

TEACHER AND STUDENT USAGE OF SCIENCE TEXTBOOKS

David Tulip & Alan Cook
Queensland University of Technology

ABSTRACT

This study examines the differences between teachers' and students' perceptions of textbook usage in the science classroom. Four categories of use were identified: teacher directed student activities; teaching/studying guidance; as a source of information for the user and as preparation for assessment. The results of the study show that differences do occur between teachers and students with respect to their perceptions of the extent to which textbooks are used in the classroom and the purposes for which they are used, namely as a teaching/studying guide and as preparation for assessment. The findings of the study should be important to all those who use, write and publish high school science textbooks.

TEXTBOOKS IN SCIENCE EDUCATION

Over the last three decades, numerous studies have examined many different aspects of textbooks and their usage in science classrooms. Textbooks have been variously described as the 'tools of the teacher's trade' and as a principal means of spreading knowledge (Kamm & Taylor, 1966); as being central to the teaching of science; as dictating the science curriculum which students experienced and of acting as the primary source of knowledge for most students (Gottfried & Kyle, 1992). Ade-Ridder (1989) shows that students spend a great deal of time and energy reading and digesting the material in their textbooks and that teachers depend on textbooks for information. There have also been other studies which have shown that textbook usage in class has been, and is as high as 90% of available classtime (Muther, 1985; Woodward, 1988; Laws, Horsley, Young & Downey, 1990; Shymansky, Yore & Good, 1991). Yager (1983) has even asserted that the selection of a textbook is one of a science teacher's most important instructional decisions.

Notwithstanding this high status and usage in teaching, textbook authors and teachers' reliance upon textbooks have been criticised. Authors have been accused of treating scientific concepts superficially (Ruis, 1988); making extreme vocabulary demands which often exceed that required for foreign language mastery (Yager, 1983); not utilising accepted theories of teaching (Mann, 1981); presenting the development of science as errorless and linear (Kuhn, 1970) and acting as the prime determiners of what students must do and learn (Yager, 1983). Teachers have been criticised for promoting teaching as the transmission of facts from textbooks (Wellington, 1989); for hiding behind the text's terminology to mask their own lack of understanding of scientific concepts (Yager, 1983); for being inflexible in using textbooks (Davey, 1988) and for using textbooks to give students a false impression of the nature of science (Chiappetta, Sethna & Fillman, 1991).

Textbooks have also been examined for their level of conceptual difficulty (Vachon & Haney, 1983), their effects on student comprehension (Hare, Rabinowitz & Schieble, 1989) and as a source of student misconceptions about science (Cho, Kahle & Nordland, 1985). However, amongst this plethora of research there appears to be little which compares the perceptions which teachers and students have about the way in which textbooks are used. Studies conducted by Laws, Horsley, Young and Downey (1990) and Cook and Tulip (1992), imply that teachers and students may differ in their perceptions about textbook usage in science classes. The former study found that students value a textbook primarily for security as it

provides the information which needs to be learned for examinations and the latter study found that teachers value a textbook primarily for its emphasis on student cognition. This apparent disparity of values between teachers, as directors of textbook usage, and students as users, is a cause for some concern. It implies that both parties involved have perceived that the resource is being used for entirely different purposes. This must surely create an inefficient usage of the resource which the literature shows is a very important component of science teaching. This concern has given rise to the research question for this study. 'Do students perceive the usage of textbooks in a science classroom differently from teachers?'

METHOD

To compare teachers' and students' perceptions of textbook usage it was necessary to place realistic limits on the dimensions of comparison. Four major areas of usage were determined from the literature (Spiegel & Wright, 1984; Chiappetta et al., 1991; Gottfried & Kyle, 1992; Yore, 1991; Roth & Anderson, 1988; Shymansky et al., 1991; Yager, 1983). Textbooks are used to provide: teacher directed student activities; teaching/studying guidance; a source of information for the user; and ideas for assessment.

