Fostering Literacy Learning Across the Curriculum

Dr John Munro

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Abstract

Many students at the secondary level have difficulty learning by reading in the subjects that they are studying. Their teachers find themselves in a perplexing situation; they are aware both that successful learning in their content area requires students to read and to learn by doing so and that some of their students have difficulty learning by reading. The present investigation examines the effectiveness of including literacy teaching procedures as part of regular teaching in the various subject areas on student literacy comprehension. Seven literacy teaching procedures were targeted. Students were instructed explicitly to: (1) organise what they knew about a topic to be read and recode it into a verbal linguistic form; (2) say accurately, read and spell between five and ten terms that related to the content to be studied and suggest synonyms for each; (3) read aloud short portions of relevant text; (4) paraphrase each sentence in the text read; (5) say the questions that each sentence in the text answered, (6) summarize each paragraph; and (7) review by reading silently a written summary of the content covered in the lesson. Students at all year levels made substantial improvement in reading comprehension, with the greatest gains made by the initially less able readers. The literacy skills more closely associated with comprehension, such as paraphrasing and summarising for the younger students, and vocabulary knowledge for the older students, were the best predictors of gains in comprehension. At all year levels recognition of the correct spelling of words was the least predictive of the comprehension gains.

Introduction

Dealing effectively with students' literacy difficulties is a challenge that faces many teachers and schools. This problem increases in its influence at the late primary and secondary levels when students are required to learn by reading in the various subject areas. It has been exacerbated in recent years with the increased focus on self managed and directed student learning and the need to access a range of information sources.

Students who have difficulty converting written information to knowledge are at a severe disadvantage in the world of the twenty first century. Not only are they less able to access information, but they have less opportunity to display what they know in written ways. As well, they have less opportunity to have their existing knowledge of a topic 'programmed' in verbal linguistic ways. As a consequence, they are less able to align their knowledge of a topic with related written text on subsequent occasions. Because of their earlier lack of experience in doing this,

they are likely to have learnt incidentally to use a range of text processing strategies that would assist them to convert written information to knowledge.

Many subject area teachers at the secondary level find themselves in a perplexing situation. They are aware that successful learning in their subject area requires students to read and to learn by doing so. They recognise literacy as an essential vehicle for learning in their subject. As well, because some of their students have difficulty learning by reading, they seek to avoid the need for students to read in their subject and minimise exposure to text.

The present investigation describes a project in which secondary teachers in three secondary colleges were taught to incorporate in their regular teaching a set of literacy teaching procedures that attempted to target these problems and to enhance students' literacy knowledge, first in the particular subject area and then more generally.

A set of explicit literacy teaching procedures that secondary teachers in all subject areas could use to enhance students' literacy knowledge had earlier been identified and researched (Munro 2002). The procedures needed meet a number of criteria: (1) they needed to be known to enhance text comprehension; (2) they needed to be able to be included in the regular teaching program and to be implemented on a whole class basis; (3) they needed to teach the learning outcomes that teachers were intending to achieve in each lesson; and (4) they needed to lead to reading comprehension strategies that students could learn to use, initially when directed and then independently and spontaneously as the need arose.

Earlier studies have reported the effectiveness of teaching various types of reading strategies. Reading comprehension has been enhanced by teaching students to (1) paraphrase (Beck, 1997), (2) summarize (McCormick & Cooper, 1991; Nelson, Smith & Dodd, 1992); (3) self question (Mastropieri, Scruggs, Hamilton, Wolfe, Whedon & Canevaro, 1996; McCormick & Cooper, 1991) and to (4) predict, infer, summarize, visualize, and monitor their comprehension (Dole, Duffy, Roehler & Pearson, 1991; Pressley & Afflerbach, 1995). Underpinning these strategies is a knowledge of syntax; readers' syntactic ability correlates with reading comprehension (Bentin, Deutsch, & Liberman, 1990; Demott & Gombert, 1996; Gaux & Gombert, 1999). In addition, a knowledge of vocabulary predicts comprehension ability (Dewitz & Dewitz, 2003).

These strategies operate as 'text manipulation' actions; they equip the students with procedures to use with written text in systematic and consistent ways. They can be taught either individually or combined into sequences such as Reciprocal Teaching (Palincsar & Brown, 1984) or Transactional Strategy Instruction (Brown, Pressley, Van Meter, & Schuder, 1996). In line with contemporary strategy teaching, the present approach teaches several strategies simultaneously rather than one strategy at a time (Kucan & Beck, 1997; Pressley, Harris & Marks, 1992).

