# Disciplinary Literacy: A Study of the Literature

## Summary

*Disciplinary literacy is a growing area of interest as educationists see the need for students to not only have generic literacy skills (the ability to read and write) but to also have the language skills they need in order to fully understand and work with the different types of texts, whether spoken or written, that are typical in the subject areas they study. The suggestion is that different disciplines (or subject areas) have thinking and language practices that are specific to them and that students are likely to be held back from a full understanding of the content of such disciplines to the extent that they do not master the related language and thinking practices.*

*What constitutes disciplinary literacy varies from writer to writer. All see reading and writing as essential components but some also emphasize such areas as appropriate thinking skills and related oral skills. For example, for historians (and therefore, it is suggested, for students of history) a text can be analysed in terms of who the writer was and how the writer's historical position may have affected the content. On the other hand, for a scientist, the writer of a text is largely irrelevant. What is important is the logic of the content. Thus, it is suggested that the thinking skills demanded by the two disciplines are different.*

*As this field is relatively new, the available literature generally focuses on the theoretical aspects and there is very little reported experimental research that supports this approach to teaching in the disciplines. There is a need to work with researchers, discipline experts, teaching practitioners and even students to establish what the special language requirements of specific subject areas are and how they are the same or different from non-specialist language. Once that work is done, it will be easier to outline the specific needs of the disciplines.*

## Introduction

The focus of this Digest is disciplinary literacy. This term relates to students and the content subjects they take such as Mathematics, the Sciences, the Social Sciences and the Arts. There are a number of related concepts and terminology to disciplinary literacy. For example, Moje (2008, p. 97) suggests that the following terms are used interchangeably depending on the writer – *secondary school literacy, subject area literacy, subject-matter literacy, content area literacy* and *disciplinary literacy*. In this review, we will touch on some of these terms but will focus on defining and evaluating the concept of *disciplinary literacy*.

The interest in disciplinary literacy first grew in the USA as a result of the perceived difficulty of raising or even maintaining the literacy levels of students in subject areas. For example, Bennett (2011, p. 51) notes that America is in 'an adolescent civic literacy

crisis' where performance levels in Social Studies subjects are extremely low and students are bored with Social Studies. She suggests that a way out of this crisis is through a focus on disciplinary literacy. Altieri (2011, p. 5) points out that our view of literacy has changed. We now expect students to deal with a much greater amount and variety of texts as the development of information technology makes more and more available. They need to learn how to approach texts in the different disciplines.

These concerns are not peculiar to the USA. A. Wilson, Jesson, Rosedale, and Cockle (2012, p. 1) point out the New Zealand Curriculum makes it the responsibility of every subject-area teacher to meet the needs of students in developing the literacy and language skills required in their subject area.

It is worth noting that there are other approaches to literacy in school subjects including approaches based on a systemic functional linguistic (SFL) framework. Examples of the latter are Christie and Derewianka (2010), and Fang and Schleppegrell (2010). This is another major area of study to be looked at in a future Digest and so has not generally been included because of space limitations although Fang and Schleppegrell (2010) is discussed here as their article also relates disciplinary literacy to an approach based on the SFL framework.

*We now expect students to deal with a much greater amount and variety of texts as the development of information technology makes more and more available. They need to learn how to approach texts in the different disciplines.*

## Disciplinary literacy in the literature

What then is 'disciplinary literacy'? McConachie (2010, pp. 15-16) reports that the term 'disciplinary literacy' was first coined in 2002 by the Institute of Learning at the Learning Research and Development Center of the University of Pittsburgh. She points out that their use of 'literacy' was unusual as it was not restricted to its usual meaning of 'reading and writing' but also included content knowledge, thinking, speaking, etc. She offers the following definition:

> *Disciplinary literacy involves the use of reading, reasoning, investigating, speaking, and writing required to learn and form complex content knowledge appropriate to a particular discipline (p. 16).*

Moje (2007, p. 13) reviews four different approaches to disciplinary literacy that she found in the literature.

1. *Teaching cognitive literacy processes*

This approach is built on the assumption that 'learning to read (and write)' should develop into 'reading (and writing) to learn'. However, according to Moje (2007, p. 14), the cognitive literacy strategies taught in this approach focus more on further developing the reading skills of the students (i.e. on the first stage of 'learning to read'), albeit in the context of content subjects. Despite this, she notes that research that has been carried out shows that these strategies appear to have had some success in developing student ability to read content subject texts.

