highlighted “disturbing ignorance about science” amongst the Australian population (Santow, 2010), which indicates the necessity of encouraging students to embrace science and understand its relevance. Science is also beneficial in the curriculum, as the required processes of reasoning and argumentation foster communication and critical thought by compelling students to apply their knowledge (Cavagnetto, 2010, p.337; Erduran, Osbourne, & Simon, 2005, p.382). Additionally, science education involves an inquiry-based educational model in which the teacher ideally facilitates learning rather than imparting information, employs multiple assessment strategies and provides constructivist based learning environments, which effectively caters for a variety of needs and learning styles (Martin, 2006, p.58).

# Barriers Inhibiting Scientific Literacy’s Development in the Primary Classroom

While the nurturing of scientific literacy in the primary classroom has clear benefits for developing a variety of fundamental skills, factors do exist which impede its progress. It has been shown that the teaching of science in primary school is becoming an undesired exploit due to a lack of confidence and competency in this area as well as a growing perception of irrelevance (Jarvis, & Pell, 2005, p.157; Santow, 2010). Furthermore, schools’ capability to provide an adequate amount of scientific practice to achieve the goal of developing familiarity and depth of understanding has been questioned because of curriculum time constraints (Cavagnetto, 2010, p.353) and since this vision is often preceded by the allegedly more practical goal of producing future scientists (Martin, 2006, p.56; Shamos, 1995, p.73).

Schools have also been criticised of inhibiting the development of scientific literacy through: focussing on test results rather than enhancing appreciation and understanding of science (DeBoer, 2000, p. 582), hindering the development of students’ scientific process skills by generating anxiety related to tests (Kaya, Bahceci, & Altuk, 2012, p. 498) and promoting immediate recollection rather than long-term retention of knowledge (Shamos, 1995, p.74). Additionally, although it is supposedly the goal of science education to develop scientific literacy in all citizens, students with disabilities are often neglected due to a preconception that they cannot benefit from instruction in science (Martin, 2006, p.279). This can be combated through an awareness of the developmental impact of attitudes and expectations towards students with special needs, which calls on teachers to cater for individual requirements by making suitable alterations to learning processes.

# Scientific Literacy Achieved in the Classroom

The acquisition of scientific literacy skills is promoted in the classroom by developing abilities in scientific processes and encouraging positive attitudes in students (Kaya, Bahceci, & Altuk, 2012, p.499). As discussed, this is facilitated through inquiry-based learning environments (Martin, 2006, p.58), which also indicates the need to acknowledge the ever-changing understanding of science by choosing content based on considerations of student interest, expertise of teachers and cultural contexts (DeBoer, 2000, p. 597).

Within school circumstances, students’ scientific literacy skills are developed across stages to enrich views of themselves, society and the environment by applying learning in relevant contexts (Board of Studies NSW, 1993, p.7). An example of this coming to fruition is found in the Science and Technology K-6 Syllabus through comparing the successive units of work on the “material world” (Board of Studies NSW, 1993, p.106, 132). While the Stage 2 unit proposes that students will learn about natural and processed materials, how they are used as well as the associated benefits and problems with humans changing the environment (Board of Studies NSW, 1993, p.106); this is extended during the Stage 3 unit where students are encouraged to identify ecological consequences of production, explore technology’s effect on the Earth’s environments as well as consider future impacts and changes to living caused by interacting with the environment (Board of Studies NSW, 1993, p.132). This clearly demonstrates an achievement of scientific literacy through progression from immersing students in learning and knowledge acquisition to provoking discussion and applying content to solve real world problems.

The process of developing scientific literacy equips students with the necessary knowledge, values, skills and attitudes for making informed decisions about key issues and future considerations of an ever-changing scientific and technological society. This practice transpires through a process of inquiry and gradually sophisticating students’ abilities to apply scientific thoughts as they interact with the world around them. Clearly, this is an abundantly important pursuit and indicates the need to combat inhibiting factors such incompetency and anxiety amongst teachers, as well as the misguided focus on test results.

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