Jermaine Dunn's Method of Teaching Mathematics to Students for the Development of Mathematical Skills and Conceptual Knowledge.

This method involves the integration of several methods and technologies. Each method serves a specific role in building mathematical understanding and mathematical skills. Some methods and technology are interdependent. The first part of this method was developed by undertaking a detail study of biological systems, in order to understand the origin of the Language of Mathematics. This study revealed that, in nature, things can only be naturally **added** or **subtracted** and in order for either to be done, the entities needed to have, their core, being of the **same: shape, size and type.** Once entities have these three common characteristics, they are called identical.

Memory of definitions of key concepts and at least average reading comprehension skills are integral to the success of this method.

STAGE 1

The foundation concepts and introduction to the 3 step critical thinking guide.

All concepts should be linked to one underlining concept of identical and non-identical SETS. Students' should be taught the basic concept of Arithmetic which includes the conceptual definitions of each basic operations. Pictorial illustrations must be used in order to build understanding. This will cater to both visual and audio visual learners. Once the concept of the basic operations is learnt, students must be allowed to memorize the 3 step critical thinking guide developed by Jermaine Dunn. Students should be allowed to gain proficiency in the use of the guide in an interleaved way by using questions related to the basic operations. Students must learn that in the language, addition and subtraction are the only two operations that separates sets. Algebra addition, algebra subtraction, fraction addition, fraction subtraction, integer addition, integer subtraction, algebra multiplication, algebra division, fraction multiplication, fraction division, integer multiplication and integer division must all be linked to the concept of identical and non-identical sets. Students must be exposed to at least two subtopics before interleaved practice is done using the 3 step approach critical thinking guide. During this phase, all students are expected to put each step in writing. This will help with development and mastery of the skills. The teacher should ensure that at this stage retrieval of learnt concepts is done at least 4 times within an hour of learning to ensure consolidation in long term memory to aid the critical thinking process. A book called "A Conceptual Approach to Mathematics for High School," was developed to meet these objectives.

Equations and expressions should be learnt by having students derive patterns from real life situations and using algebra to generalize the pattern. This will be integral to the complete understanding of Mathematics. The conclusion guide must be included at this phase. If students fail to understand the origin and concept of equations, the remainder of Mathematics will be impossible for them to understand. Once students have derived the basic conceptual definition of equations and expressions and understands the inner working of equations and expressions, they are then required to do interleaved practice. This should be done using the 3 step approach critical thinking guide. Subsequently, the teacher should ensure that at this phase retrieval of learnt concepts is done at least 4 times within an hour of learning to ensure consolidation in long term memory to aid the critical thinking process. At no point in time should students' learn BOMDAS or BODMAS or any of those rules. Instead, students should learn how to read

an expression or equation from their conceptual understanding of the basic operations. Thus, naturally be able to tell which operation supersedes.

STAGE 2.

Application of critical thinking to non-familiar concepts

During this stage, students must be given non-familiar problems to work through. They will be required to write, how they would approach the problem using the steps in the critical thinking guide. Each step must be adequately provided for. At no point during this stage will students be required to actually work out the final answer to any problem. At least 20 problems are to be given at this stage and students should not move to step 3 until they are at least highly proficient in this stage. This step is the intermediate step which prepare students for stage 3, the application stage.

STAGE 3

The use of the Critical Thinking Guide will be integral at this stage, the APPLICATION stage.

All other topics should be treated as an application of concepts and topics mentioned in stage 1 above. The topic of Percentage for example, should be treated as an application of fraction. Conversion of decimal fractions to fraction should be treated as application of fraction addition. Consumer Arithmetic should be treated as an application of pattern generalization; equation writing and percentage. Measurements, should be treated as application of the concept of identical sets and pattern generalization; equation writing. Relations, Functions and Graphs should be treated as an application of integers, fractions and pattern generalization; equations. Geometry and Trigonometry should be treated as application of all concepts, specifically pattern generalization; equation writing.

Notwithstanding the above mentioned, All topics not mentioned in stage one should be presented in the form of guided discovery, interconnected, conceptual written activities which present Mathematics, using straight forward language in a completely student-centered approach. The instructions should be such that the student appear to be having a conversation with the writer, who is guiding them in understanding mathematical concepts. The Mathematics should be presented using concrete methods followed by abstract, and all concepts presented as being related. Once students complete a major objective, they are then to be navigated by the writer to undertake minor projects, thereby employing *project-based learning*, which is known to solidify understanding while developing **creativity** and **application skills**. At the end, students are to be given a major project. This will integrate all concepts presented in previous. Active learning will form the foundation of the conceptual activity sheets. Concepts are to be linked to real life situations. **Cooperative, Collaborative** and **Project Based Learning** should be emphasized significantly. Student's problem solving skills must be addressed by having students use a problem solving guide provided to come up with answers to abstract questions. Student's critical thinking skills should be addressed by having students use a three (3) step approach, critical thinking guide to make decisions about what to do in each activity. Student's reasoning skills should be addresses by having students use a conclusion, justification, explanation guide and by interrelating concepts. Student's long term knowledge retention skills is to be addressed by adequately spacing concepts in the activities in an interrelated way, having students do peer teaching, employing verbal repetition and doing interleaved practices. Student's Mathematical comprehension skills should be addressed through the learning of Mathematics in an interrelated conceptual way and by using an application guide. Each activity must be interconnected to

previous activity while meeting the specific objectives. During each activity, the teacher's role is to be reduced to being a director to the various guides and to pose directional questions if the students are unable to complete an aspect of the activity. Once the student completed an activity, including lesson summary, critical thinking questions within the stipulated time, the students are to be asked to repeat the activity following which, a video recorded lecture covering the said objectives must be shown to the students. At the end of each group of objectives, interleaved practice questions must be done; using the 3 step approach critical thinking guide, by each student. A book called "40 Hours to a grade 1 in Mathematics" was developed for this stage.

STAGE 4

Interleaved practice without any skill development guide

Only interleaved practice is done at this stage. No guides will be given at this stage. Students will be expected to naturally critically think about questions without explicitly being asked to do so. Students should also be able to justify, conclude, explain and solve problems without the need for guides.

STAGE 5

Exam ready

Students are now ready to sit examinations successfully at the high school level.