A questionnaire of ten items representing these four major areas of usage was developed. The ten items were chosen by a panel as being representative of the four areas of usage because they depicted common classroom occurrences in terms which students, as well as teachers, would be able to recognise and associate with. For ease of reference the items were labelled using the letters A to J in the order they appeared in the questionnaire. For 'teacher directed student activities', the items were: to set students' homework (J); for student activities (E); for class reading (I). For 'teaching/studying guidance', the items were - to determine depth of topic (C); to determine sequence of topic (B). For 'a source of information for the user', the items were: for examples (D); for explanations (A); for teacher demonstrations (F). For 'ideas for assessment', the items were: for examination questions (G); for projects (H). These items were not intended to canvass all possible areas of textbook usage. Rather, they were chosen because of their commonality of terminology between teachers and students and the belief that the response on these items would be sufficient to indicate whether a difference in perceptions of usage existed between teachers and students.

Two equivalent forms of the same questionnaire were prepared, one worded appropriately for students and the other for teachers. For each item teachers and students were asked to record their perceived level of usage of the textbook and any anecdotal comments they wished to make. A Likert type scale of "All of the time", "Most of the time", "Some of the time", "Seldom" and "Almost never" (scored 5/4/3/2/1) was defined on both questionnaires in terms of decreasing percentages of times for which the textbook was perceived to be used.

PROCEDURE

The teacher version of the questionnaire was distributed to 250 secondary high schools in Queensland as a component of a larger study (Cook & Tulip, 1992). Questionnaires were completed and returned by 390 teachers, representing responses from 130 schools. The sample of students used in the survey was made up of 444 students from years 9 and 10 from the teacher schools surveyed. The classes of students represented a cross section of science classes throughout Queensland. The sample was an extension of that used in the study by Tulip and Cook (1991).

RESULTS AND TREATMENT OF DATA

Median scores were calculated as data was both ordinal and not normal in distribution (Isaac & Michael, 1985). The semi-interquartile range was calculated for each median to give a measure of the variability of the median score and the significance of the difference between

TABLE 1
COMPARATIVE ORDER OF TEXTBOOK USAGE BY ITEMS RANKED ACCORDING TO TEACHERS' PERCEPTION OF USAGE

Item Code	Item	Teacher			Student			Significance of Difference between Medians
		Median (N=390)	Semi-inter-quartile Range	Rank Order	Median (N=444)	Semi-inter-quartile Range	Rank Order	
J ¹	to set students' homework	4.14	0.55	1	4.53	0.71	1	<0.01
E ¹	for student activities	3.99	0.48	2	4.14	0.84	2	<0.01
C ²	to determine 'depth' of topic	3.56	0.74	3	3.33	0.83	8	<0.05
D ³	for examples	3.43	0.63	4	3.69	0.75	7	<0.01
B ²	to determine 'sequence' of topics	3.39	0.85	5	3.27	0.75	9	Not Significant
A ³	for explanations	3.30	0.77	6	3.91	0.62	4	<0.01
F ³	for teacher demonstrations	3.10	0.85	7	3.73	0.87	5	<0.01
I ¹	for class reading	3.01	0.82	8	3.94	0.85	3	<0.01
H ⁴	for projects	2.07	0.77	9	2.78	1.05	10	<0.01
G ⁴	for examination questions	1.65	0.73	10	3.70	0.86	6	<0.01

Areas of major textbook usage are shown as superscripts on Item Code:

- 1. Teacher directed student activities
- 2. Teaching/studying guidance
- 3. Source of information
- 4. Ideas for assessment

medians was found using the Median Test, which is in effect a chi square test (Isaac & Michael, 1985).

The perceived level of usage of each item by teachers and students was determined by the median score for that item. Based on decreasing median scores the items were ranked from 1 to 10. Table 1 shows a comparison of median scores, semi-interquartile ranges and the rank orders of both teachers' and students' perceptions of textbook usage in the classroom.

The patterns of perceived textbook usage in terms of the major areas of usage and the rank orders defined by both teachers' and students' responses are summarised in Fig. 1.

