
Title	Diagnosis and remediation in mathematics
Author(s)	Fong, Ho Kheong
Source	<i>Teaching and Learning</i> , 2(2)19-22
Published by	Institute of Education (Singapore)

This document may be used for private study or research purpose only. This document or any part of it may not be duplicated and/or distributed without permission of the copyright owner.
The Singapore Copyright Act applies to the use of this document.

DIAGNOSIS AND REMEDIATION IN MATHEMATICS

FONG HO KHEONG

Introduction

A fact that confronts teachers in Singapore is the high failure rate in Mathematics in many schools. There is therefore great urgency to provide a sufficient number of Mathematics teachers with the expertise to work with slow learners. This article introduces teachers to some methods of diagnosing the problems of slow learners and of carrying out remedial work in Mathematics.

What is Diagnostic and Remedial Work?

When some pupils in his class skipped 70 per cent of the questions in a test, the teacher felt that this was due to inadequate practice of mathematical problems. To remedy this, he gave additional exercises to them hoping that by doing extra work they will understand the concepts taught.

Another teacher faced with the same problem felt that it was due to her teaching. To solve the problem, she re-taught the same topics to the pupils. Later she found that the problem persisted. Were these two teachers diagnosing and remediating in the correct way?

In the medical field, a doctor will diagnose a patient before prescribing medicine. When a patient complains of pains in his stomach, the doctor has to find out in which part of the stomach the pain is located, and the nature of the pain. He has to inquire into the patient's diet and to locate the pain. Actually what he is doing is to find out the cause and type of pain, after which he will prescribe the necessary remedy.

You will notice that the diagnosis is to determine the nature of the problem. In Mathematics, to diagnose is to find out the weaknesses and deficiencies of the pupils. Following the diagnosis is the remedy.

Classroom Observation Diagnosis

A classroom observation is carried out whenever a teacher goes round the class to check on pupils' work. This method includes examining the answer scripts of tests given to the pupils. From the data available, the teacher is able to discover a variety of incorrect ways the pupils used in solving problems.

It is necessary to obtain as much information as possible about pupils' common errors and their weaknesses before diagnostic and remedial work can begin. To do this, there are certain dos and don'ts that we need to follow.

- Do accept pupils' answers, whether right or wrong.
- Do not make any comments when observing pupils working in the classroom as this may affect their work. As our main purpose is to collect data on pupils' errors, we should not in any way influence their answers.
- Do not interrupt pupils' work in order to correct their mistakes as we wish to gather all the information on their weaknesses for our diagnosis.

The following are some of the errors obtained from a pupil's work:

$$(i) \quad \begin{array}{r} 92 \\ 5 \overline{) 470} \\ \underline{45} \\ 10 \\ \underline{10} \\ 0 \end{array}$$

$$(ii) \quad \begin{array}{r} 47 \\ -28 \\ \hline 21 \end{array}$$

Example (i) shows that the pupil was able to apply the technique of long division. The teacher, however, hypothesized that the pupil's mistake was due to carelessness or weakness in his subtraction. To confirm this, the teacher checked a few more of his answers based on the same type of problem.

The second example (ii) shows that the pupil looked for an easy way out of his problem. Probably he did not know the concept of decomposition in subtraction.

To remedy the problem illustrated in the first example, it is not necessary to go through again the topic on long division. The pupils should instead be taught the rudiments of subtraction.

In the second example, it is obvious that the pupil did not know how to subtract two-digit numbers which needed decomposition. This example does not show that he was weak in single digit subtraction. Hence, special attention should be paid to subtraction which needs decomposition.

Formal Testing Diagnosis

Another method of identifying the weaknesses of pupils is based on the analysis of the answers of specially constructed test items. The items in this test have to cover all the fundamental skills of computation. Questions on each of these skills have to be constructed so that their negative responses can reveal pupils' weaknesses. In other words, there is an objective behind each item. They are constructed according to their enabling objectives. It is recommended that 4 or 5 items be constructed on each objective because if only one item is given an error made may be due to carelessness. Thus the test will be unreliable. The following examples illustrate how diagnostic test items may be constructed based on the enabling objectives of some of the problems.

Look at the problem of the addition of two-digit numbers which need regrouping.

$$\begin{array}{r} 48 \\ + 76 \\ \hline 124 \end{array}$$

What basic skills should a child acquire in order that this problem of addition could be solved?

Notice that (a) a pupil should be able to add two single-digit numbers that would lead to regrouping from the units column, and (b) a pupil should be able to add 3 single-digit numbers that need regrouping from the tens column.

Based on these basic skills, diagnostic test items can be constructed as follows:

Basic skills	Examples
(1) Adding two single-digit numbers which need no regrouping	$\begin{array}{r} 4 \\ + 5 \\ \hline \end{array}$

(2)	Adding two single-digit numbers which need regrouping to the tens column	$\begin{array}{r} 8 \\ + 9 \\ \hline \end{array}$
(3)	Adding three single-digit numbers which need no regrouping	$\begin{array}{r} 1 \\ 4 \\ + 3 \\ \hline \end{array}$
(4)	Adding three single-digit numbers which need regrouping to the tens column	$\begin{array}{r} 1 \\ 4 \\ + 7 \\ \hline \end{array}$

When a pupil works through these problems involving basic skills, a teacher should be able to identify his weaknesses and only then can remedial work be usefully carried out. For example, if he cannot work out skill (4) above, it means that he needs to be taught the addition of 3-digit numbers which need regrouping to the tens column.

Comparing the two methods of diagnosis, one cannot say which is the better method. Although the formal testing method is more systematic, some of the pupils' errors may go undetected. Sometimes classroom observation is necessary. For example, the error in addition in

$$\begin{array}{r} 34 \\ + 69 \\ \hline 913 \\ \hline \end{array}$$

can only be detected through classroom observation. So the two methods can complement each other for better diagnostic work.

Conclusion

This article explains the need for proper diagnosis and remedial work if the failure rate in Mathematics among pupils is to be reduced. It also stresses the point that teachers have to be familiar with some of the methods of diagnosis before they can carry out remedial work with slow learners.