

Mathematics Diagnostic/Prescriptive Inventory (MDPI)

General Description

Introduction

The Mathematics Diagnostic/Prescriptive Inventory (MDPI), is an individualized evaluation tool, which provides educational professionals with an easy, efficient, yet comprehensive, instrument that assesses a student's performance in mathematics and then diagnoses the source of the student's challenges. It is designed to be administered to students, ages 7 to 15, whose cognitive potential is at least in the average range. Depending upon the performance of the particular student and the experience of the examiner, the assessment can take between 45 minutes and 1.5 hours, with the average being about one hour.

The MDPI combines the advantages of personalized examiner/student interactions and on-line analytic capabilities. The student evaluation is conducted in a one-to-one personal interview by an educational professional, with the dynamic interplay between the examiner and student as a key feature. The MDPI relies on the examiner's judgments and observations. This is an important aspect of the MDPI approach because the examiner's observations of the student's performance is a key part of the input to the diagnosis. The interpretation of results is delegated to an on-line analytic tool which produces a summary of a student's achievement and learning postures in mathematics.

A unique feature of the MDPI is that a student's performance is observed beyond specific mathematical solutions and includes the consideration the quality of solutions as well as the student's particular approaches, including a description of a student's Mathematical Learning Style as well as the Qualitative Features and Executive Processes that influence performance. The student's **Mathematics Learning Style** characterizes the inherent intuitions and processing strategies brought to the circumstance of mathematics. **Qualitative Features** describe output efficiency in terms of pace and precision as well a student's facility dealing with symbolic demands, visuo-spatial cues or language requirements in mathematics. Note is taken as to whether approaches are rotely driven or supported by conceptual foundations.. The **Executive Processes** that are considered include organizational/sequencing skills, integration skills, working memory capacities, ability to shift, sustain and/or follow through on initial approaches (often described as executive function capacities) and the ability to deal with complexity.

Another key and unique element of the MDPI is the use of a web-based, [Expert System](#) (ES) to summarize and interpret the results of the assessment and provide the information necessary for the examiner to make a diagnosis of the student's learning issues. The ES reflects the knowledge and experience of the Math Diagnostic principals who collectively have assembled and

interpreted data for thousands of children over the last three decades. The ES design has been validated in research projects funded by the NIE and NICH.

The Achievement Level, the Ratings of Qualitative Features and Executive Processes and the student's Mathematics Learning Style are combined by an online analytic application to provide the Mathematics Learning Profile for the student. This Profile then drives the selection of appropriate prescriptions which are also generated by the online program. The student's team of teachers and advisors are then provided with a range of optional approaches to intervention from which they can select the best choices for the student. The team takes into account the results of the MDPI as well as their observations of the student and his circumstances in order to make the most appropriate choices among the alternative interventions presented.

The Components of the MDPI

Appendix A presents a flow chart which outlines the steps in an MDPI assessment and diagnosis. A detailed description follows.

To perform the student's assessment, the examiner is provided with:

- MDPI User's Manual
- Demonstration Video
- Raw Data Recording Form
- Performance Characteristics Checklist
- Test Kit

The **User's Manual** and the **Demonstration Video** will be available for download from the MD website's Subscribers' Page. First time users should review carefully the video and become familiar with the Manual and the other materials, particularly the Performance Characteristics Checklist, before administering the MDPI.

The **Test Kit** with the Activity Cards will be available for purchase from MD. The Test Kit contains the manipulative materials necessary to conduct the evaluation, including:

- Counting Chips
- Cuisenaire Rods
- Real Coins
- Base Ten Blocks
- Pattern Blocks and
- 2 cm Cubes
- Real Money: Coins will be provided by the examiner

Activity Cards are included as part of the Test Kit. They are used in the evaluation as references for the examiner and the student. The Cards are mounted on a stand and placed between the examiner and student. The test items viewed by the student are provided on the fronts of the cards, while the Administrative Guidelines, including directions and prompts used by the examiner, are on the backs of the cards. The cards are easily flipped on the stand after each question is completed.

The **Raw Data Recording Form** will be available for download on the Subscriber's page. The Raw Data Form is used to record the results of the evaluation, including the examiner's judgment about the student's performance on each mathematical topic presented.

A **Mathematics Achievement Scale** and the **Performance Characteristics Checklist** are available to be completed online after the evaluation is completed. The Mathematics Achievement Scale is used to record the student's performance on mathematical topics typical of specific grade levels. The Performance Characteristics Checklist is used to record the approaches and other notable features of the student's performance.. A hard copy of the Performance Characteristics Checklist is can be downloaded so that the examiner can review it prior to administering the MDPI and can gain an understanding of those Performance Characteristics which are relevant to a student's performance and may be observed in the student's approaches.

After the diagnostic analysis is completed, a selection of **Prescriptions** is generated by the online application and aligned with the student's particular Mathematics Learning Style, Qualitative Features and Executive Processes. Prescriptions include suggestions for specific interventions that are offered to capitalize on a student's strengths and to address a student's particular learning vulnerabilities as reflected by the Qualitative Features and Executive Processes that characterize his performance.

The Scoring & Interpretation Process:

After the evaluation is completed, the examiner goes online to the MDPI system and manually inputs the data from the Raw Data Form. This takes about fifteen minutes to a half hour. At this point, the online application takes over and provides an analysis of the data. The Output is an individualized, Mathematics Learning Profile of the student, which is used as a basis for suggestions on an intervention program.

An Expert System has been programmed to translate the scores for each mathematical topic assessed (Scale of 2 to 0; 2 for Mastery, 1 for Some Proficiency and 0 for Unavailable) and to generate an overall Achievement Level for the student (e.g. Late Grade 2 to Early Grade 3). The Achievement Level reflects whether the student has the necessary prerequisites as well as meets the curriculum expectations for his grade level as specified by the Common Core Standards for mathematics as well as the Focal Points of the National Council of Teachers of Mathematics (NCTM).

