Report on the Effectiveness of a Literacy & Learning Program in a Science Classroom

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ABSTRACT

This paper is concerned with an evaluation of literacy program introduced into a science classroom. The paper reviews the genre-based literacy program focussing on descriptions. The research design may be described as a One Group Pretest Post-test. The evaluation of student texts is based on the program's criteria. However, the texts are also evaluated in terms of their cognitive expression using SOLO taxonomy.

Introduction

How best to teach writing across the curriculum has been a hotly contested area. Over the past twenty years formal instruction in language has not been encouraged. Knapp & Watkins, (1994, p. ix) point to the fact that so many students can use language without knowledge of grammar attests the success of the anti-formalist approaches of recent years However, more formal genre, or functional, approaches to language are becoming mainstream. In NSW, Metropolitan East Region Disadvantaged Schools Program pioneered a genre approach to writing in the mid 80s with its Language and Social Power Program. This program continues in the 90s as Write It Right. The Metropolitan West Region Literacy & Learning Program (MWRLLP) was conceived in 1991. The Writing Resource Book (1994), researched and developed by the Education Department of Western Australia is firmly genre orientated. The new NSW K-6 English Syllabus (1994) makes the teaching of functional grammar (genre) in primary schools compulsory. Furthermore, the NSW DSE has announced that all teachers of Year 7 must be aware of functional grammar.

This study is concerned with the evaluation of a genre-based teaching/ learning program designed to increase student literacy levels. The Metropolitan West Region Literacy and Learning Program (MWRLLP) is a DEET funded initiative. In just two years 19 schools involving 500 teachers have been introduced to the MWRLLP. Yet no formal evaluation of the program in terms of student outcomes has been completed. This study of student writing has been undertaken in a school where three

teachers from each of seven faculties have been trained in the program.

It must be emphasised at this point that the linguistic analysis of the MWRLLP is on its own terms, That is, any improvement found in the literacy levels of students will be on the basis of the grammar and structure indicators as defined in the MWRLLP Resource Book (1992).

Metropolitan West Region Literacy and Learning Program

Christie, (1990 p8) suggests that in Australia we are used to thinking

of language as, once learned, a neutral carrier of information and ideas. She continues, that such a view has led to the notion that knowledge, content and ideas are held to have an existence independent of various behavioural modes, including language, in which they 'find expression'.

On the other hand, genre approaches to writing see language, not as some neutral conduit of information, but as a symbolic system that is constructed by individuals to represent ideas and meanings. Knapp (1992 p11) states that genres are culturally embedded and represent the way people and disciplines get things done through language . As such, genres are best taught within contextual framework of the subject disciplines where distinctive discourses have evolved.

The MWRLLP has adopted a genre approach to literacy adapted from the work of Halliday (1985) and Kress (1989).

In contrast to other genre models of writing, the MWRLLP has moved its emphasis away from the idea of genres as text-types to the notion of genres as processes. For example, genres perform the processes of describing, arguing, explaining, instructing and narrating. This genre-as-process model allows the production of very diverse and complex text-types from only a few basic processes. Figure 1 from Knapp (1992, p.13) illustrates some of the diversity of text types that can be produced from these genres.

Literacy

The MWRLLP views literacy as a process. Knapp, the author of the Resource Book, (1992 p.8) suggests that becoming literate involves:

*learning to apply a range of text types to experience the world in order to make it meaningful;

*having control over the structure and grammar of the socially and educationally valued text types and;

*having the capacity to draw on and mix a range of text types in order to address the complexity of writing required in high school subjects.

The Metropolitan West Region Literacy and Learning Program
Teaching/Learning Process

The following discussion of the teaching/learning model is necessarily brief, but demonstrates some of its flavour. For a full account of the teaching/learning process refer to the Resource Book (Knapp 1992) and Science KLA Book (Knapp & Sturgiss, 1992).