2. *Teaching epistemological processes of the disciplines*

This approach suggests that the knowledge processes used in a particular subject or discipline along with the type of text produced can be taught to students so they

can more readily access the material of that subject or discipline. Students' learning of the thinking methods of the discipline is seen as important. The approach has been most commonly used in History learning where there has been some criticism of textbooks that present History as a fixed set of indisputable facts when expert historians interpret artefacts that are sometimes contradictory. Moje (2007, p. 22) then reviews Science classes where the thinking methods are quite different from those of History. She notes that, beyond looking at such aspects as specialist terms, temporal cues and subtexts, this approach lays more emphasis on modes of thinking than on the language of the disciplines.

### 3. Teaching linguistic processes of the disciplines

This approach involves teachers guiding students through the process of deconstructing texts (highlighting the grammatical and lexical features of the texts), jointly constructing new texts using the features found and, finally, getting students to independently construct their own texts. In this way, students are helped to familiarize themselves with the texts in a particular subject area.

Moje (2007, p. 26) suggests, however, that the approach is currently missing out on an important opportunity by focusing only on academic texts. She points out that, in their free time, young people do read texts that may have very similar language features to those of academic texts and these texts could be used to bridge the gap between everyday language and school language.

*Early strong reading skills do not necessarily translate into an ability to deal with the special language requirements met in subject classrooms and, as students rise through the school, they need ever increasing specialized literacy skills.*

### 4. Teaching linguistic and discursive navigation across cultural boundaries

The fourth approach seeks to get students to learn that the different styles of communication that they meet are cultural in nature and are negotiated by the communities that use them. Thus, academic discourse of whatever type is not immutable but can vary by situation and over time. The approach starts with the students' own knowledge of texts, text practices, and interests and then moves on to teaching disciplinary text processes. The teaching emphasizes the purposes, norms and conventions for making knowledge in the disciplines. The focus of the approach is on showing the links between everyday communication and subject specific communication. Moje (2007, p. 32) notes that this approach tends to focus on everyday language and has thus left the definition of academic language rather vague. Much of the work in this approach has been done in the language arts and social studies areas with much less done in the sciences.

Moje (2007, p. 34) suggests that it might be possible to productively combine these four approaches to disciplinary literacy so that prior and expert knowledge, the linguistic and rhetorical styles of disciplinary experts, the technical vocabulary of texts, and motivation and interest could all be considered together.

In a subsequent article, Moje (2008, p. 98) advises that it would be best to set up disciplinary literacy programmes rather than get content teachers involved in teaching literacy practices and strategies, i.e. she emphasizes the second of the four approaches listed above.

Shanahan and Shanahan (2008) consider disciplinary literacy to be '(l)iteracy skills specialized to History, Science, Mathematics, Literature, or other subject matter' (p. 44). They (p. 43) suggest that early strong reading skills do not necessarily translate into an ability to deal with the special language requirements met in subject classrooms and, as students rise through the school, they need ever increasing specialized literacy skills. They propose three levels of literacy: basic literacy, intermediate literacy and disciplinary literacy (Shanahan and Shanahan, 2008, p. 44). As the child moves up the levels and their literacy skills become more and more specialized by subject area, these skills may not always be transferable across subjects.

> *Disciplinary literacy is an approach that combines content with discipline-appropriate habits of thinking. The belief is that knowledge and thinking must go together in order to develop the deep conceptual knowledge needed to do well in the various disciplines.*

Here are the definitions of each level that they give:

- **Basic Literacy**: Literacy skills such as decoding and knowledge of high-frequency words that underlie virtually all reading tasks.
- **Intermediate Literacy**: Literacy skills common to many tasks, including generic comprehension strategies, common word meanings, and basic fluency.
- **Disciplinary Literacy**: Literacy skills specialized to History, Science, Mathematics, Literature, or other subject matter.

The focus for Shanahan and Shanahan is very much on reading. In fact, they do not mention oral skills at all.

Fang and Schleppegrell (2010) argue for an approach to disciplinary literacies based on Systemic Functional Linguistics (SFL) which they call 'Functional Language Analysis'. (This fits in with the third category in Moje (2007)'s list above.) They suggest that students can be helped to analyse selected short texts according to the experiential, textual and interpersonal meanings embedded in the text. They will then learn the preferred language functions used in that discipline and be better able to apply the same principles to other texts. Their approach does not exclude spoken text but the examples they give are all from written text.

