

Introduction to MAP Directed Instruction

June 5

2008

Every student in a classroom has unique knowledge, strengths, and deficiencies within every subject area. Efficiently meeting these unique needs in a classroom of 25 students and guiding each and every student to his/her next learning step can appear logistically very challenging. This can influence teachers to focus on a particular need group within the class. The goal of implementing MAP Directed Instruction (MDI) at a school is to effectively meet all these individual students' needs and guide their learning at a rate that is appropriate for them. MDI creates dynamic, practice-based classes for each student, customized for his/her next learning step in each subject area. After five weeks of implementation at the upper school level, tests showed significant growth in the subject areas covered by MDI, more than in areas not covered. Also, overall growth in scores was higher than the year prior to implementing MDI - even though normalized expected growth was lower. These results suggest that continued implementation of MDI may result in further learning gains above the norm. In addition, it is speculated that implementing MDI in more subject areas may result in similar benefits.

MDI – Taking the Correct Next Steps

Purpose of the Report:

This report provides an outline to MAP Directed Instruction (MDI) as implemented by the American School of Puerto Vallarta (ASPV). The outline provides the philosophy behind an innovative, portable, cost and resource effective approach to better serving the individual learning needs of students. It provides a detailed explanation of what MDI is, how it can be implemented, it's results and implications, and finally where to go for more information.

What is MDI?

MDI is an effective system designed to make the best use of test results, not a system to test kids. It is believed that standardized testing can be a traumatic experience for kids. Therefore, schools have the responsibility to make productive use of these tests' results. MDI is about taking the *correct* next steps.

At ASPV, Northwest Evaluation Association's^{*} Measures of Academic Progress testing system (MAP) is used because it offers the most precise, accurate, and immediate measurement tool for students. In essence, MAP testing gives schools a snapshot of how each of its students performs with respect to its own chosen standards. It provides information about a child's knowledge and skills at a very specific level, and further provides guidance as to best help the child grow. An exemplary student may have deficiencies in areas that are masked by strengths in others, and MAP testing is precise and accurate^{**} enough to help identify them. Students within the same grade level and classes differ in their understandings and methods of learning. After a school has assessed its students with NWEA's MAP testing system, a school is faced with the question of what to do with the results. The school has data detailing where each student is deficient and what the next growth steps should be for each school learning standard for any particular child. Still, having an organized, effective and feasible response to each student's needs can seem implausible under existing educational structures. Remediating learning gaps and providing effective instruction as outlined by the MAP data becomes more difficult the more diverse these needs become, and the more students there are in the class.

MDI is a framework for improving student achievement. It incorporates students' achievement scores and the corresponding DesCartes^{***} guidelines as a roadmap for building a customized curriculum for each student. It then provides an effective and logistically efficient structure to instruct students in a manner based on these guidelines. In this way it directs instruction to meet students' specific needs with respect to each school standard or strand. Some unique benefits of MDI include:

- Students are not grouped by grade or class (Algebra II or American Lit). They are grouped by ability in a specific math strand, and then another group by ability in a specific verbal strand.
- Because students are grouped by ability in their specific strands, instruction is tailored to their specific needs.
- Class sizes are manageable and the strands are handpicked so that the system can be executed well.
- Teachers can focus their teaching and become specialists. They don't need to try to teach to such heterogeneous abilities. They can focus and specialize.
- MDI models the logistics required to directly address the needs that are apparent in a school's MAP scores.

How does MDI work?

MDI Administration

MDI begins with the administrative workload of making customized classes for students. This is accomplished by defining the full set of students, and making subsequent divisions that result in effective learning sessions. First, the MDI student body must be established.

MDI Student Body: The initiative for MDI at ASPV started with teachers at the upper school level. In its first year, it was implemented using the scores from every student in grades 7 through 11. This sample included every normalized score in the upper school.

MDI RIT Categories and Strands: Using the test results for the entire MDI student body, the scores were separated by category and then by RIT strand. ASPV chose to separate as such:

* NWEA (The Northwest Evaluation Association), *Assessment System*, <http://www.nwea.org/system.asp> (Mar. 28, 2008).