Rank Order	Responses							
	Teacher directed student activities		Teaching/Studying guide		Source of information		Ideas for assessment	
	Teacher	Student	Teacher	Student	Teacher	Student	Teacher	Student
1	J	J						
2	E	E						
3		I	C					
4					D	A		
5			B			F		
6					A			G
7					F	D		
8	I			C				
9				B			H	
10							G	H

Fig. 1 Teachers' and students' patterns of perceived textbook usage

DISCUSSION

The extent of the differences between students' and teachers' perceptions of the usage of textbooks in science classes is evident from Table 1. For eight out of the ten items on the questionnaire the students' median score is greater than the teachers' median score and the difference between them is statistically significant ($p < 0.01$). Only on one item is the teachers' median significantly greater than the students' median ($p < 0.05$) and there is one item on the questionnaire on which no significant difference occurs between medians. It appears that teachers believe that they use textbooks in the classroom to a lesser extent than students believe is the case.

However, not only is there a difference in the perceived levels of usage, there is also a difference in the patterns of perceived usage (see Fig. 1). There is limited agreement about the importance of three major areas of textbook usage, 'Teacher directed student activities', 'Source of information', and 'Ideas for assessment', but there are also some clear differences within these areas and strong disagreement in the area of using textbooks as a 'Teaching/studying guide'.

The reasons for these differences are open to debate. In the teaching/studying guide area, it could be argued that students would tend to rank the items more lowly because they have little or no control over the sequence and depth of topics in their courses of study and therefore would not use the textbook for these purposes. By contrast, however, the high ratings given to items B and C by the teachers, indicate that Queensland teachers still rely

significantly upon textbooks for guidance on what to teach, when to teach it and to what depth it should be taught even though modern educational theory and preservice teaching courses often indicate that this is poor pedagogical practice (Roth & Anderson, 1988). It appears that with respect to this issue, pragmatism carries more weight with teachers than theory.

In the other three areas of textbook usage, the rankings of items I and G displayed the greatest differences between teachers' and students' perceptions. As shown in Figure 1, the students ranked item I highly, suggesting that they believe teacher-directed student reading is widely used in the classrooms. By contrast teachers indicated that the practice is not particularly frequent. Similarly, the rankings obtained for item G show students use the textbook as a source of examination questions far more frequently than teachers. Furthermore, students substantiated their usage of the textbook in this manner by comments on the questionnaire asking for more answers to problems to help in their study for examinations.

These results give rise to further speculation about the importance of theoretical concepts in teaching practice when it is noted that both items I and G have been strongly criticised in pre-service teacher courses (Roth & Anderson, 1988). In contrast to the results obtained for items B and C, in this case the teachers appear to practise what theory suggests. Could it be that some theories are more in vogue than others or could it be that there is a difference between what teachers (or students) do in the classroom and what they report they do?

CONCLUSION

The differences between teachers' and students' perceptions of textbook usage in the science classroom which this study has reported, raise some issues which should be of concern to teachers and textbook authors. The data suggest that students perceive textbooks to be a very important part of their science education. Teachers, however, appear to downplay their usage in the classroom. This incongruence could have deleterious ramifications. Chiappetta et al. (1991) and Laws et al. (1990) have described students' narrow perceptions of science as that information which is in the science textbook and the results of this project seem to support these findings. If this image of science is to change, authors and publishers will need to introduce to textbooks mechanisms which encourage students to perceive textbook usage in the science classroom differently from that currently employed. This view is supported by Ormiston-Smith (1993) when she states that "textbooks should be written as an argument for the plausibility, fruitfulness and intelligibility of their content" and Morris and Stewart-Dore (1987) when they advocate techniques by which students can gain meaning from textbooks rather than use them as objects of memorisation. Of course, such mechanisms will be useless teachers adopt and support them.

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AUTHORS

- MR DAVID TULIP, Lecturer in Science Education, Centre for Mathematics and Science Education, Queensland University of Technology, Kelvin Grove, Queensland 4059.
Specializations: science education.
- DR ALAN COOK, Senior Lecturer in Science Education, Centre for Mathematics and Science Education, Queensland University of Technology, Kelvin Grove, Queensland 4059.
Specializations: science education.