Altieri (2011, p. 6) emphasizes a slightly different interpretation of literacy, one that is similar to that mentioned by McConachie (2010) cited earlier. In the same way, she suggests that previously the concept of literacy focused only on reading and writing but points out that in the 21$^{st}$ century:

> *Literacy is a complex, multifaceted concept that changes as society changes. Students must not only be able to read and demonstrate understanding but also be able to view and comprehend a wide range of texts and make intertextual connections. Students also must be able to share knowledge through written and oral communication and through visually representing information (p. 6).*

Thus, she emphasizes the need to develop student oral skills as well as written skills.

Bennett (2011) defines disciplinary literacy as an approach that involves 'the use of reading, investigating, analysing, critiquing, writing, and reasoning required to learn and form complex knowledge' (p. 52). She goes on to say that disciplinary literacy is an approach

that combines content with discipline-appropriate habits of thinking. The belief is that knowledge and thinking must go together in order to develop the deep conceptual knowledge needed to do well in the various disciplines.

Buehl (2011, p. 15) offers an adaption of the model from Shanahan and Shanahan (2008). The third level, the disciplinary level, is now broken up into a set of different arrows thus emphasizing that the skills at this level are more specific to each subject discipline. The length of an arrow indicates the competence of an individual in that particular subject (discipline) area. Thus, for example, a reader could be fairly comfortable with Literary Fiction but less so with History and be weakest in Maths, and the Biological and Physical Sciences.

Dehm Bamford (2011) considers disciplinary literacy to be 'the practice of teaching students how to use reading, writing, and other literacies, in order to learn and form complex content knowledge' (p. 1). She draws a contrast between content area literacy and disciplinary literacy by pointing out that the former focuses on teaching generic literacy skills that can be used across the disciplines or subject areas while the latter sees each discipline as a discourse community with its own specialized language and approaches (p. 8). These must be navigated by any learner and thus literacy forms an important part of any study of the subjects in question and is not an add-on. It thus involves, she suggests (p. 13), the reading, reasoning, investigating, speaking and writing skills needed to learn the knowledge and concepts of the subject area.

A. A. Wilson (2011, p. 435) feels that a generic approach to literacy does not take into sufficient account the discipline-specific features of texts. In her article on content area literacy, she seems to use that term in a sense that is very similar to that for which others use disciplinary literacy, emphasizing as she does the need to focus on discipline-specific characteristics. She (p. 441) highlights that these discipline-specific characteristics are not immutable but may change in response to changed societal needs. She thus argues that it is important that these characteristics are not taught as rules. Students should learn the purposes and uses of the different types of text and how these may vary across the disciplines. The approach she suggests would include learning the use of multimodal representations and seeing how different modes for expressing meaning (texts, graphs, etc.) may be good for certain purposes but not for others.

*She draws a contrast between content area literacy and disciplinary literacy by pointing out that the former focuses on teaching generic literacy skills that can be used across the disciplines or subject areas while the latter sees each discipline as a discourse community with its own specialized language and approaches.*

Colwell (2012, p. 2) states that behind the concept of disciplinary literacy is the assumption that, within any discipline, there are specific beliefs and processes associated with the reading and understanding of texts in that discipline. By teaching students those beliefs and processes, we help students build up competence in the discipline.

In her paper on adolescent literacy, Goldman (2012, p. 90) suggests that 21st-century literacy makes extra demands on readers in four ways. First, readers have to go beyond what the text says; they must also consider its meaning by synthesizing and evaluating the content. Second, they must be able to

apply those skills differently depending on the subject. Third, advances in technology mean that there are vast amounts of information which readers must evaluate and select from. Fourth, readers must learn to connect what they learn in one context to topics in other areas. In summary, readers must select, interpret and synthesize what they learn from reading. She says that content teachers have a dual responsibility to teach disciplinary content and disciplinary literacy (p. 93).

In their paper, Shanahan and Shanahan (2012) contrast content area literacy with disciplinary literacy, two different constructs which they felt had been confused in the literature. They believe that content area literacy focuses on teaching generic reading skills that can be used across all subject areas by students. Such coaching tends to help only weak students. However, disciplinary literacy focuses on discovering the reading approaches used by subject experts and then teaching these to students. The advantage of this approach, they feel, is that it is likely to help student at all ability levels and is more acceptable to content teachers as it relates more directly to their subjects.

Billman and Pearson (2013) suggest disciplinary literacy is about 'how to do reading, writing, talking, and thinking in school subjects' (p. 25). They argue strongly that the practice of disciplinary literacy should start as soon as students enter school (or, preferably, before) as they arrive at school already using language to learn and talk about the world (p. 26). They argue against setting literacy as a goal. Instead, it is a set of tools to be used in the learning process (p. 27).