** NWEA (The Northwest Evaluation Association), *Research-based Accuracy*, <http://www.nwea.org/assessments/researchbased.asp> (Mar. 28, 2008).

*** NWEA (The Northwest Evaluation Association), *DesCartes*, <http://www.nwea.org/classroom/descartes.asp> (Jun. 9, 2008).

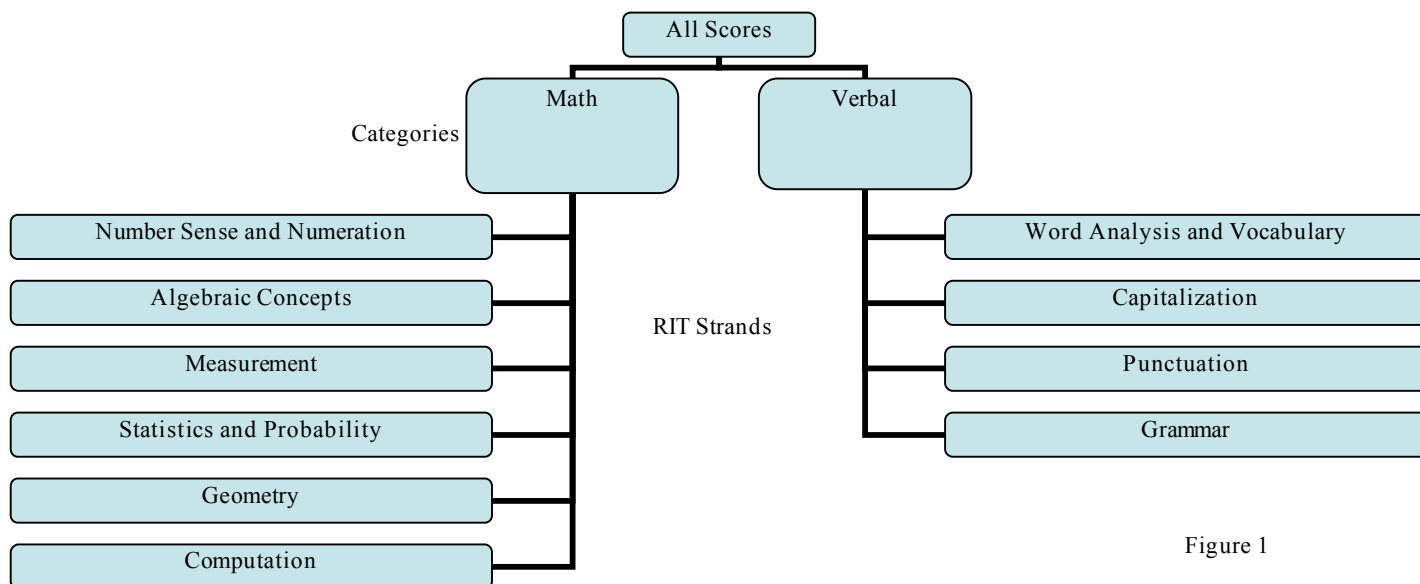


Figure 1

The categories were chosen based on the normalized data that ASPV had available, while the RIT strands were chosen based on two criteria. These were

- a) Strand must measure skills or knowledge that is fundamental enough for ASPV students to grow without significant outside remediation
- b) Strand must be well-suited for practice-based learning with short lecture introductions (all within 45 minute sessions).

Some RIT strands did not meet both criteria. For example, many of the strands from the Reading Exam measure skills that would require more than a single 45 minute session to make incremental gains. Also, some of the Language Usage strands are complex in nature and require a strong mastery of more fundamental skills that some ASPV students may not possess. ASPV deemed these types of strands inappropriate for the first year of MDI. ASPV excluded the following RIT strands

- a) Math-Problem Solving
- b) Reading – Literal Response and Analysis
- c) Reading – Literal Comprehension
- d) Reading – Interpretive Comprehension
- e) Reading – Evaluative Comprehension
- f) Language Usage – Writing Process
- g) Language Usage – Composition Structure

From week to week, MDI administrators must choose the RIT strands to be practiced that week. At ASPV, RIT strands were repeated for two consecutive weeks in an effort to maintain some level of continuity for kids.

