Are Textbooks Sinful?

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Teachers use printed material, for example textbooks, workcards, practice examples extensively in mathematics classrooms. They are given little advice on different forms of usage and additionally they are made to feel that they should not be employing these aids. Mathematics educators need to research styles and effective use of textbooks.

> At the primary stage new topics and the concepts should always be introduced by appropriate oral and practical work and the necessary links with what has gone before established by discussion.
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> Nevertheless, textbooks provide valuable support for teachers in the day-by-day work of the classroom. They can provide a structure within which work in mathematics can develop and provide ideas for alternative approaches. They can be a source of exercises which have been carefully graded and are likely to provide revision exercises at suitable intervals. Accompanying teachers' manuals may suggest other kinds of work which should be undertaken alongside the exercises in the textbook and indicate ways in which the topic can be developed further for some pupils. However, it is always necessary to use any textbook with discrimination, and selections should be made to suit the varying needs of different children. It may be better, too, to tackle some parts of the work in an order which is different from that in the book or to omit certain sections for some or all children. It should not be expected that any textbook, however good, can provide a complete course or meet the needs of all children; additional activities of various kinds need to be provided.
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> (Mathematics Counts, p.91)
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> Moreover, pupils need to be able to extract, appraise and use mathematical information not only from textbooks and workcards but also from a range of other sources such as topic books, reference books, advertisements, catalogues, newspapers, radio and television.
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> (Mathematics from 5 to 16, p.13)
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> It is perhaps surprising that the textbook should have continued to be used in traditional form by reformers; for by its very nature - its cost and its comprehensiveness - it militates against changes in the curriculum. Even its appearance, particularly when in hardback form, proclaims authority and permanence. Yet financial and administrative constraints, together with the ease of use of a textbook with its inherent structure, have helped to preserve its supremacy in the face of opposition from other written forms.
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> (Mathematics: Society and Curricula, p.93)

These comments from two very influential sources and an overview on the mathematics curriculum are not very informative but are noteworthy because the documents say so little about textbooks.

They would lead any teacher to think that using a textbook (or other printed material) was best avoided and might even prove to be sinful. Verbal advice has often been even more strongly against adherence to a scheme or printed text. Teacher-trainers and advisers have often been heard to say 'you should dip into a textbook, do not follow it page by page'. "Slavishly" is sometimes added, gratuitously. This really appears to be strange advice when one considers that the author of the book has presumably sequenced the content so that it made sense and in order to address pre-requisites. "Dipping-in" destroys this sequence. If a teacher was seeking examples to illustrate or extend material already available, then the textbook may be being used for a purpose not intended by the author but better served by lists of examples/word problems.

In "Better Mathematics" (HMSO, 1987), which was issued to all schools the authors went further in damning the use of textbooks quoting a college lecturer who likened them to junk food.

FOOD FOR THOUGHT

JUNK FOOD	**JUNK MATHEMATICS**
There is a lot of it about.	See most school textbooks.
All the preparation is done for you by someone else.	This is done by the author or teacher - all the nasties are removed.
The instructions for use are simple and laid out in steps.	See most textbook questions.
It is superficially attractive but turns out to lack flavour.	It looks well structured and appears logical, but is dull and lack substance.
It does you little good; it tends to pass through quickly.	Pupils are unable to retain or apply it in new contexts.
All the real nutrient is removed and substitutes have to be added.	It offers no real life situations but invents and contrives them.

DANGER: HEALTH WARNING
Junk mathematics can seriously damage your pupils

Fig 1 Textbooks (Better Mathematics, p.15)

During 1964 to 1971 the Nuffield Project in the U.K. produced not textbooks for children but guides for teachers and provided examples of workcards that could be given to children. The teachers were expected to extend and adapt these workcards for their own classes but with help,

> They were written against the background of teachers' centres where ideas put forward in the books could be discussed, elaborated and modified. We hope very much that they will continue to be used in this way. A teacher by himself may find it difficult to use them without the reassurance and encouragement which come from discussion with others. Centres for discussion do alreay exist and we hope that many more will be set up.
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> (Computation and Structure 5, p.iii)

Even this support proved to be insufficient and ten years later the Assessment Performance Unit (A.P.U.) reported extensive use of published textbooks in British primary schools. Instead of criticising this trend we should ask if it is reasonable to expect teachers to write material as well as do all the other types of work expected of them. Would it not be better to have them concentrate on planning, classroom interaction, questioning and other verbal communication and simply exhort them to think carefully about the printed material they use. This might make all those concerned with mathematics education more interested in research and design (with evaluation) of school textbooks. There is very little research on the effectiveness of printed material in mathematics classrooms and yet it is the predominant influence.

