

INSTRUCTIONAL STRATEGIES FOR TUTORING MATHEMATICS TO AN ASSORTED GROUP OF LEARNERS

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ABSTRACT

Planning effective instruction for a classroom full of learner's demands that the educator should know what works and more importantly what works better for the group of people residing in the educator's classroom today. This action research study tested the efficacy of using the full complement of assessments included in the curriculum adoption at the researcher's school and that of guided note taking. Each strategy was implemented in its own separate unit of a mathematics class. The researcher used student growth, which was determined by the difference observed between a student's pre-test percentage score and their final unit test percentage score, as the metric by which to evaluate each strategies' efficacy. Measurable growth was observed with both strategies. The All Assessments strategy showed greater and more consistent growth among learners than that which was observed during the Notes strategy. These findings indicate that more research is needed on the effectiveness of using assessments for learning and a need for further study to evaluate the efficacy of guided note taking. Findings in this study should be considered as illuminating but not conclusive as the sample used is not generalizable.

THE PROBLEM

Today's classroom is a diverse place where students from innumerable backgrounds and abilities are brought together with the spoken rationale of developing knowledge and skills that will assist students in growing as individuals while preparing them for the next level in their academic lives. The classroom where this study took place embodies these circumstances and strives towards these intentions. To effectively realize success as measured by today's formal assessments this researcher recognizes the need to find, specialize and implement a system of instructional strategies which will help assure that each of these groups of learners are engaged, challenged and trained to use their skills and knowledge to any challenge life throws at them. The students comprising the sample in this study class are vigorous, inquisitive and inhabit in an encouraging and passive mass society. In pre- mathematics the half are performing at grade level with about 25% below and about 25% or so above. Are there ways challenge each learner and teach them in a way that best meets their needs while doing so for all learners? Are there instructional strategies that could be implemented that would yield better results for more students? Can this be accomplished within the confines of the time currently

used to plan? A safe assumption is that there is likely to be many permutations of strategies that can be implemented in this classroom that will yield a different result as represented by student performance on chapter tests. The purpose of this action research study will be to evaluate the specific effectiveness of several strategies as used by this researcher in this classroom. The study sample of students are distributed by their performance on the 2009 California Standards Test for Math as, Advanced 24%, Proficient 29%, Basic 41%, Below Basic 6%, Far Below Basic 0% (CST Report, 2009). It has been observed by the researcher that these groups of students are generally encouraged to keep up with their academic work. The group is comprised of fifteen students, most of who have been in the same class together for the duration of their school years. Finding the right strategies for today's students is important, but so is developing strategies that can be used as a base program from which to specialize for the next year's students who will come with unique instructional requirements.

PURPOSE OF STUDY

This action research study sought to locate and evaluate instructional strategies for use in teaching mathematics to a specific group of seventh grade students. The purpose for doing so was to improve the effectiveness of instruction as determined by measurable student growth observed during a series of instructional units.

DEFINITION OF TERMS

In this study the researcher will be using the term "self-regulating" which is define as a group of students who are taught all core academic subjects, physical education and art by the same teacher. When referring to the subject at time use the term "diverse inhabitants" when doing so researcher referring to the distribution of math scores as reported by the 2009 CST test and formative assessments administered by this groups regular school teacher. The abbreviation CST stands for the California Standards Tests. The term STAR refers to the California's standardized Testing andReporting.

RESEARCH QUESTIONS

What strategies can use in self-contained classroom during math that will allow me to meet the needs of my advanced, grade level and low performing students? Can an improvement in student scores on summative assessments be accomplished without significantly increasing planning time? Which strategy or combinations of strategies when used result in an improvement in the consistency and quantity of growth each student experiences as measured by comparing a unit's pre-assessment and the unit's summative assessment?