*Preparing students for life beyond school involves preparing them to think and communicate effectively in every area of the curriculum.*

Fang and Coatoam (2013, pp. 627-628) distinguish between disciplinary literacy and content area literacy. For them, the supporters of content area literacy believe that the reading/writing requirements are largely the same across subjects and thus expect students to use fairly generic skills and strategies in learning subject content. As opposed to that, disciplinary literacy focuses on developing a student's ability to utilize the skills used by content experts and these vary from subject to subject. They go on to suggest that disciplinary literacy is grounded in the belief that each subject has its own ways of presenting content and that these are best learnt as part of the subject. Importantly, they believe that 'being literate in a discipline means understanding of both disciplinary content and disciplinary habits of mind (i.e. ways of reading, writing, viewing, speaking, thinking, reasoning and critiquing)' (p. 628). Thus, their view of disciplinary literacy covers a broad range of skills, including not just reading and writing but also speaking and thinking among others.

Roberts (2013, p. 20) argues for an approach similar to that of Buehl (2011), i.e. that at the disciplinary literacy level there is a multiplicity of specialist literacies. His own specialization is History and he argues that History as a discipline requires an understanding of the past, a critical view, and the ability to communicate effectively areas of understanding and knowledge not required in other subjects.

One common feature to all the explanations of disciplinary literacy discussed above is the belief that different disciplines or subjects demand different literacy skills and students need to learn these skills in order to master the respective disciplines. However, there are

differences in which particular skills are emphasized. As noted by McConachie (2010, p. 16), the word 'literacy' has traditionally connoted 'reading and writing' and all the explanations include some reference to reading and writing. Shanahan and Shanahan (2008) and Buehl (2011) focus on these two areas. Bennett (2011), Colwell (2012), Goldman (2012) and Roberts (2013) add thinking like the specialists to the mix. In tune with what McConachie (2010, p. 16) describes as the original intent of the creators of the term, Altieri (2011), Dehm Bamford (2011), Billman and Pearson (2013), and Fang and Coatoam (2013) all include speaking as well. Finally, Moje (2008, p. 99) even suggests that a student who has learnt well in the discipline may need to communicate through oral language, visual images, music and artistic representations and not just through reading and writing.

One other area that A. A. Wilson (2011, p. 441) adds to this mix is the suggestion that students should learn that the disciplinary practices have been developed by the experts to serve purposes that may change over time and circumstances. These are not rules that cannot be changed given the appropriate circumstances.

*Different disciplines or subjects demand different literacy skills and students need to learn these skills in order to master the respective disciplines.*

The models from Shanahan and Shanahan (2008) and Buehl (2011) discussed above suggest that at the primary school level students and teachers need to focus on the basic or intermediate levels of literacy in all areas of study and that it is at the secondary (or tertiary) level that communication becomes more differentiated between subjects (or disciplines). This is in part confirmed by Moje (2007), who, in explaining the focus of her article, suggests that disciplinary literacy becomes more clearly

differentiated at secondary and postsecondary levels (p. 3). Fang and Coatoam (2013, p. 628) also discuss this issue and come to the conclusion that, while disciplinary literacy is certainly more clearly differentiated at secondary and tertiary levels of education, instruction in disciplinary literacy can start as early as in upper primary. In fact, Juel, Hebard, Park Haubner, and Moran (2010) propose activities for use with children as young as eight years, using different 'disciplinary lenses' to question texts, that is asking the questions and making responses appropriate to different disciplines such as science and history.

## Teaching disciplinary literacy

A number of writers have reported that introducing the notion of literacy skills into the subject area classrooms has not been easy. Terms such as 'content area literacy' and 'disciplinary literacy' have been problematic with teachers in the schools. Colwell (2012) found that the subject teacher she worked with was not happy with a focus on 'literacy' and only cooperated with the research when she felt that the approach being suggested was the same as 'critical thinking'. Colwell (2012, p. 27) goes on to suggest that the pre-service training of secondary school teachers could actually be an impediment to their willingness to take up disciplinary literacy. She feels that the focus for such teachers on developing content knowledge might lead them to believe that literacy was not an important consideration in the content class. Moreover, she quotes evidence that some pre-service teachers had chosen to teach content subjects in order to avoid having to deal with students' reading and writing skills. She thus believes it important to prepare pre-service teachers to

be ready to focus on areas of literacy.

