

## 2020 Vision: An information literacy continuum for students primary school to post graduation

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***Abstract:** By the year 2020, those now commencing school will have emerged into a variety of contexts. Despite their years of education, these young people may lack the skills of information literacy that an information age demands. One reason for this could be a lack of information literacy vision on the part of their educators. The term Information Literacy was coined in the 1970s and has, since then, developed a substantial academic literature. Despite the acknowledged need for information literacy, to date there has been little in the way of a comprehensive vision of information literacy development. Ideally, such a vision would accommodate both the vertical and lateral transitions students make as they proceed on their educational journey. One starting point is to perceive learning as a lifelong endeavour, the information literacy needed for that endeavour being the responsibility of all the participants in the learning process. A model which presents information literacy as a continuum offers a framework which allows the whole information literacy journey to be conceptualised by the participants. The model presented here fulfils the challenge put by those developing information literacy standards to convert those standards into a useable continuum. It attempts to chart information literacy development from novice reader-writer to independent researcher. As well as having practical, pedagogical application, the information literacy continuum may provide a framework for future research.*

***Keywords:** information literacy, graduate attributes, information skills*

By the year 2020, some students presently in Year 2 will be commencing postgraduate courses. Others will be managing their own businesses, working as employees, enrolling as mature-aged students, completing Technical and Further Education, caring for family or friends or looking for work. Ideally, these students will have undertaken an educational journey that developed, in a coherent manner, an information literacy that will serve them well in their various educational, personal, social, recreational, and employment endeavours.

In this article, we suggest that one reason this may not occur is a lack of vision on the part of educators from primary school teachers to post-graduate supervisors; vision that encompasses the scope and nature of the information literacy journey students embark on early in their lives and continue throughout their

formal and informal educational experiences. To support the development of such a vision, we present a framework that illuminates ways in which students may develop information literacy.

### **The nature of information literacy**

Information Literacy has been identified as an abstract notion (Behrens, 1994, Hayden, n.d.) which embraces a broad set of skills related to engaging in meaningful ways with others' textual or multimedia information and making it one's own and often to re-presenting it for specific audiences. Macpherson (2002) claims that '[d]efinitions of information literacy are almost as numerous as writers on the topic'. However, most of the literature on information literacy (for example Behrens, 1994; Lenox & Walker, 1993; Seamans, 2001) take as a starting point the American Library Association's statement that 'information literate people know how to find, evaluate, and use information effectively to solve a particular problem or make a decision' (Association of College & Research Librarians, 1989).

Since the term was coined in the 1970s, information literacy has become of increasing academic interest, particularly for librarians and information professionals (Virkus, 2003). By the 1980s, information literacy had become a general education issue (Behrens, 1994) with a corresponding increase in the literature relating to it (Virkus, 2003). By the late 1980s, implementation of information literacy principles within academic settings had begun, accompanied by the development of information literacy standards (Seamans, 2001). Its principles have been distilled into the 'graduate attribute' statements of numerous Australian universities. However, information literacy implementation was slow through the 1990s, particularly in the field of higher education (Seamans, 2001; Bundy, 2004).

### **The need for a vision of information literacy**

The 21<sup>st</sup> century will be one, not only of an increasing proliferation of information, but also of increasing access to this information. In order to survive in this information age, people will need to be information literate (Seamans, 2001; Candy, 1995; Council of Australian University Librarians, 2001). They will need to 'recognise their own need for good information, and ... have the skills to identify, access, evaluate, synthesise and apply the needed information' (Bundy, 2002). The society of the future will need to be populated by a knowledgeable citizenry who will form 'the building stone for a society that is equitable and possesses economic growth potential' (Rader, 2002, p. 2).

While comprehensive information literacy has been identified as an imperative, there is, as yet, little indication that its development is being addressed in a comprehensive way. Numerous studies indicate the contrary. Virkus (2003) cites a recent OECD report which expresses concern that 'many students lack experience in information handling and effective independent learning...[I]n all the countries and regions surveyed, at least one of every four adults fails to reach minimum literacy levels for coping with everyday life and work in advanced societies'. Studies carried out at universities (Hepworth, 1999; Caravello, Herschman & Mitchell, 2001; Doherty, Hansen & Kaya, 1999; Clerehan & Walker, 2002) indicate that students are not only entering, but graduating from, university without the information literacy skills they need to function in the society of tomorrow.