METHODOLOGY

Each strategy selected for assessment in this study was implemented in the researcher's classroom for two weeks in the following way. Each new strategy was inaccessible from influence by the other strategies during assessment to the degree practical in this real classroom environment. Students were instructed using in the researcher's normal teaching style that included working problems as a group until it was clear to the researcher that the majority of students were able to continue independently. At this point instruction continued on a case by case basis as the need presented itself. This was determined through teacher observation or through the direct demand of students. Efforts were taken to maintain a consistency of instruction during each strategy assessment. Before beginning instruction on the unit's lessons a pretest was administered. During the course of the unit, quizzes were administered. The number of quizzes was determined by the strategy being assessed. Each quiz was given the afternoon the day re-teaching for the lesson being quizzed had been completed. A mid chapter quiz was given after the sixth or seventh unit lesson had been corrected and re-taught. This was followed by more lesson quizzes administered as previously described. The unit was completed with a final chapter test consisting of questions from the whole unit. During testing students were directed to move into "test manner" where they moved their desks so they had a one foot gap between their desk and their nearest neighbor. This was done to reduce distractions that might impact evaluation results. Students were not allowed to talk to each other all through quizzes and tests. They were allowed to ask the researcher for explaining on questions. Each quiz and test was corrected in class by the students and then reviewed by the researcher. This was done to provide students with instantaneous feedback on their work.

Strategy 1: All Assessments with next opportunity

All unit assessments included with the textbook support were used. After each assessment was given and corrected, a quiz or test, students were offered the chance to correct the problems they missed, while displaying their work, for additional credit. In the case of quizzes, students were offered the chance to earn back all credit by working the problems out again and resubmitting their corrected quiz. On tests students were offered the chance to correct their missed problems for half the credit missed. The researcher's intention was to determine if student performance could be inclined by a greater regularity of assessments, united with immediate feedback and the chance to correct assessments for further credit. Only raw uncorrected scores were used in this study. The improved scores were used only for scheming student grades.

Strategy 2: All Assessments, shortening and make a note

During lessons students were asked to split a page down the middle. In the left margin students were directed to take notes that included lesson examples and vocabulary. In the right margin students

were directed to expand on notes with their own examples and explanations. A pre-test assessment was given the first day before instruction. Midway through the unit a mid-chapter test was given. At the end of the Unit a chapter test was administered.

DATA COLLECTION AND RECORDING

Data used to assess the instruction strategies was collected through formative assessment, observation and summative assessment. Each strategy received a one unit time outline, which generally worked out to a two week segment. The first day of each unit a complete chapter test was be administered. The score of these assessments was converted to a percentage mean for the whole class and compared on an individual basis with mid-chapter assessment scores and the chapter summative assessment scores. Unit formative assessments consisted of several lesson quizzes given the day after formal instruction on the quiz content had been completed and only after a session of homework correction and re-teaching. Copies of all assessments were kept to allow for comparison among content areas as determined by the lesson description written in each section of every assessment. These were used to determine any changes in performance as related to each lesson area.

STUDY RESULTS

To compare the two strategies it was required to find a way to determine the effectiveness of each tactic for the class as a sum total. The researcher chose to compare increase in scores from the pretest to the ultimate test (Figure 1 and 2). A mean of this set of differences was calculated for each strategy as was the standard deviation for each. The explanation for comparing the two strategies in this manner was that this measure quantified the boost students made during each strategy and provided a clear picture of how consistently this growth was seen over the population (as shown by the standard deviation).

