

QUEENSLAND COLLEGE OF TEACHERS RESEARCH DIGEST

2007/1



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The Queensland College of Teachers has commissioned the Australian Council for Educational Research to prepare this series of electronic research digests

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Introducing the Research Digest

This Research Digest is the first in a series of periodic digests to be produced by the Australian Council for Educational Research (ACER) for the Queensland College of Teachers. The digests will be delivered electronically to registered teachers in Queensland in an accessible format.

Each digest will focus on a single topical issue, and will provide a review of major messages from research on the issue. A key feature of the digests will be an emphasis on what the research means for teachers and teaching. Over the course of several editions, a wide range of issues will be covered, so that teachers from different areas of schooling will find topics of particular relevance to their needs.

Writing to Learn

The research tells us that writing-to-learn strategies can be used by any teacher, in all subject areas, and at all levels of schooling.

This edition of the Research Digest summarises key research studies that provide evidence of the potential of writing-to-learn approaches in improving student learning in a range of subject areas. The research tells us that writing-to-learn strategies can be used by any teacher, in all subject areas, and at all levels of schooling. Throughout the digest there are descriptions of a range of writing-to-learn strategies that demonstrate possibilities for classroom practice.

This research digest is based on searches of a number of databases and bibliographic resources, including the Australian Education Index,

ERIC, Education Research Complete, British Education Index and Scopus.

The first section presents an overview of research on how students learn from writing. This is followed by a selection of effective writing-to-learn strategies described in the research. A short section is focused on some studies of how writing influences learning in different curriculum areas, and the final section draws on some recent research on writing-to-learn in science. Practical, research-based classroom strategies are highlighted. Some useful websites are listed, and a full reference list is provided.

Writing to learn

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The first edition of the Research Digest draws on research evidence to provide some answers to some important questions:

- ▶ How does writing contribute to students' learning?
- ▶ Are critical thinking skills developed when students use writing as a mode of learning in different curriculum areas?
- ▶ What does research tell us about the connections between writing and students' learning?

demonstrating what has been learnt, and students demonstrate their learning in many different kinds of written assignments, across the curriculum.

Research shows that writing also plays a key role in learning, and that writing to learn is not the same thing as writing to communicate, or to demonstrate learning. Writing helps students to make connections between what they read, view and hear, and what they think and understand. Writing to

Learning to write and learning to read are key goals for all students in the first years at school.

Throughout the years of schooling students learn to communicate effectively in writing, for many different purposes and audiences. Learning to write and learning to read are key goals for all students in the first years at school.

From Years P-12, writing is a significant component of the curriculum. Writing plays a central role in all areas of learning, and students learn to write appropriately in the genres of different disciplines. Writing in school is valued as an important means of

learn provides a significant tool that strengthens reading comprehension, and enables students to reflect on and question information and ideas. Writing-to-learn strategies help students to become more active learners. ■

Writing as a way of learning

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Current interest in the impact of writing on learning has its roots in studies dating from the 1970s. Recent research in the area includes a meta-analysis of research findings relating to the efficacy of writing-to-learn programs.

The 1975 study undertaken by James Britton and colleagues, *The development of writing abilities (11-18)*, remains a landmark study that recognised connections between the process of writing and the growth of students' thinking and understanding. The researchers involved in this study had a strong interest in the importance of language in learning, and this informed their interest in the relationship between writing and learning.

In the descriptive and developmental study, over 2000 samples of the writing of British secondary school students aged 11-18 were analysed. The data were drawn from school students' work in all subjects of the curriculum where extended writing was used. The strengths of the model have been widely recognised, for example, by Applebee, who noted 'its grounding in actual samples of student writing and its emphasis on the actual purpose of the writing, thus focussing attention of the effectiveness of the writing as a whole instead of on its parts' (Applebee, 2000). In analysing the writing samples, the research team drew on an extensive body of theory and research to derive a model that emphasised the function served by the piece of writing and the audience to which it is addressed. The

three function categories in the model—transactional, expressive and poetic—have played a significant role in school curriculum since 1975.