McConachie and Petrosky (2010a), Moje (2008) and Shanahan and Shanahan (2008) have all highlighted the difficulty of getting teachers of subject areas other than language to take on board the idea that they may be responsible for the communication and literacy skills of students in their subject areas. Many feel that this is the sole purview of the language teachers. Even those content teachers who believe in the importance of helping students read and write in their discipline may feel ill-equipped to help them (A. A. Wilson, 2011, p. 435).

Goldman (2012, p. 94) suggests that one reason for the poor teaching of 'reading-to-learn' subject matter is that it involves a lot of factors that can vary independently (different strategies, different texts, different goals, ensuring interaction with peers, etc.). Working with all these factors together can be a difficult task. These problems are very much an issue in approaches to disciplinary literacy. Moje (2008, p. 104) also talks of the complex 'repair work' that teachers may be involved in in helping students learn the subject matter. She also wonders how well the teachers themselves are prepared in the thinking of the disciplines they are trying to teach.

According to McConachie (2010, p. 21), for teachers to teach and guide the students towards disciplinary literacy, they themselves must be familiar with the structure and organization of knowledge common to the subject they are teaching. They need, she says, to have the content knowledge and the habits of thinking associated with the subject (discipline) as well as the teaching techniques and practices needed to support the

*Teachers need to engage their students through classroom discussions that show them the literacy and thinking skills necessary for 'doing' the subject they are teaching.*

students' learning. She goes on to suggest that the classroom should become an apprenticeship into the discipline (p. 22), i.e. teachers must demonstrate the accepted approaches to the subject area and then get students to use these approaches while the teacher scaffolds their learning. In order for this to happen, the students must solve given problems and the teacher's job then becomes the presentation of problems that are sufficiently challenging but not beyond the capabilities of the students. To maximize student use of the appropriate language and strategies, the students can be organized into groups so that their processing can be monitored by the teacher. The questions the students are asked can be on the subject content or on the ways of working (or habits of mind) related to the subject. Nagy and Townsend (2012, p. 96) point out that the learning in subject areas is not simply about getting students to learn lists of vocabulary. To really learn the subject and the related vocabulary and concepts, students need to have constant and repeated exposure to their use.

McConachie (2010, pp. 30-31) goes on to elaborate five interdependent principles for implementing disciplinary literacy:

*Principle 1: Knowledge and thinking must go hand in hand.* The suggestion is that learning knowledge without understanding is short-term. Students soon forget the decontextualized facts they have learnt once the exams are over. Similarly, thinking without the requisite knowledge is futile. Thus students need to learn the two together.

*Principle 2: Learning is apprenticeship.* The activities in the classroom apprentice

students into the disciplines (subject areas) they are learning. For the apprenticeship to succeed, the students must carry out activities related to the discipline and come to understand the habits of thinking of the discipline that direct the reading, talking and writing they do. They need to be able to articulate what activities help to communicate the disciplinary ideas and why.

*Principle 3: Teachers as mentors of apprentices.* Teachers provide an array of approaches that help initiate students into the thinking and approaches of the discipline, scaffolding their development appropriately.

*Principle 4: Classroom culture socialises intelligence.* This principle emphasizes that the classroom culture should encourage students to believe that they have something to contribute to the learning process and that they can ask questions, discuss and evaluate the content they are learning so that they become more competent in the discipline.

*Principle 5: Instruction and assessment drive each other.* Different forms of formal and informal assessment procedures are used to feed into the apprenticeship so that students can see how they are developing in the discipline. The assessment matches the instruction, replicating many of the activities that are appropriate to the discipline. The assessment results feed into the instruction for both teacher and students.

McConachie and Apodaca (2010, pp. 190-191) give a list of features of a student apprenticeship (which they suggest can also be used in training 'apprentice' teachers in disciplinary literacy approaches). The five features are:

1. modelling and observation (where the activity is modelled and the students ask questions and comment);

2. active practice (where students take over the activity in a controlled environment);

3. scaffolding (where learners can be helped to complete a task by their teachers or more competent peers but where the help is reduced over time);

4. coaching (where the teacher or more competent peers observe and challenge the students at work); and

5. guided reflection (where students reflect on what they have done, evaluating and considering ways for improvement).

McConachie and Petrosky (2010b) give a table in Appendix A of their book (pp. 197-214) that gives a framework showing how these principles would work in practice for students and teachers in four core subject areas – History/Social Studies, Mathematics, Science and English Language Arts.

*Students must show they have learnt the core ideas and concepts as well as the 'habits of thinking' of the subject area or discipline in order to be said to be disciplinary literate.*

Murnane, Sawhill, and Snow (2012, pp. 9-10) also offer some suggestions for post-primary teachers although their ideas are exclusively related to reading. The suggestions include developing a reason for reading, showing how to read actively, teaching reading strategies, studying different subject-related genres and pre-teaching important vocabulary.