Figure 1 All Assessments Pre-Test and Final Test Raw Percentage Scores

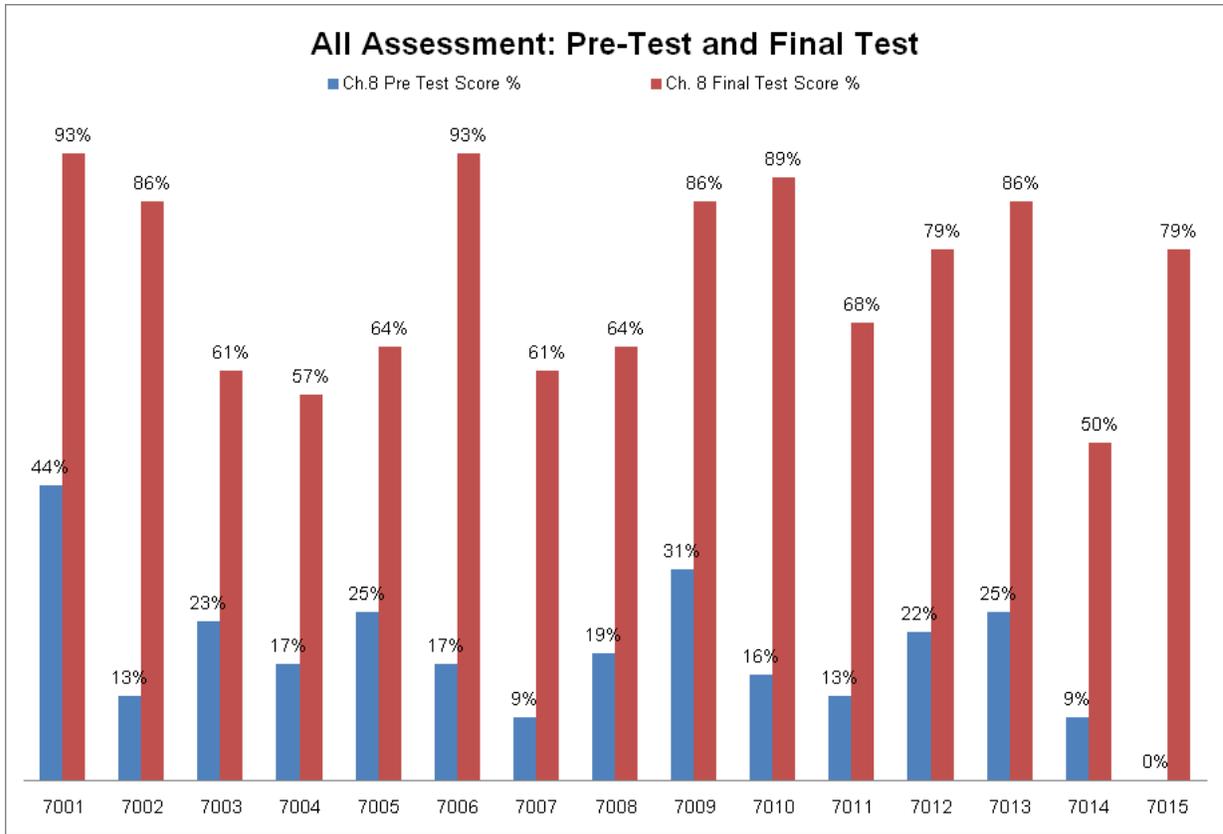