Following trialing across all curriculum areas, the present investigation identified seven literacy teaching procedures. During the trialing these were shown to enhance students' ability to learn by reading and to enhance literacy knowledge of the topic being learning. They are described in terms of the student activities they foster as follows. Students were instructed explicitly to (1) organise what they knew about a topic to be read and recode it to a verbal linguistic form; (2) learnt between five and ten key relevant verbal concepts that relate to the content to be studied, say accurately each concept, read and spell each, suggest synonyms and

antonyms and clarify the meaning of each; (3) read aloud short portions of relevant text; (4) linked the concepts in each sentence in a literal way by paraphrasing or saying in their own words each sentence in the text read; (5) linked the concepts inferentially by saying the questions that each sentence in the text answered and (6) by summarising the text read, usually paragraph by paragraph; and (7) read silently a written summary of the content covered in the lesson to review, consolidated and showed comprehension of what has been learnt. The last two procedures helped them to 'program' their new knowledge in a literacy type way so that it would be available for later literacy learning.

This sequence of teaching procedures matches the steps individuals use to learn new knowledge. A long term aim of the teaching was for students to learn to use the sequence of literacy strategies spontaneously and selectively as part of their self talk to comprehend written text. The teachers taught the students to talk about what they did when they used the strategies, to evaluate their usefulness and decide when to use them. This helped them learn to manage and direct their learning by reading. Students wrote the strategies on small cards and used these to self cue. They also learnt to use the strategies in a self diagnostic way. When they found a text difficult to comprehend, they used the sequence to identify the strategies they had used effectively and those they needed to re-apply.

The present study examined the influence of this strategy teaching on improved student literacy performance.

Method

Experimental Design

Students over two school terms were exposed to teaching that included the seven literacy teaching procedures in each subject that they were learning. These procedures were included as part of the regular teaching for all students in each subject area.

Prior to and at the conclusion of the two terms, the students' reading comprehension was assessed using different tasks from the Tests of Reading Comprehension (Mossenson, Hill & Masters, 1987). In addition, their reading self efficacy and their ability to read and spell key concepts, suggest synonyms and antonyms, to paraphrase year–appropriate text, suggest questions these texts answered and to summarise paragraphs of these texts as single sentences were assessed.

The procedures were incorporated in regular teaching by the students' subject teachers. The teachers received training in this using to the procedure described below. Key aspects of this training included the teachers (1) having access to models and coaching and (2) trialing one of the teaching procedures in an action research activity. An observer who was a trained teacher monitored the use of the teaching procedures by each teacher in the last two weeks of the implementation phase. For their students' data to be included in the study, each teacher needed to display use of all teaching procedures in the lessons monitored.

These data were used to examine changes in students' reading comprehension and reading strategy use. Causal links between these variables were examined using multiple regression procedures.

Participants

The three secondary schools in which the participating students were enrolled were in metropolitan Melbourne. All were identified as 'disadvantaged', on the basis of (1) the proportion of students who received an Educational Maintenance Allowance and (2) the portion who were rated as 'mobility'. The three schools had been identified as having low literacy levels of achievement by statewide literacy benchmarks.

Students were selected for involvement in the study based on their membership of particular classes, that is, those of teachers who had been involved in the teacher training program. They were 'regular' learners in the sense that none of the students had identified disabilities or impairments such as sensory, intellectual, physical or emotional that would exclude them from membership of a regular class at each of the schools. The number, mean chronological ages and entry level reading abilities of the student participants at each year level for the are shown in Table 1.

Table 1
The mean chronological ages and entry level reading abilities of the students at each year level.

Year level	mean age (months)	mean score (stanine)	range in stanine scores
7 (N= 87)	147.3	3.27	1 to 8
8 (N= 104)	1569	3.16	2 to 6
9 (N= 65)	169.2	3.38	1 to 6
10 (N= 81)	183.6	3.02	1 to 5

Materials

The materials used included:

1) Written text materials typical of the texts students needed to read in each subject area. Most of these texts were in text books used regularly by students at each year level. In terms of readability indices (Fry and SMOG), the texts were either at or up to two grade levels below the year level of each group.

2) Tests of Reading Comprehension (Mossenson, Hill & Masters, 1987) to assess reading comprehension.

3) A set of tasks that measured students' ability:
   a) to read and spell key concepts, identify synonyms;
   b) to paraphrase year – appropriate text, to suggest questions these texts answered; and
   c) to summarise paragraphs of these texts as single sentences.