One of the reasons for this failure to come to terms with what Bundy (2004, p. 6) identifies as 'the single most pervasive educational issue for the 21<sup>st</sup> century', is that both students and teachers are 'without a clear blueprint or roadmap on how to teach and learn the concept' of information literacy (Koch, 2001). With no map there are ad hoc initiatives and major discontinuities. There exists a 'surprising divide' between what happens in the K-12 environment and in higher education (Seamans, 2001, p. 23). University staff have expectations regarding the information literacy levels of commencing students and these expectations are not being met. Bundy (2004) identifies as a 'myth' the belief that students will be information literate when they enter university.

There is no clear vision of the path of information literacy development or of how that development can best be fostered. Nor is the development simply a linear one. Clerehan and Walker (2002) write of the 'lateral' transitions - those between disciplines - as well as the 'vertical' transitions - those between educational levels - students must make as they progress through their educational experiences, and both of these transitions need to be accommodated in any map or model of information literacy development. There needs to be provision for the notion that information literacy is not linear and once-and-for-all. Rather it is contextual, with recursions up, down and sideways being part of the journey to be mapped. Students may well be information literate in the school context, but the new, discipline-specific information literacy demands of university may render them seemingly information illiterate, giving rise to the chagrin expressed by Bundy.

### **Developing an information literacy framework**

The challenge is to develop a framework that will clearly express this notion of contextuality. A danger with a simple linear or 'list' model is that it can lead to the misconception that 'the skills have been mastered for good once each unit can be labelled as completed' (Webber & Johnston, 2000, p. 384). Life, and information literacy, are not that simple.

One approach to developing a more holistic model of information literacy is to perceive it in terms of lifelong learning. Seeing learning as something that occurs continuously over the life span rather than happening in discrete and unrelated chunks in various educational institutions may lead to a model that encompasses the recursions discussed above. Increasingly, the development of lifelong learning is being seen as an important function of educational institutions, the Council of Australian University Librarians (2001) and the Association of College and Research Libraries (2005) both identifying it as being 'central to the mission of higher education'. If learning is something which occurs continuously over life, and if information literacy is necessary for independent learning to occur (Behrens, 1994; Candy, 1995; Hepworth, 1999), then information literacy too must develop continuously to support and facilitate this learning. To accommodate this fluidity, we must 'shift our instructional emphasis from acquisition of a product to execution of a dynamic process' (Lenox & Walker, 1993, p. 317), a process that is engaged with recursively in a variety of contexts for a variety of purposes.

To be relevant to these various contexts, it is necessary for the abstract principles of information literacy to be embedded within particular learning contexts. This embedding has been argued for reasons of simplicity (Bruce & Candy, 1995), effectiveness (Hepworth, 1999), professional relevance (Carroll, Johnston & Thompson, 2001) and importance (Fitzgerald, 1999). Embedding, however, raises the issue of ownership. Whose responsibility is it that students develop information literacy skills and how can this development take place most effectively?

While much information literacy work has been the province of librarians and while some see that situation as necessarily continuing (Virkus, 2003; Bundy, 2002), there is also the view that librarians' spheres of influence are limited (Webber & Johnston, 2000). Others locate the responsibility for information literacy development in progressively wider domains involving teachers (Behrens, 1994; Doherty, Hansen & Kaya, 1999), institutional leaders (Lenox & Walker, 1993; Angeley & Purdue, n.d.) and the learners themselves (Dunbar, Edwards & Stemler, 2001). Nor does the responsibility lie at just one point in the educational journey. As Hepworth (1999) points out, the responsibility is not only lateral at any one time, but also vertical, across all levels of formal education. A useful information literacy framework, then, would be one which could inform the activities of all participants in the learning process, across the time span of that learning.

One such framework to help conceptualise information literacy development is to see that development in terms of a continuum. Indeed, the Council of Australian University Librarians (2001) recommended that a 'continuum of expectation' be developed from their information literacy Standards.