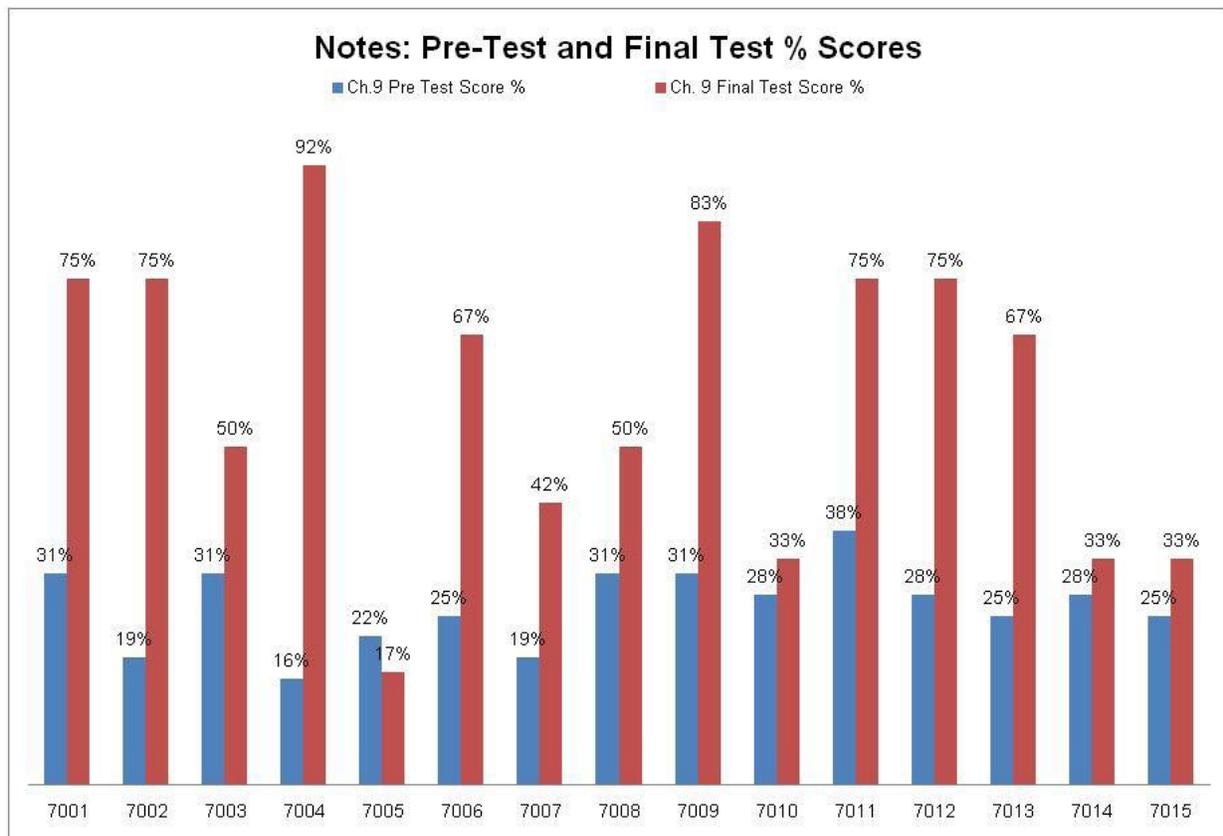
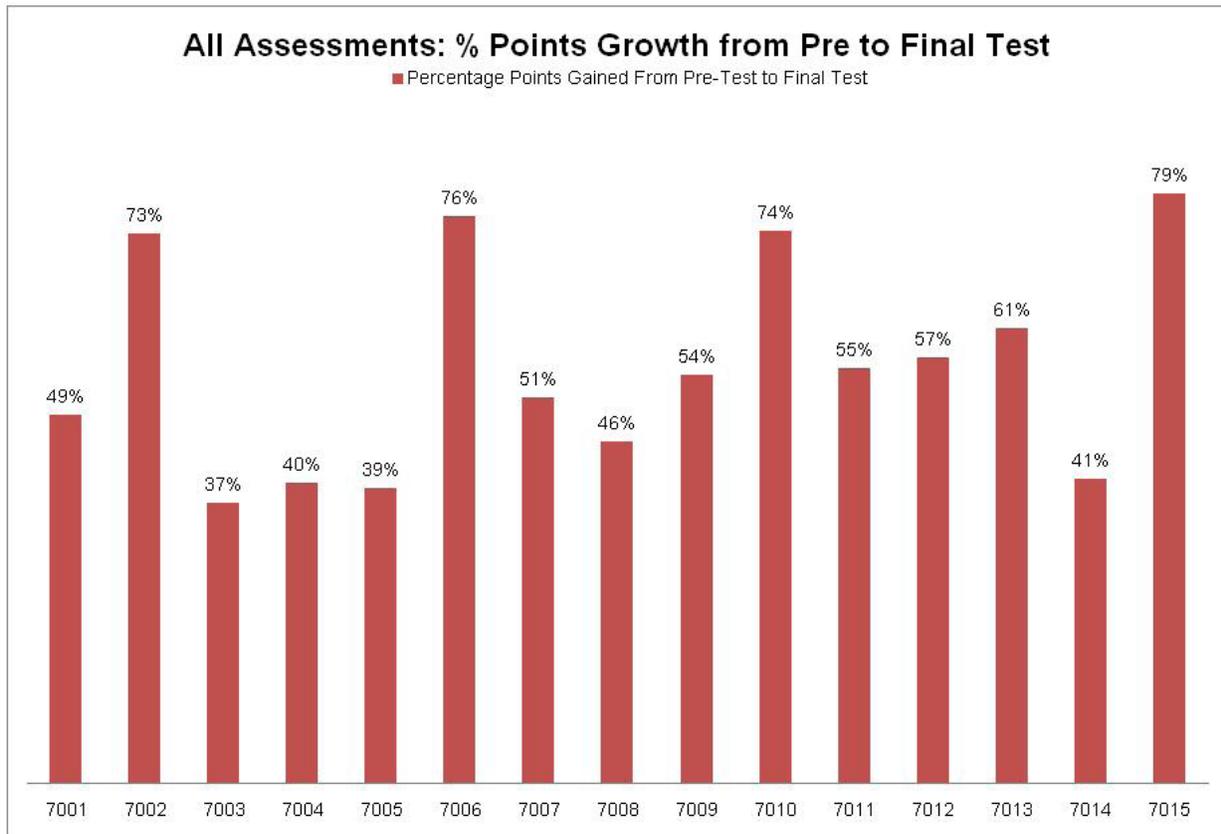