Quartiles: When the scores were separated by strand, they were then quartiled. For example, all 7th through 11th grade scores in Number Sense and Numeration were pooled into a single list. This list was sorted in order from lowest to highest. At this point it was separated into four distinct groups or quartiles,

- a) Quartile A consisting of the lowest 0-24 percentiles of the scores
- b) Quartile B consisting of the middle 25-49 percentiles of the scores
- c) Quartile C consisting of the middle 50-74 percentiles of the scores
- d) Quartile D consisting of the highest 75-99 percentiles of the scores

This quartiling process was repeated for the remaining nine strands. At the end of this, each student belongs to ten specific quartiles in the ten RIT strands from Figure 1.

Sessions: After quartiling, MDI sessions are created. ASPV Faculty and administration agreed to two MDI sessions per week, excluding major exam weeks and the week prior. The opportunity cost for these MDI sessions are the classes that would

normally meet during at these times. One session met on Wednesday, while the other session met on Thursday. The period that the MDI session would “take over” would rotate as well, so as to minimize the number of lost classes for any particular period of the day. Figure 2 provides a sample rotating period schedule for MDI sessions.

Week	1	2	3	4	5	6	7
Wednesday	Period 1	Period 3	Period 5	Period 7	Period 2	Period 4	Period 6
Thursday	Period 2	Period 4	Period 6	Period 1	Period 3	Period 5	Period 7

Figure 2

One strand is chosen for the week from each category, math and verbal. Within the strands, the quartiles are split into the Wednesday and Thursday sessions by means of last name. From the math strand, students with last names beginning in A-L from Quartiles A through D would meet for their math session on Wednesday, then for their corresponding Verbal session on Thursday. Conversely, students with last names beginning in M-Z would meet for their verbal session on Wednesday, then for their corresponding math session on Thursday. This complex division served a single purpose, providing MDI sessions of no greater than 17 students per teacher. Thus, the students are assigned to sessions. Concurrently, teachers and classrooms are assigned to the sessions in whichever manner is seen fit by the respective departments. A sample session schedule for one week is provided below as Figure 3.