### **A theoretical framework for information literacy**

One of the dilemmas in developing such a continuum, is what, if any, learning theories should underpin it. Different epistemological perspectives provide divergent views of what an information literacy framework is or should involve. An objectivist view of knowledge acquisition and utilisation conflicts markedly with a personal constructivist perspective (Fosnot, 1993), let alone a social constructivist perspective (Laugksch, 2000). Objectivist accounts of learning focus on the objective nature of a body of discipline-specific knowledge and the notion that this body - information, skills and attitudes - must be acquired and processed by learners of that discipline (Cannon & Jinks, 1992). Personal constructivist accounts focus on the building of ideas through internal cognitive processes, stating that these are salient for learning in any context, and that teaching activities can and will be interpreted in learner-specific ways (Hand, Prain, Lawrence & Yore, 1999). For social constructivists, the emphasis is on the interaction amongst learners and others and the language they use (Anderson, Holland & Palincsar, 1997). The various conceptions of learning suggest a range of possibilities for an Information Literacy Continuum. Marcum (2002) states that most common understandings of information literacy are at least implicitly informed by the objectivist perspective, a point corroborated by Tobin and Tippins (1993) who label it as the default epistemology for those who have not made explicit their underlying assumptions for learning and teaching. However, accepting this or any other particular approach would necessarily exclude models based on other theoretical bases.

Dewey noted that when there is such an educational dilemma, each perspective should be viewed from a 'level deeper and more inclusive' (1938/1963, p. 5). Applying this principle along with Lakoff and Johnston's (1999) 'conceptual metaphor', each epistemological perspective could be viewed as having a metaphorical basis (Willison & Taylor, in press), and therefore could be used in a complementary rather than a competing manner. Notwithstanding Marcum's comment above, we are more of the opinion that information literacy 'standards' owe much to Bloom's taxonomy (1956) and its hierarchy of knowledge, understanding, application, analysis, synthesis, and evaluation; ways of engaging with information that are appreciated by objectivists, constructivists and those committed to other learning theories.

In developing the Information Literacy Continuum we present here (See Appendix), we adopted this complementary approach, considering that people adhering to any of the above epistemologies (or some other) could be well-informed by the Information Literacy Continuum we have devised. This is primarily because each perspective recognises the usefulness of engaging meaningfully with information.

Any descriptive framework, such as the Information Literacy Continuum, is open to interpretation shaped by the individual's own theories of education. It is for this reason that we believe the Information Literacy Continuum is not, and should not be, a prescriptive program, a benchmarking activity, a quality assurance device or an assessment agenda. It is primarily intended to enable a more visionary approach to developing a crucial set of skills. One hoped-for outcome would be a vision-in-common amongst people with otherwise divergent opinions about education, especially for educators in very different sectors of education.

### **An information literacy continuum primary to post graduation**

We based the continuum on the Information Literacy Standards which were generated initially in the USA ( Association of College and Research Libraries, 2000), modified for the Australian context (Council of Australian University Librarians, 2001) and further edited (Australian and New Zealand Institute of

Information Literacy, 2004). The continuum represents an elaboration of these standards into a model showing sequential levels of information literacy development, each level specifying associated skills and information literacy activities. In our framework, the 6 information literacy Standards of 2004 are shown in the first column. We have 'stretched' each of these along a continuum, and the second to sixth columns show critical points along the continuum for each standard. These points correspond to sequential levels of information literacy development, identifying students' engagement at increasing sophistication with increasingly demanding tasks and contexts.

There has been at least one other attempt to expand information literacy standards into what its authors call an 'information and ICT literacy matrix of student learning' (Australian School Library Association and Australian Library and Information Association, 2001). A major limitation of this matrix is that it is designed solely for the school sector. Some design features also limit its ease of use; the levels are given no identifying labels and the matrix spreads over six pages, making it difficult to access as a whole.

Our continuum seeks to provide a comprehensive framework which outlines information literacy development, from novice reader-writer to independent researcher. It provides a conceptual and strategic map and, for lecturer, teacher and student, a sense of 'my role in the whole'. The progression from the top to the bottom of the continuum table represents the move from student as processor of information to student as producer of artefacts, including text, multimedia, designs or physical structures. The progression from left to right across the table is to increasing levels of student independence, moving from teaching strategies of modelling, through scaffolding to teacher withdrawal and student autonomy. An individual's level for each standard is context-specific, varying with the extent of familiarity with the subject-area and genre and associated conventions. There are also cultural and language determinants, an individual's position being influenced, for example, by whether the task is being carried out in the student's first or a subsequent language.