Figure 2 Notes Pre-Test and Final Test Raw Percentage Score



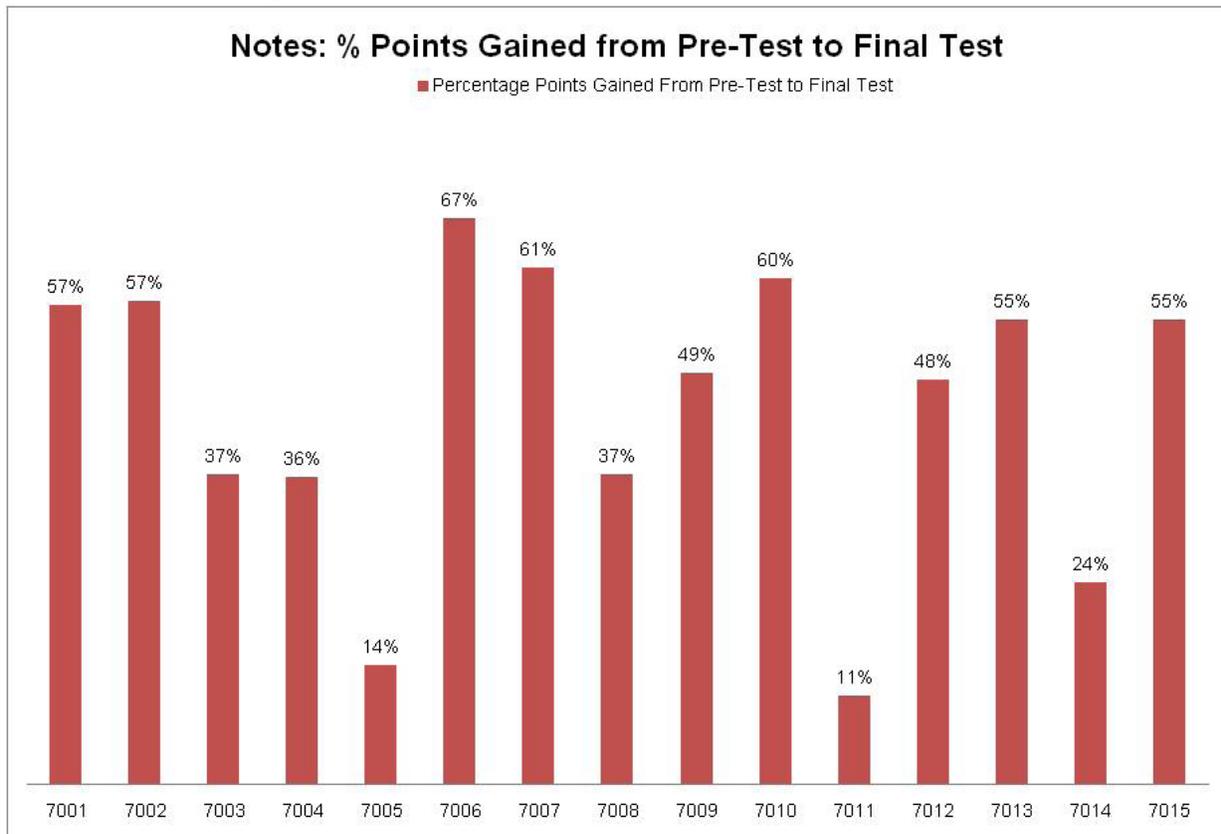
The subjects showed a mean growth of 55 percentage points in the All Assessments unit of the study. Individual scores fell within a standard deviation of 14.21 percentage points of the mean. The highest growth in percentage points observed was observed in subject 7015 at 79 percentage points of growth. The lowest observed growth was observed in subject 7003 at 37 points of growth (Figure 3).