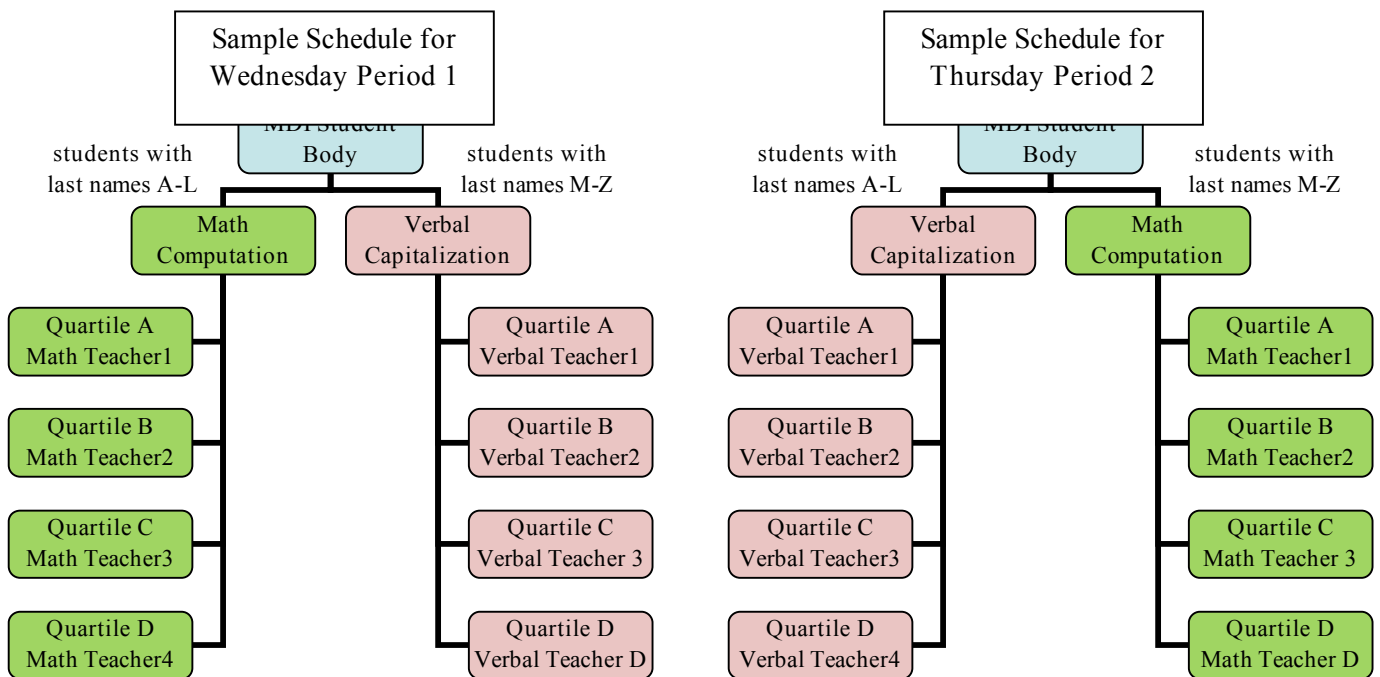


Figure 3

MDI administrators must communicate the details of the sessions to the rest of the school, MDI teachers and MDI students. At ASPV, this is done in the form of teacher checklists that communicate

- the students in their Wednesday and Thursday sessions,
- the RIT range for these sessions (not visible to students),
- the RIT strand,
- classroom and period for the MDI session,

A sample teacher checklist can be seen in Appendix C; and its corresponding DesCartes is in Appendix A. After MDI sessions are offered, administrators collect and file the teacher checklists. From these, scores are compiled to measure every student's respective math and verbal MDI grades. At ASPV, one point is offered for productive attendance, and another point for completed homework, resulting in two possible points from each session. At ASPV the math and verbal MDI grades are compiled at the end of the quarter and sent back to the math and English teachers to count for half the participation score within each student's respective class grade. The purpose of this is to provide each MDI student with some level of accountability for his/her performance in each MDI session.

MDI Teachers

In addition to the administrative workload, teachers also make some adjustments to incorporate MDI sessions into their workload. Teachers must forfeit two periods a week from their regular schedule to offer MDI sessions. The topic covered in an MDI session requires minimal planning on their part, as it comes directly from DesCartes Guidelines. A sample DesCartes guideline is available in Appendix A. Teachers provide a homework assignment for each student, and collect these assignments in the week that follows. A sample MDI homework assignment can be seen in Appendix B. Additionally, the teachers must take attendance and score the homework assignments as complete or incomplete. This is done on the teacher checklist like that in Appendix C. And finally, math and English teachers must figure in the MDI math or verbal score (as provided by MDI administrators) at the end of the quarter.

From an instructor's perspective, this type of MDI structure offers the following advantages:

- a) A homogenous ability level as a result of a narrow RIT score range
- b) A level specific, DesCartes-guided lesson
- c) Only planning one MDI lesson per week
- d) A teachable 45 minute period with minimal discipline issues.
- e) MDI sessions of no more than 17 students
- f) An opportunity to effectively address students' deficiencies in their respective subject areas
- g) Minimal grading responsibilities
- h) An opportunity to specialize in teaching a particular skill or knowledge level of student

MDI Students

Finally, MDI students must also make adjustments. In essence, for the student each MDI session feels much like the first day of school with everything in flux. This is further emphasized at ASPV by the fact that the students are accustomed to the same classmates since nursery. Students must check the bulletin weekly for where to go on Wednesday and Thursday, and what period. From the student standpoint, the following things change from session to session:

- a) Period of the day
- b) Topic of discussion
- c) Skill being practiced within the topic
- d) Classmates
- e) Age range within the classroom
- f) Instructor

Students have a responsibility to be productive during their MDI session, to complete their homework assignment, and to turn in the assignment to the appropriate teacher within a week's time. These responsibilities help students to retain the increment in knowledge or skill covered by the MDI session.