## Assessing disciplinary literacy

Inevitably, once disciplinary literacy is defined, the question becomes how we recognize when a student has developed such literacy. McConachie (2010, p. 21) suggests that students must show they have

learnt the core ideas and concepts as well as the 'habits of thinking' of the subject area or discipline in order to be said to be disciplinary literate. Murnane et al. (2012, p. 3) note that advanced literacy is not just a matter of decoding a text. It involves using that skill to access knowledge, to evaluate argumentation, to synthesize and to learn new topics.

Fang and Coatoam (2013, p. 630) believe students' disciplinary literacy can be assessed by giving authentic tasks that allow them to demonstrate control over the reading, writing, thinking, reasoning and enquiring skills that are required by the particular subject area. They suggest this would call for subject teachers and literacy teachers working together to devise such tasks along with the scoring criteria particular to those tasks and subject areas.

*Approaches that incorporate disciplinary literacy are relatively new and much that has been written has been theoretical rather than based on experimental studies.*

## What the evidence tells us

Unfortunately, approaches that incorporate disciplinary literacy are relatively new and much that has been written has been theoretical rather than based on experimental studies. Moje (2007, p. 35) notes that much of the writing on disciplinary literacy is theoretical and that very few classroom trials have demonstrated student learning gains in any standard way, with a number of studies failing to provide sufficient details of the actual research for the research to be replicated. This is confirmed by Goldman (2012, p. 90) who notes that little has been done experimentally for the emerging field of disciplinary literacy. Most of the work is descriptive rather than experimental. However, she emphasizes that, despite this, the work that has been done is instructive. Colwell (2012, p. 5) similarly claims

that little has been done to turn the theory of disciplinary literacy into workable classroom practice that accomplishes the intended goals while appealing to both teachers and students. Shanahan and Shanahan (2012, p. 14) point out that the empirical roots of disciplinary literacy is not focused on teaching specifically and that there has been little research on the effectiveness of disciplinary literacy in the classroom. The results of the research that has been done have been mixed. Fang and Coatoam (2013, p. 629) also suggest that so far the work in the area has been largely theoretical with a focus either on making a case for the approach or on highlighting the language differences between subject areas. They claim that empirical studies have been limited in number with very few meeting the evidence standards of the *What Works Clearing House*.

A. Wilson et al. (2012) carried out a study to see how far the disciplinary literacy practices recommended in the New Zealand Curriculum appeared in actual classrooms. They chose to observe twelve classes in five of the best performing schools given by teachers chosen by their schools on the basis that they were the top performers. The researchers chose this approach because of the belief that they were more likely to see the target practices in this type of class. They found there was little evidence of disciplinary literacy practices even in these classes. They suggested that one possible interpretation was that disciplinary literacy was not related to student ability in a subject. However, they felt it was also quite possible that these effective teachers, recognizing the difficulty students had with disciplinary texts, were reinterpreting the texts for the students thus helping them learn the content and perform reasonably well. They felt, however,

that this was likely to leave the students without the thinking and language skills appropriate to the subjects, thus disadvantaging the students in the longer term.

One source of research evidence that may well be seen as support for the principles of disciplinary literacy as defined by writers such as McConachie (2010) could come from research into the brain. Bransford, Brown, and Cocking (2000), and Donovan and Bransford (2005, pp. 1-2) report that three principles have now been well established in brain research:

1. *Students come to the classroom with preconceptions about how the world works. If their initial understanding is not engaged, they may fail to grasp the new concepts and information, or they may learn them for purposes of a test but revert to their preconceptions outside the classroom.*

2. *To develop competence in an area of inquiry, students must:*
   i. *have a deep foundation of factual knowledge,*
   ii. *understand facts and ideas in the context of a conceptual framework, and*
   iii. *organize knowledge in ways that facilitate retrieval and application.*

3. *A 'metacognitive' approach to instruction can help students learn to take control of their own learning by defining learning goals and monitoring their progress in achieving them.*

These principles underscore the need for students to communicate. If they do not talk or write, their misunderstandings will not come to light and they will not have the opportunity to be corrected. A simple example given is the notion that the Earth is round. According to the writers, many students have difficulty imagining the Earth as a sphere as it would mean that objects at the 'bottom' of the sphere would fall off. They thus tend to redefine the teacher's use of 'round' as 'like a pancake'. If students are not helped to correct this false image of the Earth, their understanding of and ability to incorporate certain facts will be seriously impeded. When helped to develop the appropriate concepts, students are better able to remember facts that fit in with the concepts. Moreover, by getting students to talk about and monitor their own learning, teachers help students take over their own learning.