The demands of school writing in science tend to become more complex in each successive year. In Years 7 and 8 student texts tend to be simple and monogeneric, usually descriptions or explanations. In Years 9 and 10 writing tasks tend to be multigeneric. For instance, a research assignment on the greenhouse effect may require a definition of the greenhouse effect, a description of its effects, an explanation of its causes and may use an argument to explore possible solutions. HSC Science papers require the student to have a competent control of all these genres.

The MWRLLP proposes that factual texts of description, explanation, instruction and argument be taught explicitly. These texts are taught

in three distinct stages. However, Knapp (1992 p.85) emphasises that these stages are not necessarily sequential.

1.Demonstrate using models the intrinsic connection between content knowledge and the language used to process it.

2.Present students with an explicit scaffold that demonstrates the structure of the genre that will support the content/knowledge being developed.

3.Students analyse and edit their texts in terms of purpose of text, grammar and structure.

G e n r e s
Social Processes that:

Describe:
Through the process of classifying and describing things into cultural or scientific taxonomies of meaningExplain:

Through the process of sequencing phenomena in temporal and/or casual relationshipsInstruct:
Through the process of logically ordering a sequence of actions or behavioursArgue:
Through the process of persuading readers to accept a logical ordering of propositionsNarrate:
Through the process of sequencing people and events in time and space

Personal Descriptions
Commonsense Descriptions
Technical Descriptions
Information Reports
DefinitionsExplanations of How:
Explanations of Why:
Elaborations
Accounts
Explanation EssaysProcedures
Instructions
Manuals
Science Experiments
Recipes
DirectionsEssays
Expositions
Discussions
Debates
Reviews
Interpretations
EvaluationsRecounts:
* Personal
* Historical
Stories
Fairy Tales
Myths
Fables
Narratives

Figure 1. Genres viewed as processes can produce a variety of text-types.

Descriptions

The genre of describing is the focus of this study.

Descriptions are used to classify and describe the world. Other text-types, such as arguments, explanations or narratives do not have this fundamental purpose, but they often incorporate elements of

describing as part of their overall frameworks (Knapp, 1992, p14).

Structurally, descriptions usually begin with a classification, followed by a descriptive passage. Classifications define the object to be described and serve to orientate the reader. In science, classifications tend to be technical and semantically dense. Compare the following classifications: This is an old Sydney Blue Gum and This Eucalyptus saligna is approximately 120 years old. The descriptive passage that follows a classification will describe the parts, behaviours and characteristics of the subject.

The description in figure 2 (Attenborough, 1979, p173), while not exemplary, is typical of almost any found in popular science books. It has been scaffolded to reveal its structure. Such descriptions may be used as models for student texts. The description in figure 3 was produced by a student in the study. It too, has been scaffolded to reveal its structure. She demonstrates competent control over the grammars and structures required for a coherent description.

Figure 2. A typical description

Figure 3. A description from a student

The most significant grammatical features of descriptions are the use of relational verbs to classify and describe the components of the subject, eg. A frog is an amphibian.... It has four legs; and the use of action verbs to describe behaviours eg. the female frog lays her eggs in the water.

The Problem

The MWRLLP was developed through a grant from the Department of Employment, Education and Training as part of the Commonwealth Literacy and Learning Program. To date, around 500 teachers have been inducted into the program. The program involves Teacher reaction to the program has been positive, with both the regional Science and English Teachers Associations presenting further inservices on the genre approach. Sales of Resource and KLA Books have totalled nearly $50,000.

The program has not yet been formally evaluated in terms of student outcomes. The purpose of this study is to assess the value of the genre approach to literacy in a science classroom.

Research Variables

The variables under study are:

*The structure of writing

The structure of a text is indicative of a student's ability to organise ideas into coherent themes.

*The grammar of writing
The grammar of a text is indicative of a student's ability to produce particular text types that are coded in distinct and recognisable ways.