Does MDI work?

MDI was piloted at the American School of Puerto Vallarta's upperschool in the spring of 2008 for a period of five weeks, followed by MAP testing. Math and Verbal skills were quartiled as discussed earlier, and the entire student body from 7th grade to 11th grade participated. After five weeks of implementation at the upper school level, tests showed significant growth in the subject areas covered by MDI, more than in areas not covered. Also, overall growth in scores was higher than the year prior to implementing MDI. This section provides some insight into the results deduced from that spring's testing period and some of the conclusions drawn from them.

Growth

We first began by looking into the scores from the spring MAP testing and comparing them to the scores from the fall, providing some evidence as to the growth across the year. Our result produced a combined math and verbal average growth of 1.4 RIT. But this number came without context. Our next step was to provide a basis of comparison, the best available being the previous year's fall-spring growth, 1.0 RIT. In other words, this year ASPV's upper school grew 0.4 RIT more than we did last year, fall to spring. Further research into NWEA's recommendations suggests that this still lacks context without a backdrop of expectations. This is shown below.

	Fall 06 – Spring 07	Fall 07 – Spring 08 (includes 5 weeks of MDI)
Combined Math and Verbal Average Growth	1.0 RIT	1.4 RIT
Combined Math and Verbal Expected Average Growth	2.85 RIT	2.70 RIT

These rudimentary results show that even though the expected growth decreased, actual growth increased from fall 07 to spring 08. This is not insignificant. If normal data based upon hundreds of thousands of scores suggests that the growth would statistically decrease, it makes the 0.4 RIT increase in growth that much more the exception. Of course, this comparison shows no direct attribution to MDI, as other factors may be at play here such as changes in textbooks, teachers, and certain students. More analysis was warranted.

Increment in Strand Growth

With so many factors changing from fall 2006 to spring 2008, it became increasingly apparent that it would be difficult to find a way to really look at the impact of MDI. In the end, we felt it was best done using both strands and increments with respect to the historical data. We first split the data into two categories, strands covered by the five weeks of MDI and strands not covered by MDI. Then we calculated growth increments for both categories. An increment in growth refers to the difference between F07-S08 growth and F06-S07 growth. For example, if on average ASPV students grew 3 RIT points in the computation strand from F06-S07, and 5 RIT points from F07-S08, the growth increment for the computation strand would be $5 - 3 = 2$ RIT. When this was done for each strand, these increments were then used to find their respective category's average increment. ASPV showed increments in growth as such:

Non-MDI Strands	-0.258
MDI Strands	0.763

This shows that Non-MDI strands, that is, subject areas not covered during the 5 week MDI session, showed some contraction in growth in 07-08. This is expected, since MAP's normalized expected growth decreased for the second year, as stated earlier. However, MDI strands, after 5 weeks of implementation, showed improvement over the previous year's growth despite the contraction trend found in the norm. The difference in increment was $0.763 - (-0.258) = 1.021$ RIT. To provide some context to this difference, 1.021 RIT accounts for 36.1% of the average expected growth for F07-S08. In summary, MDI strands performed better than non-MDI strands by 36.1% of the expected growth after just 5 weeks of implementation.

Implications

Taking into account overall growth and increment in strand growth, MDI looks favorable in creating an efficient learning environment with respect to APSV's chosen standards. We are impressed by the difference in scores that is visible after 5 weeks of implementation, and curious to see if we can extend these results across the longer time frame of an entire school year. In addition, if appropriate lessons can be designed to fit the DesCartes standards, we believe we can achieve similar positive outcomes by extending the scope of MDI to include more strands and even more MAP standards in the realms of Science and Concepts and Processes. Such possibilities are currently being explored for fall 2008 to spring 2009.