In parallel, the computer takes the scores from Performance Characteristics Checklist, as entered by the examiner (scored 1 for present or 0 for not present) and groups them into sets of Qualitative Features and Executive Processes. The Expert System then analyzes the Qualitative Feature and Executive Process and determines whether the student has Appropriate Skills, Some Deficits or Significant Deficits in these processes. These determinations are made by the ES, using the knowledge-base that reflects the judgments of the authors of the MDPI. The details of these determinations is not a direct output of the system but is available to the examiner by "drilling down" into the analysis if the examiner wants to understand more details.

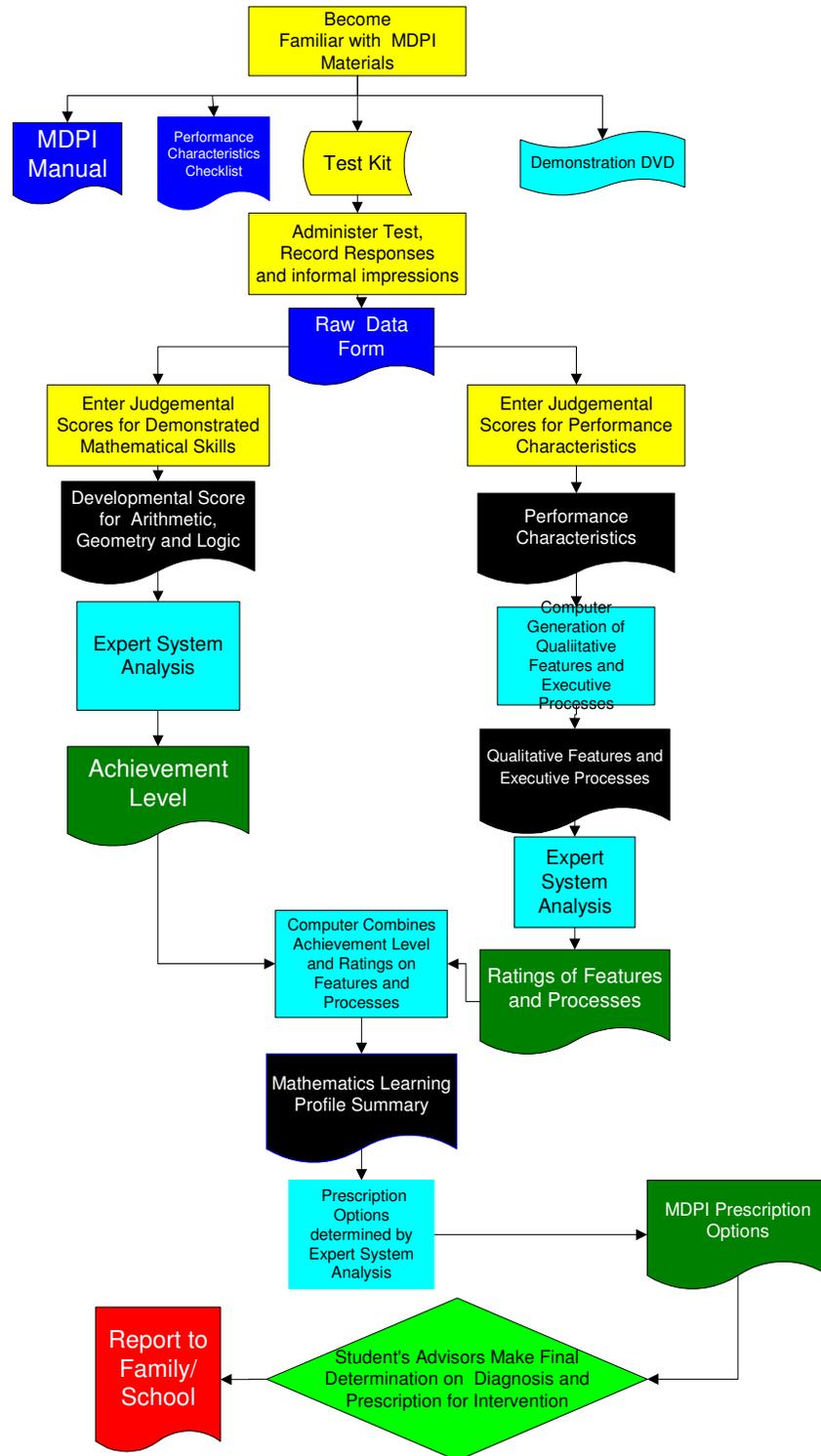
The online application then provides a Mathematics Learning Profile. This profile is used to drive the selection of appropriate Prescriptions which are then listed for review by the examiner. The output of the MDPI is particularly supportive of Response to Intervention (RTI) initiatives in that it offers a description of the particular instructional needs of a student as determined by his pattern of strengths and weakness and then offers differentiated approaches tailored to address the student's needs.

Using the MDPI, teachers and special educators will gain a greater appreciation of why is student is having difficulty and can use that knowledge to personalize interventions. Because of the MDPI's broader focus on Qualitative Features and Executive Processes and their relationships to more general neuropsychological parameters, mathematics specialist and tutors can use the results to design and select approaches which will enhance the student's efforts at meeting curriculum demands and achieving appropriate mathematical understandings and skills.

Appendix A presents a Flow Chart which summarizes the elements and procedures of the MDPI program.

Appendix A

Mathematics Diagnostic/Prescriptive Inventory



Key to Shapes/Colors

Hard Copy Document

Expert System Input

Expert System Output

DVD

Manual Process

Computer Process

Test Kit

Decision

Report