*Conceptual achievement
It is possible for students to produce structurally and grammatically correct texts and yet these texts may be conceptually flawed. SOLO taxonomy is used to measure this variable.

Hypothesis

As a result of the Metropolitan West Region Literacy & Learning Program introduced into a Year 9 science classroom:

a) student texts will reflect a growth and development in structure;

b) student texts will reflect a growth and development in the use of grammar;

c) student texts will reflect an improvement in cognition of scientific concepts.

Research Design

This study may be described as a One Group Pretest Post-test. The study of student writing is undertaken in a school where three teachers from each of seven faculties had been trained in the program. The school provided an opportunity to sample student texts before the literacy program was introduced and after the comprehensive teaching training in the program.

Figure 4 Representation of the Study Design.

1. X represents the exposure of a group to the literacy program.
2. The Os represent the process of observation.

3. X's and Os in the same row are applied to the same persons.
4. Left to right indicates temporal sequence.

Sampling

The vertical curriculum operating in the school meant that the age of students in any class ranged from 13 to 16 and no class remained intact for more than 10 weeks. Samples of student texts were collected in the first week of the 10 week course and again in the final week. To reduce any carry-over effect no class discussion of items was undertaken after the initial testing.

Instruments of measurement

One of the strengths of the MWRLLP is that it explicitly teaches learners to assess their own texts in terms of grammar and structure.

That is, there is an inbuilt component of evaluation. The assessment of genre given in Table 1. is loosely based on the model produced by Met. East DSP (1990,p47) and adapted for use with the Met. West model.

SOLO taxonomy (Biggs & Collis, 1982) has been used to gauge any shift in cognitive expression found in the student texts. This not only represents an external evaluation of the program, but provides a basis to measure one of the implied gains of enhanced literacy - that writing facilitates metacognition. A student using writing to reflect upon his/her thoughts should produce deeper more meaningful texts.

The students in this study were given three writing tasks:

What is a frog?

Why is it dark at night?

What use is science anyway?

These tasks were selected as they represent a description, an explanation, and an argument. The fields represented would not be taught during the study and, therefore, would not likely to be rote responses. Note. Descriptions are the focus of this paper - only the description data has yet been analysed.

Table 1. lists the criteria used to assess student writing. Figure 5. gives an example of a student text analysis.

Table 1.
Criteria for assessment of DESCRIPTIONS
Structure

Classification
0None
1Non-technical found in body of text.
2Non-technical found at beginning of text
3Technical found at beginning of text.

Information organised into paragraphs:
1one paragraph
2more than one paragraph

Each paragraph has a theme:
0totally confused
1relevant & irrelevant information present
2consistent

Each paragraph has a topic sentence
0none
1 inconsistent
2consistent

Appropriate use of diagrams:
0none
1no labels
2labels

Grammar

Consistent use of singular or plural nouns:
1inconsistent
2one inconstancy
3no inconsistency

Appropriate use of tense
1inconsistent
2one error
3consistent

Appropriate use of relational verbs
0none
1inappropriate usage
2one error
3appropriate

Appropriate usage of action verbs
0none
1inappropriate usage
2one error
3appropriate

Appropriate use of technical terms:
0none
1inappropriate usage
2one error
3appropriate

Reference consistent:
1inappropriate usage
2one error
3appropriate

Appropriate use of personal reference:
1inappropriate ie many times
2one reference
3none.

SOLO

0Prestructural.
No answer, a virtually complete lack of understanding of ... an irrelevant answer incorporating none of the above features.

1Prestructural - transition
Reaching toward an understanding of one feature.

2Unistructural.
An understanding of one relevant feature.

3 Uni-transitional.
Two points one relevant one irrelevant.

4Multistructural.
Several relevant features discussed.... Commonsense classification

5 Multi-transitional.
Several relevant features discussed... Technical classification

6Relational.

Several features discussed. Each related to the distinguishing technical classification.