### **Use of the information literacy continuum**

One of the major benefits of this continuum framework is that it both charts and anticipates students' information literacy development. By making explicit some of the milestones of information literacy development, both actual and required levels of attainment can be identified. Each student brings a unique information literacy history; these histories locate students at disparate points along the continuum. Awareness of these positions and of the continuum itself can help teachers in developing strategies to facilitate the movement of their students towards independent research skills. It is important that students are appropriately guided through the processes of asking questions, finding appropriate information, making this information their own and making it known to others. We anticipate that the Information Literacy Continuum will prove to be a comprehensive and broad-reaching framework that will lead to (as it partly evolved from) practical strategies for classes and individuals at the primary, secondary and tertiary level.

The Information Literacy Continuum may assist lecturers, teachers and students to bridge those discontinuities inherent in the current education system. As we have suggested, without such a framework, the development of information literacy skills can be a haphazard affair, with little in the way of a cohesive approach within each educational sector, let alone between sectors. Students typically experience discontinuities in the transitional phases of their studies from primary schooling to post graduate level. Teachers at a particular level are probably aware of the information literacy skills they expect and seek to develop in their students. They may be less aware of how that fits into the overall picture, or indeed what the overall picture is; where their students have come from in information literacy terms and where they are heading, individually and collectively. Students, too, may have little sense of their overall information literacy journey and how what they are doing at any point fits into the whole.

The big picture that the Information Literacy Continuum supplies can be supplemented by specific resources and we are currently developing a website (<http://www.adelaide.edu.au/clpd/materia/projects/ilcontinuum/>) to which practitioners may post exemplars from specific contexts, and so demonstrate practice that facilitates student movement to higher levels. Ideally, the web site will evolve, bringing together a community of practitioners who will share resources as well as their stories and perspectives of information literacy.

### **Research issues**

There are many research questions the Information Literacy Continuum can begin to generate. What useful guidance is the Information Literacy Continuum able to provide to educators from each sector of education? To what extent can the Information Literacy Continuum help educators identify and minimise the information literacy development discontinuities that seem to exist? Could the utilisation of the Information Literacy Continuum as a tool for student self-assessment and course evaluation contribute to enhanced learning outcomes?

Longitudinal case studies of a cohort and their educational experience could be conducted utilising the Information Literacy Continuum as a tool for framing curricular aims and for assessment and evaluation of information literacy development. Research into curricular artefacts such as assignments could be evaluated by utilising the Information Literacy Continuum. What is the correlation, as identified by the Information Literacy Continuum, between student information literacy and the information literacy required by assessments in specific course? To what extent is a student's position on the continuum context specific? Can the Information Literacy Continuum inform the notion of transferable skills? What differences in information literacy expectations do students encounter when they move from schooling to university, TAFE, and/or the workforce? In what ways and to what extent can tertiary educators benefit from the guidance of an information literacy continuum to better understand the range of skills embodied in their classes?

A common framework for the development of Information Literacy from primary to postgraduate may make the research into this area much more coherent. We place our Information Literacy Continuum into the public domain and invite scrutiny and comment, with the possibility of its further evolution.

### **Conclusion**

Information literacy is an issue well-discussed at the international level, with calls for the development of a conceptual continuum to promote a coherent approach to its development within all educational sectors. We present here an Information Literacy Continuum for scrutiny and for utilisation. The big picture that the Information Literacy Continuum supplies can be supplemented by specific resources available, for example, on the web site mentioned previously, that act as exemplars, in specific contexts, of points along the continuum.

We hope that this Information Literacy Continuum will enable the Year 2 students of 2005 and their stream of educators over the ensuing years to see information literacy, and the part each must play in its holistic development, with 2020 vision.