Where does MDI come from?

MDI was developed by American School of Puerto Vallarta educators Mariano Montes De Oca and Paul Brocklehurst. The American School of Puerto Vallarta is one of the best college-prep schools in Latin America. It continually seeks and implements innovative new programs that enhance student learning in its already rigorous curriculum. It is only through the approval, support, and hard work of the faculty, Upper School Principal Antonio Salgado, Primary School Principal Kathy Selitzer, and General Director Jerry Selitzer that MDI has already met with such success.

Paul Brocklehurst brings a wealth of experience developed during a rich and varied career in engineering and education. Since becoming an educator, he has enjoyed an exciting career as a high school teacher, department chair, and coach. He now enjoys teaching math, science, and SAT prep at the American School of Puerto Vallarta. Prior to his career as an educator he worked as a thermal design engineer and consultant. Paul is well known for bringing a technical perspective into education and continually innovating his approach to teaching. He is passionate about the systemic approach to education. He obtained an extensive background in Understanding by Design while acquiring a Master of Arts in Teaching and authoring a new math curriculum for an elite private high school in the Chicago area. Please visit Paul's website at <http://www.paulbrocklehurst.com>.

Mariano Montes de Oca has a diverse background in engineering, business management, and psychology. His experiences in education include working with the Pajaro Outreach program at the University of California in Santa Cruz and being a mathematics and engineering teacher at the American School of Puerto Vallarta. He currently teaches AP Statistics, Trigonometry, and Algebra. Mariano is known for seeking innovative ways to enrich the educational process. He is the co-author and administrator of MAP Directed Instruction, an educational system that efficiently uses standardized test results to customize for individual students, better meeting their specific needs. Additionally, Mariano owns and manages a jewelry store in Puerto Vallarta, Sun Silver, that features the works of local artists. Please visit Mariano's website at www.marianomdo.com or e-mail him at marianomdo@gmail.com.

APPENDIX A

Sample DesCartes Guideline

(Removed for External Reference)

APPENDIX B
SAMPLE MDI HOMEWORK
ASSIGNMENT

Source: Dr. Carol Fisher's Onemathematicalcat.org

Between which two integers do the following fractions lie?

1. $\frac{6}{5}$	15. $-\frac{1}{6}$
2. $\frac{16}{5}$	16. $-\frac{32}{5}$
3. $-\frac{1}{3}$	17. $\frac{46}{6}$
4. $\frac{47}{5}$	18. $\frac{34}{5}$
5. $\frac{34}{3}$	19. $\frac{13}{2}$
6. $-\frac{18}{5}$	20. $\frac{27}{4}$
7. $\frac{33}{6}$	21. $-\frac{41}{6}$
8. $\frac{22}{6}$	22. $\frac{47}{3}$
9. $\frac{41}{3}$	23. $-\frac{37}{5}$
10. $\frac{46}{5}$	24. $\frac{49}{4}$
11. $\frac{23}{4}$	25. $-\frac{21}{2}$
12. $\frac{43}{6}$	26. $-\frac{11}{2}$
13. $\frac{20}{3}$	27. $\frac{33}{6}$
14. $-\frac{34}{4}$	28. $\frac{45}{4}$

Convert the following decimals to fractions. Do not reduce.

1. 0.97 =	16. 0.18 =
2. 67.385 =	17. 6.1 =
3. 17.576 =	18. 4.76 =
4. 8.57 =	19. 90.978 =
5. 16.641 =	20. 0.18 =
6. 0.2 =	21. 8.99 =
7. 37.431 =	22. 0.99 =
8. 12.501 =	23. 7.746 =
9. 93.614 =	24. 3.52 =
10. 9.595 =	25. 10.73 =
11. 8.66 =	26. 9.73 =
12. 0.55 =	27. 61.319 =
13. 0.71 =	28. 78.598 =
14. 0.72 =	29. 3.60 =
15. 0.93 =	30. 0.41 =