The Use of Textbooks

The Second International Mathematics Study (1982) was a survey of the teaching and learning of mathematics in some twenty countries worldwide. The children studied were:
a) 12-13 year olds; and b) 17-18 year olds (12th grade in the USA).

The Americans (McKnight et al, 1987) considered: "The mathematics textbook in twelfth grade classes in the U.S. stands out as the most commonly and consistently used resource for instruction" and "The student textbook is the predominant instructional resource in U.S. eighth grade mathematics classrooms, and is so reported by 90 percent of the teachers" (The Underachieving Curriculum, page 74).

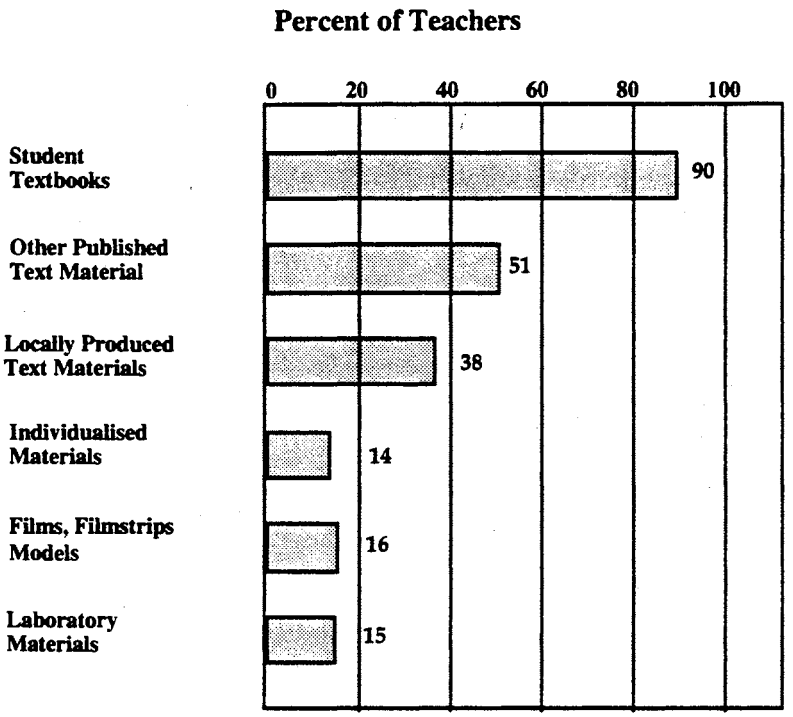

Fig 2 8th grade US sample SIMS (1982)