   These tasks required students to recognise the correct or closest to correct option:
   i) for spelling they needed to select the letter string that correctly spelt a spoken word;
   ii) the synonyms task required them to select from four words the one that was closest in meaning to a target word;

iii) the paraphrase and question tasks required them to select the relevant match from a set of five; and

iv) for the summarise task they selected the sentence that best summarised each of four paragraphs of approximately 30 words in 3 or 4 sentences.

Procedure

The professional development program for teachers involved in the study involved the following key steps: staff from all faculties:

1) explicated what they knew about how students learn literacy;
2) became aware of the set of literacy procedures as options for improving student learning in their subject;
3) contextualised the literacy teaching procedures in their subject by mapping them into a set of subject specific teaching procedures that targeted student activity;
4) evaluated their teaching in terms of the extent to which it already included similar teaching procedures;
5) observed the novel teaching practice demonstrated in their classes;
6) trialed the new teaching procedures in action research activities in their teaching;
7) evaluated and collated the outcomes of the research projects;
8) monitored and evaluated outcomes and reported outcomes to staff meeting, reported their trialing to their level team and to the school;
9) up-dated their teaching on the basis of the research and group analysis.

The teaching procedures that the teachers learnt involved students displaying explicitly each of the following outcomes:

(1) To 'get ready' their knowledge of a topic for literacy activities and for learning. This included two phases: student's (1) visualised aspects of the topic they would read and (2) talked about this imagery in sentences.
(2) To say, read, spell the words, suggest synonyms, antonyms for between five and ten key concept words in the content area.
(3) To have students read aloud short portions of relevant text
(4) To paraphrase or to re-tell sentences in the text read by changing as many words as possible while retaining the meaning.
(5) To say the questions the text answers.
(6) To summarise the text; after reading each paragraph, students identified its main idea or topic.
(7) To read silently a relevant sample of text and show comprehension, review and consolidate what has been read. Procedures the teachers found useful included having students: (1) say as briefly as they can what they had learnt and record it in writing, in pictures or in distinctive gestures; (2) say the questions they could now answer; (3) say how the new ideas were similar to and different from what they knew; (4) work on cloze activities in which they completed a written summary of text they read; (5) answer written questions about the topic; (6) write questions they could now answer, work in a small group to make up 5 difficult questions that are answered another group; (7) write a summary of the knowledge they have gained and (8) draw networks of semantic maps showing the ideas learnt and the links between them.

All teachers were introduced to the sequence of teaching procedures in group activities. They saw the sequence modeled individually in classes they were teaching and received between two and five sessions of individual coaching in the application of the sequence. They trialed one of the procedures they used in their teaching in an action research activity. This was to provide them the opportunity to investigate one of the procedures in greater depth.

Results

Changes in Students' Literacy Performance

Students' comprehensions performance on two occasions prior to the implementation of the literacy teaching procedures and at the conclusion of the two terms during which the procedures were implemented were assessed using different tasks on each occasion from the Tests of Reading Comprehension. Change in comprehension score between occasions were examined using the t-test for correlated samples. The mean comprehension scores (stanines) and the t-values (based on the corresponding mean percentile ranks) are shown in Table 2. The estimated effect size (partial eta square) was calculated using the mean percentile scores for the prior to literacy teaching 2 score and the post literacy teaching score.

Year level	mean score (stanine)		level of difference	mean score (stanine)	level of difference	estimated effect size
	Prior to literacy teaching 1	**Prior to literacy teaching 2**		**Post literacy teaching**		**(partial eta square)**
7	3.27	3.37	t(86) = 0.43	5.35	t(41) = 4.76**	0.57
8	3.16	3.57	t(103) = 0.67	4.48	t(44) = 3.41**	0.48
9	3.38	3.18	t(64) = -0.29	5.29	t(66) = 4.54**	0.61
10	3.02	3.61	t(80) = 0.54	4.69	t(66) = 2.54**	0.43

** $p < .01$

These data show that all year levels made substantial improvement in their reading comprehension during the implementation of the literacy teaching procedures. They did not make similar gains between the two assessment sessions prior to the teaching.

The extent of gain made by students in each stanine range provides an indication of how effectively the teaching procedures targeted literacy learning needs in each stanine range. The mean gain made by students in each stanine range for students at each year level is shown in Table 3.