In the model, transactional writing refers to writing to 'get things done' in the real world: to inform or persuade. *Expressive* writing provides a means of exploring and reflecting on ideas and information. *Poetic* writing 'uses language as an art medium' (Britton, Burgess, McLeod & Rosen, 1975).

The expressive function was described as writing *used to follow the ebb and flow of the writer's consciousness, to articulate the concerns and interests of the writer, free of external demands, in the same informal and implicit way as is characteristic of supportive talk* (Britton et al., 1975). Expressive writing includes, as Britton indicates, *the kind of writing that might be called "thinking aloud on paper", and is writing that might play a key role in a child's learning* (Britton et al.). This function has been important in subsequent work on writing-to-learn.

It must be admitted that the more we worked on this idea of the expressive function, the more important we felt it to be. Not only is it the mode in which we approach and relate to each other in speech, but it is also the mode in which, generally

speaking, we frame the tentative first drafts of new ideas; and the mode in which, in times of family or national crisis, we talk with our own people and attempt to work our way towards some kind of resolution. By analogy with these roles in speech it seemed likely to us that expressive writing might play a key role in a child's learning. (Britton et al., 1975, p 82)

Currently there is widespread interest in the effects of writing on learning. This is often described as 'writing-to-learn', and is linked to what is sometimes called 'writing across the curriculum'. A recent database search for studies about writing to learn identified numerous articles citing the study by Britton et al., and also many citations of an article by Janet Emig, *Writing as a Mode of Learning* (Emig, 1977), in which she contended that *writing represents a unique mode of learning.*

Emig made a strong case for the connection of writing to learning. She suggested that writing is a unique form of learning because it is integrative, connective, active and available for immediate visual review. Her main thesis was that *Writing serves learning uniquely because writing as process-and-product possesses a cluster of attributes that correspond uniquely to*

Writing as a way of learning

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certain powerful learning strategies (p. 122).

Emig also drew attention to the ways in which writing provides learners with feedback and opportunities for reflection and review.

Also, a unique form of feedback, as well as reinforcement, exists with writing, because information from the process is immediately and visibly available as that portion of the product already written. The importance for learning of a product in a familiar and available medium for immediate, literal (that is, visual) re-scanning and review

cannot perhaps be overstated. (p. 125)

Emig argued that *if the most efficacious learning occurs when learning is reinforced, then writing through its inherent reinforcing cycle involving hand, eye and brain marks a uniquely multi-representational mode for learning* (Emig, 1977).

Interest in the connection of writing-to-learn has continued in the years since these seminal studies, and later studies have also investigated the relation of writing to learning, exploring the nature of writing tasks and

the pedagogical contexts in which they occurred. A review by Durst and Newell (1989), for example, emphasised the importance of the writing task in producing learning effects. *Essentially, the authors [Durst & Newell] interpreted prior research as indicating that note-taking, answering comprehension questions and summarising have similar effects on learning: they help students to review, consolidate and retain information* (cited in Bangert-Drowns, Hurley & Wilkinson, 2003).

Klein (1999) reported on a detailed research review that

identified four major research lines and associated main hypotheses for writing-to-learn.

- 1** *The 'point of utterance' hypothesis: writers spontaneously generate knowledge when they write* (Galbraith, 1999).
- 2** *The 'forward hypothesis': writers externalise ideas in text, and then re-read them to generate new inferences.*
- 3** *The 'genre hypothesis': writers use genre structures to organise relationships among elements of the text, and thereby among elements of knowledge* (Newell, 1984).

'thinking aloud on paper'



4 The 'backwards hypothesis': writers set rhetorical goals, and then solve content problems to achieve these goals (Flower & Hayes, 1994). (Klein, 1999).