		Modelling → Scaffolding → Withdrawing		Modelling → Scaffolding → Withdrawing		Modelling → Scaffolding → Withdrawing	
				<b>Increasing student independence</b>			
<b>Standards</b>	<b>Level 1</b> The information literate person ...	<b>Level 2</b> Student engages in a closed inquiry with one well-structured text provided by teacher/lecturer	<b>Level 3</b> Student engages in closed inquiry with predetermined question/issue and criteria	<b>Level 4</b> Student engages in open inquiry, within structured guidelines	<b>Level 5</b> Student engages in open inquiry within self-determined guidelines.	<b>Level 1</b> Student engages in a closed inquiry with one well-structured text provided by teacher/lecturer	<b>Level 2</b> Student engages in a closed inquiry with i) one standard text ii) multiple well-structured text
<b>S</b>	<b>1. recognises the need for information and determines the nature and extent of the information needed</b>	Reads text and, in response to guidance by teacher/lecturer, recognises that a well-structured text contains key concepts in predictable locations. Asks questions arising from text.	Recognises the purpose of the inquiry by exploring information broadly and identifying key concepts. Identifies appropriate source types and devises relevant search strategies. Addresses emergent questions.	Asks research questions that are specific, answerable and guide the inquiry. Research questions and guiding criteria determine nature and extent of information needed.	Asks research questions based on experience, expertise and/or literature reviews. This process determines the nature and extent of information needed.		
<b>O</b>	<b>2. finds needed information efficiently and effectively</b>	Locates, records and defines key concepts when appropriate and records associated details.	Finds relevant multiple sources types using a search strategy. Uses information access tools to retrieve information in a variety of formats.	Utilises multiple source types, including primary information when possible. Develops uses and evaluates a search plan.	Multiple source types, multiple strategy searches. Keeps up to date with alerts, subscriptions, discussion groups.		
<b>S</b>	<b>3. critically evaluates information and the information-seeking process</b>	Evaluates the clarity of the text and estimates how well he/she determined key concepts and associated details. Evaluates clarity and accuracy of information artefacts produced.	Evaluates sources in terms of author, style and source type and recognises any information gaps. Evaluates the balance/fairness of information artefacts produced.	Evaluates source from a critical perspective. Considers if other sources should be used. Realises information search is evolutionary and non-linear.	Evaluates sources from multiple critical perspectives. Analyzes structure, logic, scope perspective and relevance of sources.		
<b>P</b>	<b>Standards</b>	<b>Level 1</b>	<b>Level 2</b>	<b>Level 3</b>	<b>Level 4</b>	<b>Level 5</b>	
<b>R</b>	<b>The information literate person ...</b>	Student engages in a closed inquiry with one well-structured text provided by teacher/lecturer	Student engages in a closed inquiry with i) one standard text ii) multiple well-structured text	Student engages in closed inquiry with predetermined question/issue and criteria	Student engages in open inquiry, within structured guidelines	Student engages in open inquiry within self-determined guidelines.	
<b>L</b>	<b>4. manages information collected or generated</b>	Uses a hierarchical note-taking framework (e.g. 'structured overview') for key concepts, meanings and details.	Note-taking framework integrates information from one text or from multiple well-structured sources into a coherent hierarchy.	Utilises a system to organise sources and records all pertinent citation information for future reference and retrieval.	Utilises a reference storage/organisation system eg Endnote. Keeps all references for possible use.	Categorises kept references according to an organising framework.	
<b>O</b>	<b>5. applies prior and new information to construct new concepts or create new understandings</b>	Paraphrases information to construct own notes or well-structured text, multimedia, oral communication or artefact. Asks questions of clarification and wonderment and seeks answers	Synthesises information to produce a composite paraphrase in notes, reports, essays, or oral, visual and structural representations. Asks relevant researchable questions.	Develops a new line of thought that emerges from synthesis of sources. Applies understandings developed in contexts fresh to the student. Ask rigorous, researchable questions based on new understandings.	Recognises the interrelatedness of concepts and develops theoretical or physical models. Appropriate medium and form of presentation for audience/ information.	Synthesises information to develop a framework of understanding or develops new hypotheses, models or salient further research.	
<b>E</b>	<b>6. uses information with understanding and acknowledges cultural, ethical, economic, legal and social issues in the use of information</b>	Writes/spokes/presents from a particular position which is reflected in the purpose, language and/or structure of the text. Records title/date of source	Considers similarities and differences between authors' positions in relation to cultural, ethical and other issues. Bibliography of sources used.	Identifies the relevance to their own inquiry of authors' positions in relation to these issues. Cites references in text, using appropriate quoting and paraphrasing.	Incorporates differing perspectives in relation to cultural, ethical and other issues, identifying the value and belief systems underlying them. Uses a referencing system.	Actively seeks out a range of perspectives, critiquing the underlying belief and value systems.	