Figure 3 All Assessment % Points Growth from Pre-Test to Final Test During

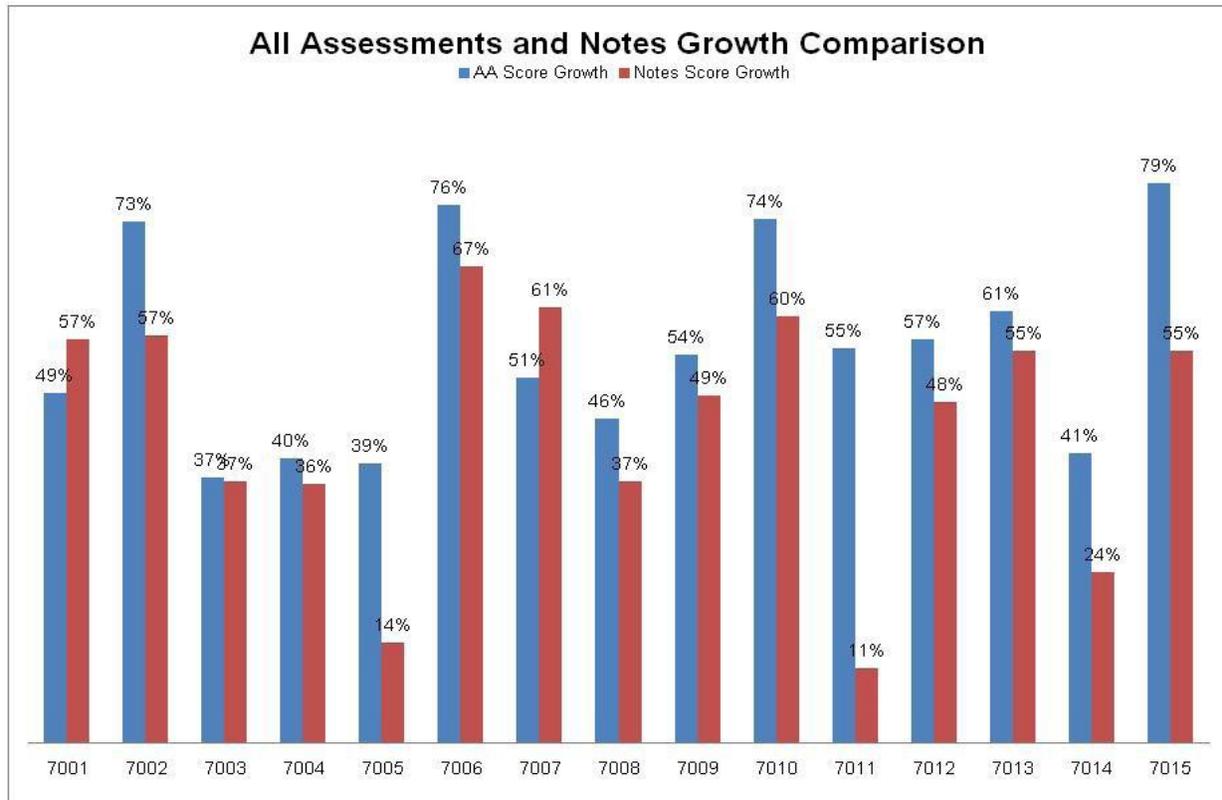


During the Notes unit subjects showed a mean growth of 31 percentage points. In this unit scores fell within a standard deviation of 22.86 points from the mean value. The highest growth was observed with subject 7006, who showed a 67 percentage point growth from their pretest score. The lowest growth observed during this unit was that of subject 7005, who showed a -5 percentage point loss from their pre-test score to their final score (Figure 4).

Figure 4 Notes % Points Growth from Pre-Test to Final Test



Differences were observed with the two strategy unit mean growth measures (Figure 5). A difference of 24 percentage points separate the two strategy growth means. Data distribution, as determined by the standard deviation, showed a 9 percentage point difference in the growth range. The All Assessments strategy elicited greater and more reliable boost from this population of students. On the other hand the Notes strategy showed less growth and less consistency in the boost students experienced during that unit.

Figure 5 All Assessments and Notes Growth Comparison

CONCLUSIONS

It is difficult to decide what to include when setting up instruction. There are never-ending variables to consider that may or may not have a significant impact on the engagement and consequent persistence of learning expressed by students. This research study was motivated by an aspiration to compile a means of comparing the efficacy of different strategies. Prior to this study, using all the included assessments that come with a given curriculum adoption had not seemed, to the researcher, to be of obvious benefit. However, the results of this study are convincing enough for this researcher to consider more carefully the role assessment can play in aiding student learning. The results of the note-taking unit came as a surprise. It was assumed that the notes unit would show at least as good a boost as the unit using all assessments. After all, the