Bransford et al. (2000, p. 134) and Donovan and Bransford (2005, p. 13) expand the three principles gleaned in brain studies into a four-item framework which, they believe, is consonant with the three principles. According to this framework, learning must start from what the learners know (or think they know) so it must be *learner-centred*. It must be based on the knowledge that has to be mastered. That is, it must be *knowledge-centred*. The learning must also be assessed so that the next steps in learning can be decided on. In other words, it must be *assessment-centred*. Finally, it must be community-based as the learners learn from

> *Learning must start from what the learners know (or think they know) so it must be learner-centred. It must be based on the knowledge that has to be mastered. That is, it must be knowledge-centred. The learning must also be assessed so that the next steps in learning can be decided on. In other words, it must be assessment-centred. Finally, it must be community-based as the learners learn from each other and from the environment they live in. The teacher is not the only source of learning.*

each other and from the environment they live in. The teacher is not the only source of learning.

## Moving Forward

Moje (2007) suggests that much more detailed research needs to be done to demonstrate the benefits of disciplinary literacy if it is to gain traction. Moreover, she suggests, a lot more work needs to be done to clarify what language is used to what audiences and why. This will involve working with experts in the disciplines, with teachers in the school subjects, with teacher educators and even with the school learners themselves (p. 36). At the same time, she advises that a parallel study into the everyday language of the young people who form the target group should be undertaken. This would allow for an understanding of the differences and similarities not only in the language but the cultural reasons for those, an understanding that would inform classroom practice.

In a similar vein, Shanahan and Shanahan (2008, p. 57) note that their work has shown the benefits of getting disciplinary experts, literacy experts, high school teachers, and teacher educators working together to work on the training needs of pre-service secondary teachers. Instead of trying to persuade teachers of content subjects to adopt in their subjects approaches to reading developed by reading experts, they worked together with the experts from a variety of areas such as discipline experts and this helped focus attention on the literacy skills relevant to the particular subject areas.

*Student teachers who have taken courses in content literacy during their pre-service training may not be implementing the skills learned when they enter their schools. This could be because of time constraints in the syllabus, a lack of understanding of the importance of such literacy by the teachers and a simple resistance to seeing literacy as part of the content of their subject area.*

There are a large number of potential subject areas that could be studied but the writers reviewed here have generally worked with a few groupings. The most common number of groupings seems to be four with McConachie and Petrosky (2010b), Shanahan and Shanahan (2008), A. A. Wilson (2011) and others generally using the groups History/ Social Studies, Science, Mathematics, and Literature/Language Arts.

As mentioned earlier, Goldman (2012, p. 106) suggests that one of the difficulties in introducing disciplinary literacy is that the content teachers themselves have not been exposed to 'doing History', 'doing Maths', etc. As they do not have the experience themselves, they have difficulty passing on the necessary skills to their students. They need to engage their students through classroom discussions that show them the literacy and thinking skills necessary for 'doing' the subject they are teaching. Reading and writing, as well as speaking, can then be seen as tools in learning the subject. She sees preparing teachers for this as a long-term project involving not only demonstrations of how it can be done but also the formation of learning communities among the teachers.

Dehm Bamford (2011, p. 3) mentions the belief that student teachers who have taken courses in content literacy during their pre-service training may not be implementing the skills learned when they enter their schools. This could be because of time constraints in the syllabus, a lack of understanding of the importance of such literacy by the teachers and a simple resistance to seeing literacy as part of the content of their subject area (p.

43). Until teachers accept that preparing students for life beyond school involves preparing them to think and communicate effectively in every area of the curriculum, the problem is likely to continue.

# References

Altieri, J. L. (2011). *Content counts!: Developing disciplinary literacy skills, K-6.* Newark, DE: International Reading Association.

Bennett, S. M. (2011). Moving beyond a single discipline: Disciplinary literacy in a social studies classroom. *Journal of Content Area Reading, 9*(1), 51-66.

Billman, A., & Pearson, P. D. (2013). Literacy in the disciplines. *Literacy Learning: The Middle Years, 21*(1), 25-33.

Bransford, J. D., Brown, A. L., & Cocking, R. R. (Eds.). (2000). *How people learn: Brain, mind, experience and school (Expanded Edition).* Washington, DC: National Academies Press.