Bangert-Drowns, Hurley & Wilkinson (2003) used the research methodology of meta-analysis to investigate findings about the efficacy of writing-to-learn programs. Meta-analysis involves the application of statistical analysis to literature review. Their study involved the location and selection of studies for inclusion in the review, coding of study features, calculation of effect sizes, and statistical analysis of effect sizes. The review sought studies that investigated writing-to-learn interventions in school settings. They identified studies that encompassed findings from 48 comparisons of schoolbased writing-to-learn treatments with conventional instruction on the same subject-matter content. They posed several questions about the effects of writing about subject matter content on classroom learning, including the following: *Can teachers bring about improvements in their students' academic performance by having them writing about the subject matter of the class?* (Bangert-Drowns, et al., 2003, p.330).

The main findings of this meta-analysis were summarized

Can teachers bring about improvements in their students' academic performance by having them writing about the subject matter of the class?

in three key points:

- 1 *Writing to learn typically produced small, positive effects on school achievement.*
- 2 *Grade level, minutes per writing assignment, and presence of prompts for metacognitive reflection moderated writing-to-learn achievement effects.*
- 3 *Treatment length may moderate writing-to-learn effects, suggesting that the influence is cumulative over time.* (Bangert-Drowns, et al., 2003)

They concluded that *the consistency of the positive effects in these studies does suggest that one can reasonably expect some enhancement in learning from writing and that the enhancement is optimized by contextual factors* (Bangert-Drowns, Hurley et al., 2003). The more positive results were yielded by interventions where students reflected on their current understandings and learning

processes. The review also suggested that the writing tasks involved in writing-to-learn interventions need not be elaborate.

The significance of language and writing as resources for making meaning is recognized in an Australian book that provides a comprehensive view of writing in the primary school years (Harris, McKenzie, Fitzsimmons & Turbill, 2003). The authors frame their book within a holistic model of writing and social practices. They identify the ways in which writing is a culturally reflective tool, and cite a key reference to the valuing of writing for learning:

Writing is (or can be) learning itself – it is the protracted synthesis or coming together of our human thinking and language competence, handling a range of problems that cannot be satisfactorily managed by mental reflection or talking (Winch, Johnston, Ljundahl & March, 2001).

The authors base the social model of writing on the model of reading developed by Luke and Freebody (1999). They

describe writing as a set of practices:

Text encoder practices

encoding written and visual language

Text participant practices

composing meaning into written and visual texts

Text user practices

constructing written and visual texts for social purposes

Text analyst practices

constructing underlying values, beliefs, views, and positioning the reader as in reader/viewer

(Harris et al., 2003)

In exploring the roles of writers as text participants the authors note that *the writing process is as much a means for developing a writer's ideas about content as it is for writing that content ... The idea of writing as a means for constructing knowledge provides a strong argument, too, for writing across the curriculum. ... Approaching writing this way allows it to become an integrated part of the classroom environment and children's learning* (Harris et al., p. 113).

Writing to learn strategies

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In practice, writing-to-learn strategies are used to help students discover new knowledge – to sort through previous understandings, draw connections, and uncover new ideas as they write (National Writing Project & Nagin, 2003). Many effective writing-to-learn strategies have been developed, and are described in the research literature.

Writing-to-learn was identified as a 'hot topic' for one of a series of reports produced by the Northwest Regional Educational Laboratory (Brewster & Clump, 2004). The report included descriptions of a number of writing-to-learn classroom activities, including short in-class writings, and ongoing projects.

Short in-class writing

Entrance and exit slips. Entrance slips, often only taking a couple of minutes at the beginning of class, ask students to make a list of questions or to write a few sentences describing what they already know about the day's topic. They may be collected and read anonymously as a way to begin class. Exit slips, done at the end of class, ask students to summarise what was discussed that day or reflect on strategies they used to learn new material.