Rounding decimals

1. Round 35.9874449 to 2 decimal places:	16. Round 2.99 to 1 decimal place:
2. Round 826.08978763 to 5 decimal places:	17. Round 0.244211 to 2 decimal places:
3. Round 36.64164348 to 4 decimal places:	18. Round 3.99 to 1 decimal place:
4. Round 9.5703361391 to 5 decimal places:	19. Round 2.99999 to 2 decimal places:
5. Round 97.27693 to 2 decimal places:	20. Round 3.01812867 to 4 decimal places:
6. Round 0.868278 to 4 decimal places:	21. Round 0.4891728 to 2 decimal places:
7. Round 9.1797 to 2 decimal places:	22. Round 0.32241 to 3 decimal places:
8. Round 2.44331 to 2 decimal places:	23. Round 193.651093753 to 4 decimal places:
9. Round 5.5877676 to 2 decimal places:	24. Round 0.9978966 to 3 decimal places:
10. Round 5.999999 to 1 decimal place:	25. Round 0.77013 to 3 decimal places:
11. Round 75.3227377 to 5 decimal places:	26. Round 57.32287278 to 3 decimal places:
12. Round 56.7602 to 2 decimal places:	27. Round 554.6620037 to 4 decimal places:
13. Round 737.73873 to 2 decimal places:	28. Round 365.84792414 to 5 decimal places:
14. Round 7.1702875 to 3 decimal places:	29. Round 3.99999 to 1 decimal place:
15. Round 1.99 to 1 decimal place:	30. Round 0.43488 to 3 decimal places:

Change the percents to decimals

1. 4% =	16. 151% =
2. 107% =	17. 157% =
3. 36% =	18. 174% =
4. 110% =	19. 0% =
5. 37% =	20. 22% =
6. 111% =	21. 86% =
7. 33% =	22. 44% =
8. 86% =	23. 181% =
9. 80% =	24. 120% =
10. 200% =	25. 181% =
11. 192% =	26. 9% =
12. 145% =	27. 31% =
13. 194% =	28. 27% =
14. 9% =	29. 1% =
15. 77% =	30. 91% =

APPENDIX C
SAMPLE MDI TEACHER
CHECKLIST

Sample MDI Teacher Checklist for one week.

TEACHER	Brocklehurst		Min	225	TEACHER	Brocklehurst		Min	225
ROOM	3		Max	230	ROOM	3		Max	230
DAY	Wednesday				DAY	Thursday			
PERIODS	2				PERIODS	4			

<u>Student</u>	<u>RIT Strand</u>	<u>Quartile</u>	<u>Present</u>	<u>HW</u>	<u>Student</u>	<u>RIT Strand</u>	<u>Quartile</u>	<u>Present</u>	<u>HW</u>
Student, A	Number Sense	B			Student, M	Number Sense	B		
Student, B	Number Sense	B			Student, N	Number Sense	B		
Student, C	Number Sense	B			Student, O	Number Sense	B		
Student, D	Number Sense	B			Student, P	Number Sense	B		
Student, E	Number Sense	B			Student, Q	Number Sense	B		
Student, F	Number Sense	B			Student, R	Number Sense	B		
Student, G	Number Sense	B			Student, S	Number Sense	B		
Student, H	Number Sense	B			Student, T	Number Sense	B		
Student, I	Number Sense	B			Student, U	Number Sense	B		
Student, J	Number Sense	B			Student, V	Number Sense	B		
Student, K	Number Sense	B			Student, W	Number Sense	B		
Student, L1	Number Sense	B			Student, X	Number Sense	B		
Student, L2	Number Sense	B			Student, Y	Number Sense	B		
Student, L3	Number Sense	B			Student, Z1	Number Sense	B		
Student, L4	Number Sense	B			Student, Z2	Number Sense	B		
Student, L5	Number Sense	B			Student, Z3	Number Sense	B		
					Student, Z4	Number Sense	B		