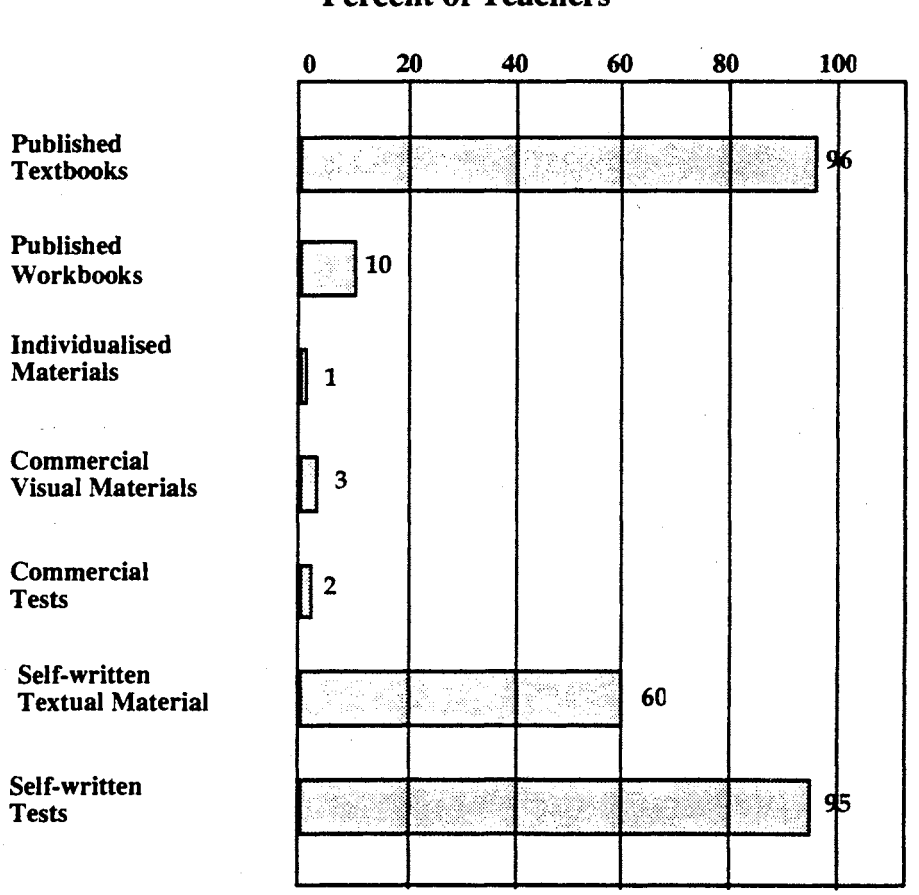

Fig 3 12th grade US sample SIMS (1982)

In Britain the APU (1982) reported the use of textbooks in primary schools to be extensive as shown in Figure 3. The series most often used was then twenty years old.

% Time	Percentage of Pupils
90% or more	19
80	18
79	18
60	15
50	16
40	6
30	3
20	2
10% or less	2

Fig 4 Percentage of Use of Mathematics Scheme
(Review of Monitoring in Mathematics)

Additionally, teachers' responses showed that about half of the pupils had spent four years or more working from the scheme then being used, (this is all the time in the junior school). Some 90 percent of pupils used the same scheme in both infant and junior schools. Seventy-three percent of the pupils used published arithmetic example books. The authors of the APU report note that there is different practice for individual schemes in extent of use and duration. The Alpha-Beta series was the most popular scheme but provided the lowest average percentage of pupils' mathematical experiences (63 percent).

There is, as yet, no more up-to-date survey than that of the APU on the use of printed material in British mathematics classes.

Teachers of Mathematics use printed materials extensively but we know very little about how or what is the most effective way of using them. Do teachers vary their use according to the age of the child, the perceived attainment level of the child, whether the content is new or review? Davey (1988) in "The Journal of Reading" reports on a study of 90 experienced American classroom teachers. The elementary school teachers taught many subjects, ten of the secondary school teachers were mathematics specialists. Davey developed a survey instrument on the use of textbooks, shown in Fig 5,

Survey items	45 elementary teachers	45 secondary teachers
(1) I give students time to read the text silently in class.	2.61	1.75
(2) I use one textbook primarily.	2.26	2.63
(3) I teach students how to use the textbook.	1.69	1.75
(4) I give independent homework assignments from the text.	2.29	3.10
(5) I have students answer questions at the end of the chapter.	2.21	2.60
(6) I use different texts with different students.	2.25	1.60
(7) I rely on text information for my instruction.	2.41	2.35
(8) I overview the text selection before giving an assignment.	3.71	2.90
(9) I ask students to read from the text orally in class.	2.31	2.35
(10) I change texts when I see students can't read them well.	2.42	1.82
(11) I expect students to read most of the text.	2.09	2.74

Ratings were on a 1-4 scale where 1 = rarely and 4 = most of the time.

Fig 5 90 teachers' ratings of textbook uses

Note how few of these teachers say that they teach their classes how to use a textbook and how rarely secondary school teachers change the text when they cannot be read!

We have started some research on styles of using printed material in mathematics classrooms. Initially with one student's PhD work in which secondary school mathematics teachers are observed in class. The teachers are also interviewed and asked how the material has been chosen. Is there a set of textbooks chosen by the department? What part was played in the choice by this individual? The observations are for a number of reasons for example:

a) to ascertain whether a new topic is introduced by the teacher or by the child reading the textbook.
b) How close to the book is the teacher's introduction?
c) Do the examples that follow match it?
d) How do the children use the material?
e) How close to the teacher's objectives for a lesson (or series of lessons) is the class performance? In other words "How effective is the teaching?"

The simple recognition of different styles of textbook use should allow teacher-trainers the opportunity to discuss what is likely to be the principle teaching aid with future teachers. It should be possible to suggest a variety of styles amongst which the young teacher could choose and which

might be adapted for individual needs. From the comments that one receives from teachers who are asked to review a textbook it is obvious that they have very different expectations of what a book can do. Not merely that they require a book for different purposes, for example to act as a focus around which class discussion takes place, or a self-instruction module for high attainers but that it should also be:

a) understandable without being read;
b) contain explanations which must be thorough but brief;
c) readable by a non-reader; and
d) provide success.

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