Written conversations. By asking students to write for five minutes about a topic to be discussed in class that day, teachers give students time to explore what they think about a topic before being called on to contribute to the discussion. In some cases, teachers ask students to share their initial ideas with a partner, and then write a collaborative response to the questions before moving into a whole-class conversation.

Self-assessments. Often taking no more than a few minutes, students write short assessments of a project they are currently working on or are about to turn in: What was the most difficult part of the assignment? Why? What part are you most satisfied with? What will this project show me that you have learned?

(From Brewster & Clump, 2004)

Ongoing projects

Journals and learning logs. Journals and learning logs ask students to explore course content in writing. An ongoing collection of writing that can be designed to achieve multiple purposes, journals are often used to summarise newly-learned information, dialogue with peers or teachers about areas of confusion and generate questions for further investigation. A common use of learning logs in maths and science classrooms is to have students explain problem-solving processes in writing.

Double entry journals. A variation on learning logs, double entry journals are typically used to help students better understand course readings. On one side of the page, students copy or summarise important passages from texts. In an adjacent column, they may explain the significance of the passage, draw connections to other readings or experiences, or discuss how the idea might be applied in real life.

(From Brewster & Clump, 2004)

Uncovering new knowledges as they write



Other strategies include using scrapbooks of various artifacts of the learning process, blogs, chats and online discussion forums, and letter-writing exchanges.

Gammill (2006) describes how the Know, Want, Learn (K-W-L) strategy can be used.

Harris et al (2003) draw on the work of James Moffett to relate categories of writing to developing writers as text participants. These categories, in various ways, capture writing-to-learn strategies.

The K-W-L chart (Ogle, 1986) represents what students Know, what they Want to know, and what they Learn, all used in conjunction with expository texts, such as those used in science and social studies classes. K-W-L charts can be used by an entire classroom as a group-learning strategy or by individuals: students first write what they already know about a subject (K section) and then explore what questions they may want answered (W section). Schema theory serves as the foundation for the Want to know section of the chart, allowing students to access background knowledge and use self-questioning to direct their focus as they read (Jared & Jared, 1997). The what is Learned section provides students the opportunity to reflect on what they take away from the text.

Fisher, Frey and Williams (2002) found that K-W-L charts helped students organise their inquiries; however, this study did not have students refer back to the K or W sections of the chart. Referring back to the K and W sections of the chart gives students the chance to confirm that what they thought they knew was accurate and that all their questions have been answered. The K-W-L Plus chart (Carr & Ogle, 1987) invites students to add another section to the chart: what else the student wants to learn. This type of chart encourages students to continue their exploration of a subject and provides an opportunity to do research. (Gammill, 2006, p 755)

Noting down is a useful activity for students to note what they know about a topic, what they need to find out, and what they would like to include in their writing. Noting down may take different forms, such as brainstorming on paper, making lists, sketching, maps, making jottings, and so on. In all these cases, students are given opportunity to focus on their prior knowledge of a topic and identify gaps they would like to fill in ways relevant to the composing task at hand.

Looking into activities expand upon noting down activities, in that students identify questions or issues that arise from their noting down that need further investigation. Such investigation, or 'looking into' – may include conducting research, undertaking analysis, carrying out reviews, and so on.

Thinking over/thinking through activities elevate students' thinking to higher levels, requiring them to integrate new knowledge into their existing knowledge base. Relevant activities include writing position papers on an issue where writers explore various sides and argue for their own position; carrying out comparative analyses of a particular phenomenon, from which a writer draws conclusions; and writing evaluations that involve informed judgements and conceptual understandings. (Harris et al., 2003, p 134-5)

Writing to learn in the curriculum

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There are many examples in the literature of how writing influences learning in classrooms in all curriculum areas, and at all stages of schooling

Fisher and Ivey (2005), for example, identified specific principles in which reading and writing actually engage students in the content they are studying. They noted how teachers include reading and writing regularly to enable students to consider new information in content areas. Two vignettes of teachers using writing-to-learn strategies are offered.