## References

- Anderson, C. W., Holland, J. D., & Palincsar, A. S. (1997). Canonical and sociocultural approaches to research and reform in science education: The story of Juan and his group. *The Elementary School Journal*, 97(4), 359-383.
- Angeley, R. & Purdue, J. (n.d.). *Information literacy: An overview*. Retrieved 2 June 2005 from <http://www.ac.wvu.edu/~dialogue/issue6.html>
- Association of College & Research Libraries (1989). *Presidential Committee on Information Literacy: Final Report*. Retrieved 2 June 2005 from <http://www.ala.org/ala/acrl/acrlpubs/whitepapers/presidential.htm>.
- Association of College & Research Libraries (2000). The Association of College and Research Libraries *Information literacy competency standards for higher education* ACRL, Chicago. Retrieved from <http://www.ala.org/ala/acrl/acrlstandards/informationliteracycompetency.htm>.
- Association of College & Research Libraries (2005). *Information literacy competency standards for higher education*. Retrieved 2 June 2005 from <http://www.ala.org/ala/acrl/acrlstandards/informationliteracycompetency.htm>
- Australian & New Zealand Institute of Information Literacy (2004). *Australian and New Zealand information literacy framework: principles, standards and practice* (2<sup>nd</sup> Edition). Retrieved from <http://www.caul.edu.au/info-literacy/InfoLiteracyFramework.pdf>.
- Australian School Library Association & Australian Library & Information Association (2001). *Learning for the future: Developing information services in schools*. Carlton Corporation: Carlton South.
- Behrens, S. J. (1994). A conceptual analysis and historical overview of information literacy. *College and Research Libraries*, 55 (4) 309-322.
- Bloom, B.S. (1956). *Taxonomy of educational objectives: the classification of educational goals*. London: Longman.
- Bruce, C. and Candy, P. (1995). Higher education contributions to information literacy education: towards a checklist for evaluating curriculum and institutional culture. Paper presented at the HERDSA annual conference, Canberra, Australian National University.
- Bundy, A. (2002). Growing the community of the informed: Information literacy – a global issue. *Standing Conference of East, Central & South Africa Library Associations Conference*. Johannesburg, South Africa. Retrieved 2 June 2005 from <http://www.library.unisa.edu.au/about/papers/growing-community.htm>
- Bundy, A. (2004). Zeitgeist: Information literacy and educational change. *4<sup>th</sup> Frankfurt Scientific Symposium*. Germany.
- Candy, P. (1995). Developing lifelong learners through undergraduate education. In L. Summers (Ed.), *A Focus on Learning*, Proceedings of the 4<sup>th</sup> Annual Teaching Learning Forum, Edith Cowan University. Perth. Retrieved 2 June 2005 from <http://lsn.curtin.edu.au/tlf/tlf1995/candy.html>
- Cannon, J. R., & Jinks, J. (1992). A cultural literacy approach to assessing general scientific literacy. *School Science and Mathematics*, 92(4), 196-200.
- Caravello, P. S., Herschman, J. & Mitchell, E. (2001). Assessing the information literacy of undergraduates: Reports from the UCLA library's information competencies survey project. *ACRL Tenth National Conference* (pp. 193-202). Denver, Colorado.
- Carroll R., Johnston, S. & Thompson, E. (2001). Information literacy and legal research skills education in the UWA Bachelor of Laws degree. In A. Herrmann & M.M. Kulski, (Eds.), *Expanding Horizons in Teaching and Learning*. Proceedings of the 10<sup>th</sup> Annual teaching Learning Forum. Perth: Curtin University of Technology. Retrieved 2 June 2005 from <http://lsn.curtin.edu.au/tlf/tlf2001/carroll.html>
- Cleahan, R. & Walker, I. (2002). Student perceptions of preparedness for first-year university assignment writing: The discipline of Marketing. In K. Dellar-Evans & P. Zeegers *Refereed Proceedings of the 2003 Biannual Language and Academic Skills in Higher Education Conference 24-25 November 2003* (pp.79-88). Adelaide, SA: Flinders University.
- Council of Australian University Librarians (2001). *Information literacy standards*, First edition. Canberra. Retrieved 2 June 2005 from [http://ilp.anu.edu.au/Infolit\\_standards\\_2001.html](http://ilp.anu.edu.au/Infolit_standards_2001.html)
- Dewey, J. (1938/1963). *Experience and education*. New York: Macmillan.
- Doherty, J.J., Hansen, M. A. & Kaya, K.K. (1999). Teaching information skills in the information age: The need for critical thinking. *Library Philosophy and Practice*, 1 (2), pp. 1-9).
- Dunbar, H.M., Edwards, V. & Stemler, S. (2001). Students as co-partners for information literacy and instruction: A modest proposal. *ACRL Tenth National Conference*. (pp. 175-180). Denver, Colorado.
- Fitzgerald, M.A. (1999). Evaluating information: An information literacy challenge. *SLMR Online*, Vol. 2. Retrieved 2 June 2005 from <http://oldweb.ala.org/aasl/SLMR/vol2/evaluating.html>
- Fosnot, C. T. (1993). Rethinking science education: A defense of Piagetian constructivism. *Journal of Research in Science Teaching*, 30(9), 1189-1201.
- Hand, B., Prain, V., Lawrence, C. & Yore, L.D. (1999). A writing in science framework designed to enhance science literacy. *International Journal of Science Education*, 21 (10), 1021-1035.



