IDM
(Individually Designed Materials):

Fundamentals of Addition, Subtraction, Multiplication, and Division

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for IDM: Fundamentals of Addition, Subtraction, Multiplication, and Division

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IDM (Individually Designed Materials): Fundamentals of Addition, Subtraction, Multiplication, and Division

INTRODUCTION

IDM: Fundamentals of Addition, Subtraction, Multiplication, and Division covers the basic math combinations in addition, subtraction, multiplication, and division. The program was designed to develop a student's competence and confidence in math computation by providing individualized instruction, while recognizing classroom limitations in terms of teacher time and available equipment.

OBJECTIVES

Academic Objectives

The objectives of IDM are to increase the learner's accuracy and fluency in basic addition, subtraction, multiplication, and division operations. There have been numerous references in the literature noting that inaccuracy with math combinations is a major source of math errors in elementary school mathematics. Kingston, in comparing the incidence of math fact errors and process errors, noted
that incorrect recall of basic facts accounts for approximately 45% of all errors, and appears to be more lasting than process errors. Because fluency in math combinations is a prerequisite to higher-level math tasks, this lack of fluency must be addressed directly and effectively.

**Affective Objectives**

Affective learner changes are an important outcome of the IDM programs. For all students, and for low achievers in particular, consistent demonstrations of academic success will positively impact the learner's self-concept.

In this IDM program the learners take responsibility for preparing for the curriculum-embedded assessments, and learners determine when they are ready to be evaluated. These experiences provide students with the opportunity to take responsibility for their own learning, and the teacher has opportunities to ensure that students' responsibility is recognized. The end product should be gains in both academic competency and self-confidence as an independent learner.

**PREREQUISITES**

This IDM program provides individually prescribed practice in addition, subtraction, multiplication, and division combinations. The basic concepts associated with addition, subtraction, multiplication, or division equations must be
taught prior to placement in this program. The following skills are also necessary prerequisites for learner success:

$ The learner can identify the numerals 0-100.

$ The learner can write the numerals 0-100.

$ The learner can identify and understand a number sentence, e.g., "9 - 7 = 2."

$ The learner must understand the concept of "equals."

$ The learner must understand that the sides of an equation are interchangeable, e.g., 7 x 5 = ? can be written ? = 7 x 5.

FIELD TESTING

The IDM programs in math and language arts were developed by Alan Hofmeister, as the result of a search for intervention procedures applicable to all students, including those with achievement skill deficits. Utah State University researchers conducted research which identified math computation and spelling as areas of frequent failure.

After observing teachers, it was found that as high as 90% of their interactions with pupils were either negative or neutral when the students were not progressing in curriculum areas in accordance with teacher expectations.
The teachers involved in these observations had extensive inservice training in the importance of positive teacher-student interactions. A need for alternative instructional procedures to support teachers and help students gain proficiency in math computation and spelling became vital. IDM uses CDs because the equipment can provide needed practice without verbally or nonverbally expressing disappointment, frustration, or criticism. CD players are a less costly way to reduce the pressure on limited computer time at school and at home. Additionally, CD equipment is often readily available at home.

IDM was extensively and repeatedly field tested to determine student gains and teacher reaction. Researchers conducted a series of validation studies with students in regular classrooms. In the math studies, the students were at least one year below grade level in math computation. The students were randomly placed in control and experimental groups and were given a computation pretest. The experimental group then received 8 weeks of instruction. The students in the control group received regular math instruction. Post-tests were administered, and the results showed that the experimental group made a 3.5-month gain beyond the control group during the 8-week treatment.
Teachers were asked to rate various aspects of the IDM programs. Their responses indicated that 88% felt that the programs were valuable, met individual student needs, and could be managed with minimal teacher preparation. Teachers reported that students accepted full responsibility for their independent work. Student's increased sense of responsibility was identified as a major element in the success of the program.

A similar study was conducted with spelling CDs and achieved similar findings. In spelling, the low achievers gained one grade level for every 10 weeks they were in the program. The IDM programs provided all students the opportunity to improve and allowed low achievers to close the gap with their peers.

**STUDENT ASSESSMENT AND PLACEMENT**

Placement tests are used to ensure that individual needs are addressed and the student has a "high-success" start in the program. Without an accurate diagnosis of the specific errors, considerable teacher and student time is wasted. Placement testing is the first step in successful instruction (see *Instructional Sequence* on page 6).
Administer Placement Test to diagnose student deficiencies in accuracy and speed in computing addition, subtraction, multiplication, and division.