Physics

A typical class session in [this teacher's] physics class starts with a writing-to-learn prompt and students enter the classroom knowing that the first thing they'll do is respond to it. For example, in a unit on momentum called "Movement is Life", students entered the classroom one day to find a prompt on the board that read, "based on what you know about the science of momentum, how or why do we use the word in our lives?" [The teacher] was clearly inviting students to make the connections between the science she is teaching and the experiences students had in their own lives. (Fisher and Ivey)

Physical Education

In a unit on aerobic fitness, in a physical education class, students first change into their gym clothes and then meet their teacher on the field. Each day, [the teacher] reads something aloud as they stretch. Some days he reads articles from the sports page while other days he reads short biographies of sport figures. He starts this particular class with an ad from a magazine about the Cooper Institute. He then shares the biographical information he found on the Internet about the person who introduced the world to the word and concept of 'aerobics' in 1968. Following his read-aloud to stretching, students are asked to move to their reciprocal teaching groups to read a short article on aerobic fitness. They know the routine – at least once a week they read in groups. [The teacher] has identified specific vocabulary terms that he wants his students to know and will provide them with practice on these words during their class time over the next three weeks. The class then moves into a variety of aerobic activities and ends with students responding to a writing prompt – an exit slip that required them to describe their previous experience with aerobic exercise. (Fisher and Ivey)



An interesting illustration of incorporating writing-to-learn in teaching children aged 5–7 to construct and write an argument is discussed in a study by Riley and Reedy (2005). The project was built on previous work on 'living things', and commenced with an initial discussion about the nature of zoos. This discussion was informed by the children's own experience of visits to the zoo. The activity continued with a reading of Anthony Browne's picture story book, *Zoo*. When talking about this book, the children became aware that

there was more than one point of view about keeping animals in zoos. The children each wrote a short piece putting forward a point of view. The researchers identified several ways in which the teaching supported the children's growing understanding, including the children's engagement with the topics, and the way in which, while the topics provided the context, the children's thinking was facilitated and shaped by the use of writing (Riley & Reedy).

A Writing across the

Curriculum research project in years prep to 1 included the collection of data on what writers did in a first grade class. Hansen (2005) reported that the teacher of this class expects each child to intentionally use writing as a way to learn. She frequently asks her students to write within the unit they are studying in social studies, maths, language arts or science, and to use writing to help them figure out complex issues and new concepts. Her writing program is focused by two values: drafts provide writers with an opportunity to

think, and response to writers focuses on what they know, content-wise.

It is recognised that the use of language in both written and oral forms is an important part of learning mathematics. Shield (2004) provides evidence of this in an account of how composing a definition after experiences with a mathematical concept can assist students to build understanding. The definition is an important language form in the register of mathematics. ■

The children's thinking was facilitated and shaped by the use of writing.



The study of geometric shapes is a useful topic through which the students can learn about definitions. Having students compose a definition after a period of exploring the properties of a geometric shape can help them to reflect on the unique features of the shape and the properties that distinguish it from related shapes. The task of writing a definition is not easy at first. A concept map ... can assist students to recognise the class to which a shape belongs. Students experience difficulties in meeting the need to specify the necessary and sufficient conditions, and often include more features than required. One useful activity involves having students compose definitions for several shapes they have been exploring. Students then rewrite their own definitions, leaving the 'item' words blank and swap their definitions with other students. Each can attempt to fill in the missing items. Difficulties in identifying the shapes being defined can be discussed. (Shield, 2004)

Writing to learn in science

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In recent years there has been a great deal of research into the ways in which writing can support learning in science.

Hildebrand, for example, shows how writing “informs” science, and science learning, as the writing becomes a tool, or medium, for posing possibilities, for playing with thinking frameworks and for the clarification of ideas (Hildebrand, 2005, p. 207). She presents comments from students commenting on the powerful learning that occurs when students are able to playfully engage in acts of hybrid writing in science.