Prior to literacy teaching 2	Mean gain score			
	Year 7	Year 8	Year 9	Year 10
1	2.7	2.6	3.1	3
2	2.3	2.4	1.8	1.4
3	1.6	-.3	1.9	2.3
4	1.6	.8	.9	.8
5	1.4	0	.76	.2
6	1.1	1.3	.5	0
7	.3	1.3	1.4	1.4
8	.42	.5	.67	.8

These data show that while all readers gained in reading comprehension, the less able readers at all year levels made greater gains in their reading comprehension than the more able readers. They suggest that the literacy teaching procedures are most effective in targeting the comprehending needs of the students who were less able readers initially. They also support inferences about the initial cause of the reading difficulty; that these students did not use their existing knowledge in systematic ways when reading in order to learn. It is not possible from the data collected to examine potential sources of this cause, for example, lack of knowledge about written text, lack of motivation or self efficacy as learners.

Change in use of literacy strategies

In two of the subjects being learnt, each student's ability to: (1) spell key vocabulary items; (2) identify or suggest synonyms for words read; (3) paraphrase previously unseen text that related to the topic being learnt; (4) summarise the previously unseen text were assessed both at the beginning and towards the end of the intervention phase. Change in performance was converted to z-scores and correlated with gains in comprehension performance (percentile gains) using Spearman's rho. The extent of association between the gains in reading comprehension and each literacy skill for each year level is shown in Table 3.

Table 3
The extent of association between the gains in reading comprehension and each literacy skill for each year level

Year level	recognise correct spelling	identify synonym	paraphrase novel text	link a question with the text	summarise novel text
7	.54**	.64**	.73**	.64**	.67**
8	.49**	.62**	.68**	.58**	.69**
9	.51**	.51**	.72**	.53**	.67**
10	.62**	.72**	.74**	.65**	.74**

** p < .01

These data suggest that all of the components of literacy correlated with gains in comprehension. The extent to which each of these components predicted the gains

in comprehension was examined using multiple regression procedures. All of the components were entered stepwise, the order in which the variables were entered and the adjusted R square value for each entry were noted. These are shown in Table 4, with the order of entry indicated and the adjusted R square value for the entry noted in parenthesis for each year level.

Table 4

The order of entry and the matching adjusted R square value for the entry in parenthesis for each component of literacy at each year level

Year level	spell vocabulary items	identify synonym	paraphrase novel text	link a question with the text	summarise novel text
7	5 (.67)	4 (.65)	1 (.51)	3 (. 62)	2 (.58)
8	5 (.61)	4 (.60)	2 (.56)	3 (. 58)	1 (.52)
9	5 (.69)	1 (.64)	2 (.66)	4 (. 68)	3 (.67)
10	5 (.70)	1 (.58)	4 (.69)	3 (. 66)	2 (.63)

These data suggest that the components of literacy that best predicted comprehension gains varied across the year levels but showed some similar trends. Paraphrasing and summarising predicted gains in comprehension best in Years 7 and 8 while in Years 9 and 10, vocabulary knowledge, through the recognition of synonyms, emerged as influential. These trends may reflect in part changes in the learning demands across these years, with a greater focus on cognitive complexity and the need to discriminate between shades of meaning as content area learning progresses from Year 7 to Year 10.

At all year levels recognition of the correct spelling of words was the least predictive of the comprehension gains. This observation is interesting given the acknowledged role of word reading proficiency in effective reading and the influence of word reading difficulties on comprehension (Berninger, 1995; Compton, 2002; van der Leij & van Daal, 1999). It may reflect the increased focus on comprehension of what was read rather than the letter structure of the words in the present study.

Summary

The findings of the study support the claim that reading comprehension at the secondary level can be enhanced by implementing systematic and consistent literacy teaching procedures in a range of subject areas. They also show that while all readers improved in reading comprehension, the less able readers at all year levels made greater gains. They suggest that the literacy learning needs of these students can, at least in part, be targeted through the use of systematic teaching procedures in a particular content area that cue or prompt the less able reading to act on the text to be read in particular ways.

The extent to which the literacy component skills predicted the gains in reading comprehension across the year levels indicate the more widespread need for the systematic teaching of literacy strategies at the secondary level. Differences in the influence of particular skills may be due to varying demands in the complexity of the information to be read and to developmental trends in literacy knowledge over this age span. It is worth noting that literacy trends over the middle years have not attracted the level of research interest given to early literacy development.

A long term intention of the instructional approach is that literacy strategy use is under the control of individual students, and that they will learn to use these types of literacy strategies spontaneously and selectively. Prior to, or in parallel with students, students need to learn the strategies as an integrated sequence. Possible studies may investigate the conditions under which students, after being taught to use each reading strategy separately, can learn to integrate them and then to self manage and direct their use.

The study does not report the long term retention of the effectiveness of the teaching procedures or the extent to which students begin to exert the level of self management mentioned above.

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