Figure 5. An example of a student text analysis.

Data Analysis

t-tests were used to analyse student work on a longitudinal basis for any significant changes in behaviour. That is, were there any significant changes in the variables of SOLO achievement, text structure and text grammar.

t for Two Related Samples

Table 2.
Analysis of Descriptions

Category	t value
Classification *	4.10
Information organised into paragraphs *	2.45
Each paragraph has a theme	0.00
Each paragraph has a topic sentence *	-2.93
Consistent use of singular/plural nouns	-1.04
Appropriate use of tense	0.00
Appropriate use of relational verbs	-1.04
Appropriate use of action verbs	-1.04
Appropriate use of technical terms *	2.57
Reference consistent	0.59
Appropriate use of personal reference	0.00
SOLO Achievement	-1.22

For 11 degrees of freedom (df) the critical value for t at the two-tailed level [t.025(12)] is ±2.201. The t value calculated for the categories are listed below. The categories marked * represent significant shifts in class performance.

Conclusions:

Has the MWRLLP increased the literacy levels of the students? The MWRLLP defines in part being literate as having control over the structure and grammar of the socially and educationally text-types. I believe that the class in this study has made considerable progress in achieving this aim.

The analysis demonstrates significant improvements in student control of the structural components of the descriptive genre. The pretest and post-test sample below is typical from the study demonstrating a shift to using more technical, more meaningful classification sentences. The classifying sentence is underlined.

"1. a slimy 4-legged creature with a long flicky tongue that lives in and around water. They have 2 webbed feet, no tail, bulgy eyes. They eat flies and have big lumpy things (called - ?) at their throats "

"A frog is an amphibian. It has 4 feet, the front 2 being webbed. Frogs range in size and there are many different species. They can be green or brown or even colours like pink for camaflouge."

The study also demonstrates that while students are more likely to use more than one paragraph in their descriptions they have not mastered the internal structure of paragraphs as indicated by their haphazard use of topic sentences.

"A frog is an amphibian which means it can live on land and water.
It can be numerous colours, and live in varying environments. The female frog leaves its eggs after it lays them, for a male frog to fertilize them.
They lay their eggs under the water."

The students have demonstrated a greater use of technical terms such as amphibian and camouflage. This indicates a growth in student awareness of the specialist science discourse and a movement away from the use of commonsense descriptions.

The study did not demonstrate an improvement in student use of grammar. This is because most students were already competent in the use of grammar required in descriptions. See Appendix A.

There was no significant change in cognitive expression as measured by SOLO. This, in hind sight, is to be expected. Descriptions, by nature, tend to be multistructural. For texts to be relational in SOLO terms they must exhibit some relating operation. That is, the texts must show cause and effect or some sort of ordering of events in time. Such texts

would be described as being explanations.

Recommendations for further investigation

One of the problems with the study was that only the first two stages of the MWRLLP program were able to be implemented in the short 10 week time frame. That is, the teachers modelled texts and concentrated on improving the structure of student texts. It would be unreasonable to think any more could achieved. Literacy is not the only thing the science teacher is expected to teach.

This study clearly reveals the awesome task of improving literacy levels of students in NSW schools. The MWRLLP represents an enormous investment of time, money and resources. In this school alone, the cost of employing casual relief to release teachers to be involved the program was over $10,000.00 . After 10 weeks the students in this study demonstrated a greater control over the use of the structural components of just one genre - describing. How much more time and effort is required to improve student control over the other, more grammatically complex, genres such as explaining and arguing?

The MWRLLP has had its funding slashed as have all such literacy programs in Australia that were funded by DEET. The future of the MWRLLP is in doubt.

The ten week time frame has been too short to allow a teacher to move beyond Stage Two of the program. Stage Three, with its emphasis on students editing the grammatical aspects of their texts needs to be implemented and assessed. A much longer time frame is also required to allow the teacher to implement other genres in an integrated way into a normal classroom routine.