‘I think it helps you when you’re actually learning the ideas. You just get virtually told about them [in

writing is a crucial problem-solving tool in the development of lifelong learning about science and in the participation in public debate on scientific issues

class], and then you write a story, and while you’re writing it then you learn about it’ (Nigel, year 9 boy). (Hildebrand, 2005, p. 225)

A recent study investigated the nature of science literacy, and recognised the implications for the role and value of student writing within the development of scientifically literate habits of thinking. The researchers noted that writing is a crucial problem-solving

tool in the development of lifelong learning about science and in the participation in public debate on scientific issues (Hand Prain, Lawrence & Yore, 1999, p. 1033).

They identified areas for potential classroom-based research on the role of writing in learning to enhance science literacy.

A small scale study investigated the effect of using writing-to-learn strategies on teaching a cell biology unit for seven weeks to mixed classes of Grade 9 and Grade 10 students. Findings from this study

provided some evidence that different writing tasks do serve unique purposes and when linked, can provide greater conceptual understanding of science. To be able to effectively use writing-to-learn strategies, students need to have opportunities to engage in meaningful pre-writing activities that require them to examine what the conceptual ideas are within the topic and how these are linked (Hohenshell & Hand, 2006, p. 287).

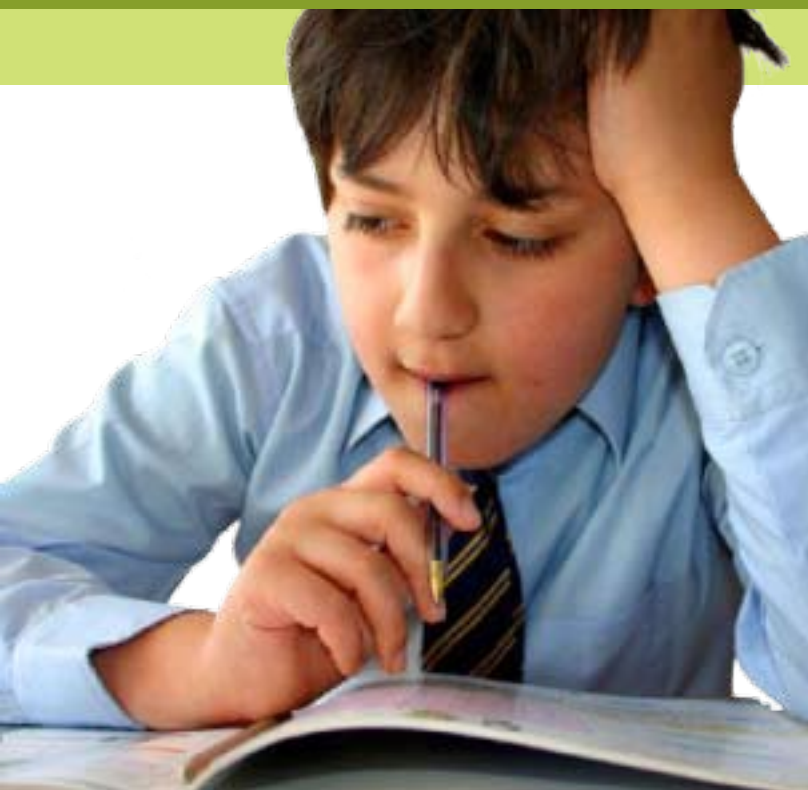
A European study investigated what happened when Grade 9 students wrote experiment manuals for their peers describing a simple physics investigation. From the numerous genres that have been identified in

science texts an experiment manual was selected as it can

serve both the learning-to-write paradigm and the writing-to-learn paradigm. As a manual is a strongly reader-oriented genre, students must have an awareness of the needs of their reader. At the same time, a science experiment illustrates a scientific insight and this insight is embedded in the manual that students will compose (Rijlaarsdam, Couzijn, Janssen, Braaksma & Kieft, 2006, p. 210).