Prepare individual prescriptions.

Assign self-study lessons on CDs. Students listen to the lesson and write the answers. Students then check the answers with the appropriate Answer/Study Sheet. Students review lessons as many times as needed.

Student exercises personal judgment and determines when ready for evaluation of lesson used in study sessions. Teacher removes answer sheet, and student listens to the lesson and writes the answers.

Record the date of mastery for successful lesson evaluation on the Individual Student Record.

If the established criterion is not met, the student is recycled into the program as necessary.

Higher-level application and generalization activities
PLACEMENT TESTING

Getting Ready

Have the following materials ready:

$ Copies of the placement test (see the Blackline Masters)
$ Pens (to discourage erasures)
$ A clock or watch with a second hand

Administration

The tests may be administered to students individually or in groups. It may be difficult for some low-performing students to complete an entire test in one session. It is recommended that these students fold their tests on the heavy lines (into halves or quarters) and complete one section at a time. In this way, the student will not be overwhelmed by an entire page of computation.

After passing out pens and test sheets, face down, in front of the students, say:

"I want to see how well you can work these problems. Write the answers as quickly as you can. If you cannot answer a problem, cross it out and go to the next problem. When you are finished, turn your paper over and raise your hand. Are there any questions? Ready . . . You may begin."
It is important that the starting time to the nearest 10-second interval be written down. As the students raise their hands, indicating they have completed their tests, record the total testing time. For example, if a student completed the testing in 4 minutes and 40 seconds, record 4/40 next to the student's name. Regardless of whether a student is working on a full, half, or quarter page, the total time for a testing session should not exceed 15 minutes. Do not draw attention to the diagonal groupings. The students should treat the combinations as a random presentation.

**Scoring**

A Placement Test is scored after all parts are completed by the student. For most students this will be after a single session, but some students may require two or more sessions to complete a test.

**PREPARING INDIVIDUAL PRESCRIPTIONS**

**Class Profile**

Once the errors are recorded, individual prescriptions can be prepared. At the mastery level the suggested criteria are 4 minutes total test time and 100% accuracy. The teacher may, however, determine the criteria for a particular student, depending upon the specific instructional situation. (See the Placement Chart on page 9.)
### Placement Chart

<table>
<thead>
<tr>
<th>Total Test Time</th>
<th>Errors in a Diagonal</th>
<th>Placement in Program</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 minutes or less</td>
<td>None</td>
<td>Student does not need the program (for that problem type)</td>
</tr>
<tr>
<td>4-7 minutes</td>
<td>2 errors or less</td>
<td>Provide untimed practice for accuracy with copies of test sheet</td>
</tr>
<tr>
<td>4-7 minutes</td>
<td>More than 2 errors</td>
<td>Lesson 1 for that diagonal</td>
</tr>
<tr>
<td>More than 7 minutes</td>
<td>Regardless of errors</td>
<td>Lesson A-1 for addition&lt;br&gt;Lesson L-1 for subtraction&lt;br&gt;Lesson A-1 for multiplication&lt;br&gt;Lesson M-1 for division</td>
</tr>
</tbody>
</table>

### PROGRAM MANAGEMENT

Proper implementation of IDM will reduce teacher time, and increase student responsibility and independence in fully using the program.

### Lessons

The CD lessons correspond to the diagonals on the Placement Tests. Lessons identified with the letters A-K are for addition, and those identified with the letters L-U are for subtraction. Each letter, A-U, has two lessons.
The first lesson, designed to improve accuracy, allows the student 6 seconds to write each answer. The second lesson, designed to improve fluency, once accuracy has been achieved, allows the student 3 seconds for each answer.

(A male voice is used for the accuracy lessons, and the female voice is used for the fluency lessons.) For example, Lesson R-1 and Lesson R-2 both cover subtraction combinations involving the numeral "6." Lesson R-1, designed for accuracy, allows the student 6 seconds to respond; Lesson R-2, designed for fluency, allows the student 3 seconds to respond.