Unfortunately the vertical curriculum in the study school has prevented any longer term study of the class. The opportunity to collect data in a new school is also no longer available. Therefore, I have commenced a longer term study within my own classroom.

REFERENCES:

Attenborough, D. (1979) Life on earth. London: William Collins Sons & Co. Ltd.
Biggs, J. B. & Collis, K. F. (1982). Evaluating the Quality of Learning - The SOLO Taxonomy, New York: Academic Press.
Christie, F. (1990). The changing face of literacy. In F. Christie (Ed), Literacy for a changing world. Melbourne: Australian Council for

Education Research.
Disadvantaged Schools Program (1990). Assessing Writing: Scientific Reports, Sydney Disadvantaged Schools Program, Metropolitan East Region.
Education Department of Western Australia. (1994). Writing: developmental continuum. Melbourne, Longman Australia.
Halliday, M. A. K. (1985). An introduction to functional grammar, London: Edward Arnold.
Howell, D. C. (1985) Fundamental statistics for the behavioral sciences, Boston: Duxbury Press.
Knapp, P. (1992). Resource Book, Parramatta: Metropolitan West Region Literacy & Learning Program.
Knapp, P. & Sturgiss, J. (1992). Science KLA Book, Parramatta: Metropolitan West Region Literacy & Learning Program.
Knapp, P. & Watkins, M. (1994). Context - text - grammar: teaching the genres and grammar of school writing in infants and primary classrooms, Broadway NSW, Text Productions.
Kress, G. (1989). Linguistic processes in socio-cultural practice, London: Oxford University Press,

APPENDIX A
ANALYSIS OF DATA

Structure
NameClassificationInfo organised into paragraphsEach paragraph has a theme

X1X2DX1X2DX1X2D
Alexandra330121220
Amy231110220
Andrew231110231
Anita330110110
Kerrie231110220
Kristy231110220
Lori231121220

Mathew33011021-1
Melanie231121220
Michael330110220
Nick231121220
Stephen 220110220
MEAN D0.58MEAN D0.33MEAN D0.00
STD DEV D0.49STD DEV D0.47STD DEV D0.41

t=4.10t=2.45t=0.00

Grammar

Each paragraph has topic sentenceConsistent use of singular/plural nounsAppropriate use of tense

X1X2DX1X2DX1X2D
Alexandra21-132-1330
Amy220220330
Andrew220330330
Anita220220330
Kerrie220231330
Kristy21-1330330
Lori220330330
Mathew11032-1330
Melanie220330330
Michael21-132-1330
Nick21-1330330
Stephen 21-1330330
MEAN D-0.42MEAN D-0.17MEAN D0.00
STD DEV D0.49STD DEV D0.55STD DEV D0.00

t=-2.93t=-1.04t=0.00

Appropriate use of relational verbsAppropriate use of action verbs Appropriate use of technical terms

X1X2DX1X2DX1X2D
Alexandra330330330
Amy330330132
Andrew330330231
Anita330330330
Kerrie330330022
Kristy330330022
Lori330330330
Mathew33033032-1
Melanie330330231
Michael330330330
Nick32-1330330
Stephen 33032-1022
MEAN D-0.08MEAN D-0.08MEAN D0.75
STD DEV D0.28STD DEV D0.28STD DEV D1.01

t=-1.04t=-1.04t=2.57

Reference consistentAppropriate use of personal referenceSOLO Achievement

X1X2DX1X2DX1X2D
Alexandra231330440
Amy231330440

Andrew33033052-3

Anita330330440
Kerrie330330440
Kristy33033043-1
Lori330330440
Mathew32-133054-1
Melanie330330451
Michael330330440
Nick220330440
Stephen 330330440
MEAN D0.08MEAN D0.00MEAN D-0.33
STD DEV D0.49STD DEV D0.00STD DEV D0.94

t=0.59t=0.00t=-1.22