The student-authors of the manuals saw videotapes of peers implementing the directions in their manuals, and then rewrote their own manual on the basis of these observations. Three weeks later, they wrote a letter of advice to peers explaining how to write an instruction manual, and this provided a meta-cognitive prompt that facilitated learning. Overall, the study found clear effects of the condition in which writers saw real-time readers’ feedback on their manual, on understanding the genre of an instruction manual, as well as on the understanding of the physics topic.

Prain (2006) explored reports in the research literature about the use of writing as a tool for shaping and clarifying knowledge in science. He also looked at reports



While you're writing it then you learn about it

about the need for learners in science to become familiar with the patterns of traditional ways of representing scientific inquiry. Prain's review showed that there are gains in learning and engagement for students when writing plays a role in learning in science. It also indicated that learning in science in future will need to take account of computer-based learning environments, and that this has significant implications for how writing for learning in science might be conceptualised for the future.

This general review of writing for learning science

in schools indicates that researchers in this field are generally agreed that writing is a necessary and valuable epistemological tool for learning. There are strong theoretical justifications for conceptualising this writing as both an induction into the signifying practices of science (its world view) and as a resource for learning, where links are made between everyday worlds, values, knowledge and epistemologies, and their counterparts in science. (Prain, 2006, p. 195)

The connections between science and literacy have been investigated in a variety

A lesson introduction might involve a small group discussion of a topical problem in terms of what the group knows about the issue and what the group wants to learn about the issue. Each student might complete the 'know' and 'want to know' columns of a KWL chart. This requires the students to access prior knowledge and to set [a] purpose for future learning. The introduction leads to the exploration of teacher-directed activities, student-generated inquiries, or search for solutions and information related to the central issue. During these explorations students are constantly talking science, exploring, inventing conflicting interpretations, and designing alternative explorations. Individual students might make dual entries in their learning journal [so] that observations and measurements are linked to speculations and further explorations. During the consolidation phase, students might collaboratively construct a concept map, draw a pictorial model or labeled diagram, prepare speakers' notes for a presentation, and compose an exploratory essay. Finally, they might complete the third column of the KWL chart with what they actually learned and reflect on whether they had achieved their purposes. Each of these actions is designed to integrate new ideas into their prior knowledge network. (Hand et al., 1999)

of studies. Strategies that have been taken up for writing-to-learn in science include:

- ▶ science journals
 - ▶ observation vs inference
 - ▶ charts
 - ▶ student authored books
 - ▶ emails to scientists
- (Akerson & Young, 2005).

Ways of enhancing the use of science notebooks or journals have been reported in recent literature. For example, Fulton & Campbell (2004) suggest organisational strategies students can use in these notebooks:

- ▶ technical drawing and diagrams with labels

- ▶ notes and lists charts
 - ▶ tables and graphs that provide students with different ways to view data
 - ▶ written observations that may present information difficult to communicate in drawings or lists
- (Fulton & Campbell, 2004, p. 28).

These recent studies put forward a number of perspectives on the relation between writing and learning in science. There is clear recognition of the usefulness of writing as a tool for learning. There are also reports of a range of proven writing-to-learn strategies integrated with learning in science. ■

comment

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The research on writing-to-learn has clear implications for teaching. Student learning improves when they are given opportunities to use writing as a resource for learning. Writing is a problem-solving tool, and a way of clarifying knowledge. The practical examples of how writing can be used for learning that have been included in this Research Digest provide some models of writing-to-learn strategies that teachers can adapt and use to expand their teaching repertoire.

useful websites

WAC Clearinghouse

Based at Colorado State University the WAC Clearinghouse, in partnership with the International Network of Writing Across the Curriculum Programs, publishes journals, books, and other resources for teachers who use writing in their courses.

<http://wac.colostate.edu/>

Northwest Regional Educational Laboratory (US)

<http://www.nwrel.org/request/2004dec/>

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