Lessons identified with A-L are for multiplication, and those identified with the letters M-W are for division. Each, A-W, has two lessons. The first lesson, designed to improve accuracy, allows the students 6 seconds to write each answer. For many students it will be appropriate to have them write the whole "number sentence" and not just the answer during the 6 seconds. The second lesson, designed to improve fluency once accuracy has been achieved, allows the student 3 seconds for each answer. For example, Lesson P-1 and Lesson P-2 both cover division combinations with a divisor of 3. Lesson P-1, designed for accuracy, allows the student 6 seconds to respond; Lesson P-2, designed for fluency, allows the student 3 seconds to respond.
The students play an active role in determining how many study sessions are needed and when they are ready for evaluation. It is essential to the program that the students be allowed to judge when they are ready for an evaluation following study sessions for a particular lesson. This procedure places the responsibility for achievement on the student. *When students demonstrate increased responsibility and independence, teachers must consequently recognize such increased responsibility.* Teachers should ensure that students’ increased independence and increased responsibility for their own learning are also shared with parents in a timely manner. Do not wait for regularly scheduled teacher-parent conferences and report cards to share such important information. Unscheduled calls to parents by a teacher should not be limited to "bad news." Involve other teachers and the principal in recognizing student success.

Each time the student listens to an audio lesson, a paper will be necessary for writing answers. The paper should be prepared in advance by either you or the student. It should contain the student's name, the date, the lesson identification letter and number, and should be lettered *a* to *j* (*a* to *k* in the case of multiplication problems). The CD will remind the student to have a lettered paper ready and to use a pen.
RETEACHING PROCEDURE

When the student does not have **ALL** the answers correct on a lesson evaluation or did not meet the criteria established by you, encourage the student by pointing out the problems that were answered correctly. Provide guidance to ensure that the criteria will be met on the next attempt. If the student failed to meet criteria on the first trial, the student continues to practice the lesson presented on the CD.

ALTERNATIVE INSTRUCTION WITHOUT AUDIO CDs

Should you choose not to use the audio CDs, alternatives in the form of worksheets are supplied [see Blackline Masters -- Worksheet-Only Alternatives (for those not using audio CDs)].

APPLICATION AND GENERALIZATION ACTIVITIES

One of the major objectives of this IDM program is the development of fluency and accuracy in math combinations. Fluency and accuracy are critical prerequisites necessary for successful participation in higher-level math concepts.

If the fluency and accuracy skills taught in this program are to be effectively applied to higher-level math skills, the student must also develop two important associated skills:
The ability to discriminate between signs, e.g., between addition, subtraction, multiplication, and division signs.

The ability to generalize the computation skills to both vertical and horizontal forms, e.g., $2 + 4 = 6$, and \[
\begin{array}{c}
2 \\
+ 4 \\
\hline
6
\end{array}
\]

The Activity Sheets (see the Blackline Masters) are used to determine if the student has developed skills in sign discrimination and generalization. These activity sheets serve to help identify strengths and weaknesses as well as practice in sign discrimination and generalization.

After a student has successfully completed all the addition, subtraction, multiplication, and division lessons in the student's prescription, assign Part 1 on the appropriate Activity Sheet. Score this section; if all the Part 1 problems are correct, it is not necessary for the student to complete the sheet. If two errors or less were made, once the student has been made aware of the nature of the errors, the student should complete Part 2. If more than two errors were made on either section, further instruction is required before proceeding to higher-level skills.
Additional generalization activities can be done in cooperative learning settings where different generalization problems can be prepared by the students' using the Activity Sheets as models. In preparing activity sheets, teachers should design them to check for:

$\bullet$ the vertical form

$\bullet$ the horizontal form

$\bullet$ the horizontal form with answer on the right

$\bullet$ the horizontal form with answer on the left

$\bullet$ activity sheets with mixed signs, e.g., $9 + 7 = ?; 9 - 7 = ?$

$\bullet$ horizontal or vertical form with one of the combinations missing,

  e.g., $2 + \ ? = 8$.

**CONCLUDING NOTE:**

**INSTRUCTIONAL ACCESS WITH DIGNITY FOR THE LOW ACHIEVER**

Many low achievers have two characteristics. First, they have not achieved the competency and confidence in the "gateway" prerequisites to the higher curriculum concepts in math and language arts. Second, they have a history of failure and low expectations of success. This history of failure experiences can
only be overcome by a massive number of success experiences in the academic area in which the student previously failed consistently.

The IDM programs provide:

1. Individualized placement tests ensuring that all instructional experiences are "high-success," i.e., 80-100% success.

2. Extensive high-success practice is essential if the needed fluency is to be achieved. The use of the "audio-tutorial" format allows students to practice with privacy and dignity and to take responsibility to determine when they will be evaluated.

3. This IDM program is a tool whereby the necessary practice each child needs is provided without risk of comments that often unintentionally add to feelings of failure and discomfort felt by the low achievers.
Appropriate implementation of the IDM programs should ensure that 90% of teacher-student interactions are positive.

First, the student must succeed!
Second, this success must be recognized by persons the student considers important.