- Hayden, K. A. (n.d.). *Information literacy*. Retrieved 2 June 2005 from <http://www.ucalgary.ca/~ahayden/literacy.html>
- Hepworth, M. (1999). A study of undergraduate information literacy and skills: The inclusion of information literacy and skills in the undergraduate curriculum. In *Conference Proceedings 65<sup>th</sup> IFLA Council and General Conference*. Bangkok, Thailand. Retrieved 2 June 2005 from <http://www.ifla.org/IV/ifla65/papers/107-124e.htm>
- Johnston, B. & Webber, S. (2003). Information literacy in higher education: A review and case study. *Studies in Higher Education*, 28 (3), 335-352.
- Justice, L.M. & Pullen, P.C. (2003). Promising interventions for promoting emergent literacy skills: Three evidence-based approaches. *Topics in Early Childhood Special Education*, 23, 99-113.
- Koch, M. (2001). Information Literacy: Where do we go from here? *Technos Quarterly for Education and Technology*, 10, 1. Retrieved 2 June 2005 from [http://www.technos.net/tg\\_10/1koch.htm](http://www.technos.net/tg_10/1koch.htm).
- Lakoff, G., & Johnson, M. (1999). *Philosophy in the flesh: The embodied mind and its challenge to Western thought*. New York: Basic Books.
- Laugksch, R.C. (2000). Scientific literacy: A conceptual overview. *Science Education*, 84, 71-94.
- Lenox, M. & Walker, M.L. (1993). Information literacy in the educational process. *The Educational Forum*, 57, 312-324.
- Macpherson, K. (2002). The development of enhanced information retrieval strategies in undergraduates through the application of learning theory: An experimental study. *Journal of Educational Enquiry*, 3 (1), 79-94.
- Marcum, JW (2002). Rethinking information literacy. *Library Quarterly*, 72 (1), 1-26.
- Rader, H. B. (2002). *Information literacy – an emerging global priority*. White Paper prepared for UNESCO, the U.S. National Commission on Libraries and Information Science, and the National Forum on Information Literacy, for use at the Information Literacy Meeting of Experts, Prague, The Czech Republic.
- Seamans, N. H. (2001) *Information literacy: A study of freshman students' perceptions, with recommendations*. Doctoral dissertation, Virginia Polytechnic Institute and State University.
- Tobin, K., & Tippins, D. (1993). Constructivism as a referent for teaching and learning. In K. Tobin (Ed.), *The practice of constructivism in science education* (pp. 3-21). Washington: AAAS Press.
- Virkus, S. (2003). Information literacy in Europe: A literature review. *Information Research*, 8 (4). Retrieved 2 June 2005 from <http://informationr.net/ir/8-4/paper159.html>
- Webber, S. & Johnston, B. (2000). Conceptions of information literacy: New perspectives and implications. *Journal of Information science*, 26 (2), 381-397.
- Willison, J.W. & Taylor, P.C. (in press). Complementary epistemologies of Science teaching: Towards an integral perspective. In Aubusson, P, Harrison A & Ritchie S (eds). *Analogy and Metaphor in Science Education*. Kluwer.

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