Buehl, D. (2011). *Developing readers in the academic disciplines.* Newark, DE: International Reading Association.

Christie, F., & Derewianka, B. (2010). *School discourse.* London: Continuum.

Colwell, J. R. (2012). *A formative experiment to promote disciplinary literacy in middle-school and pre-service teacher education through blogging.* (Doctoral Dissertation, Clemson University). Retrieved from http://search.proquest.com/docview/10395551 32?accountid=132909 ProQuest Dissertations & Theses Full Text: The Humanities and Social Sciences Collection database.

Dehm Bamford, B. J. (2011). *Instructional coaching and disciplinary literacy: An examination of the engagement of secondary content-area teachers in professional development.* (Doctoral dissertation, Oregon State University). Retrieved from http://search.proquest.com/docview/8795644 42?accountid=132909 ProQuest Dissertations & Theses Full Text: The Humanities and Social Sciences Collection database.

Donovan, M. S., & Bransford, J. D. (Eds.). (2005). *How students learn: History, mathematics, and science in the classroom.* Washington, DC: The National Academies Press.

Fang, Z., & Coatoam, S. (2013). Disciplinary literacy: What you want to know about it. *Journal of Adolescent & Adult Literacy, 56*(8), 627-632.

Fang, Z., & Schleppegrell, M. J. (2010). Disciplinary literacies across content areas: Supporting secondary reading through functional language analysis. *Journal of Adolescent & Adult Literacy, 53*(7), 587-597.

Goldman, S. R. (2012). Adolescent Literacy: Learning and understanding content. *The Future of Children, 22*(2), 89-116.

Juel, C., Hebard, H., Park Haubner, J., & Moran, M. (2010). Reading through a disciplinary lens. *Educational Leadership, 67,* 13-17.

McConachie, S. M. (2010). Disciplinary literacy: A principle-based framework. In S. M. McConachie & A. R. Petrosky (Eds.), *Content matters: A disciplinary literacy approach to improving student learning* (pp. 15-31). San Francisco, CA: Jossey-Bass.

McConachie, S. M., & Apodaca, R. E. (2010). Embedding disciplinary literacy: Leadership and professional learning. In S. M. McConachie & A. R. Petrosky (Eds.), *Content matters: A disciplinary literacy approach to improving student learning* (pp. 163-196). San Francisco, CA: Jossey-Bass.

McConachie, S. M., & Petrosky, A. R. (2010a). Engaging content teachers in literacy development. In S. M. McConachie & A. R. Petrosky (Eds.), *Content matters: A disciplinary literacy approach to improving student learning* (pp. 1-13). San Francisco, CA: Jossey-Bass.

McConachie, S. M., & Petrosky, A. R. (Eds.). (2010b). *Content matters: A disciplinary literacy approach to improving student learning.* San Francisco, CA: Jossey-Bass.

Moje, E. B. (2007). Developing socially just subject-matter instruction: A review of the literature on disciplinary literacy teaching. *Review of Research in Education, 31*(1), 1-44.

Moje, E. B. (2008). Foregrounding the disciplines in secondary literacy teaching and learning: A call for change. *Journal of Adolescent & Adult Literacy, 52*(2), 96-107.

Murnane, R., Sawhill, I., & Snow, C. (2012). Literacy

challenges for the twenty-first century: Introducing the issue. *The Future of Children, 22*(2), 3-17.

Nagy, W., & Townsend, D. (2012). Words as tools: Learning academic vocabulary as language acquisition. *Reading Research Quarterly, 47*(1), 91-108.

Roberts, P. (2013). Re-visiting historical literacy: Towards a disciplinary pedagogy. *Literacy Learning: The Middle Years, 21*(1), 15-24.

Shanahan, T., & Shanahan, C. (2008). Teaching disciplinary literacy to adolescents: Rethinking content-area literacy. *Harvard Educational Review, 78*(1), 40-59.

Shanahan, T., & Shanahan, C. (2012). What Is disciplinary literacy and why does it matter? *Topics in Language Disorders, 32*(1), 7-18.

Wilson, A., Jesson, R., Rosedale, N., & Cockle, V. (2012). Literacy and language pedagogy within subject areas in years 7-11. Retrieved from the New Zealand Ministry of Education, Education Counts website: http://www. educationcounts. govt. nz/publications/series /Secondary_Literacy/Literacy_and_Language_ Pedagogy

Wilson, A. A. (2011). A social semiotics framework for conceptualizing content area literacies. *Journal of Adolescent & Adult Literacy, 54*(6), 435-444.