strategy of guiding students to expand on their notes both during and after instruction is regularly and extensively encouraged. During the All Assessments unit, students were not asked to do anything with their notes ahead of recording what was required for them to get started on their assignments. If these findings illuminate anything it is that it is highly advantageous for the educator to have a measure for determining and to reflect on what kind of growth is occurring during each instructional unit. It is also important to consider carefully what is being included in lessons and whether or not each of those things is worth the planning and instructional time. Student motivation may have played a significant role in why the All

Assessment strategy showed greater success. The ever present pressure of a coming formal assessment coupled with the instant feedback offered by each student's correcting of his or her own paper and instantly being given time to correct their errors for extra credit may be an encouraging force. In many ways having regular assessment is like the instant feedback individuals receive when they play a video game. If a mistake is made the player knows right away and begins looking for ways to complete the task fruitfully. Subjects in this study were observed to be highly motivated to correct their mistakes for additional benefit credit, which in turn provided desirable review for content they were feeble on.

CONCERNS, LIMITATIONS AND FUTURE RESEARCH

This study was conducted with a very small sample of students and should not be considered generalizable. As is the nature of action research, in many ways the study was designed and redesigned while the units were being instructed. Where it casts light it exposes even more shadows. Comprehensive and comparable pre-tests were not available so final chapter tests were given in their place. Boost up was assessed based on the differences between the pre-test score and the final unit test score. In the case of the all assessments unit it is the researcher's belief that the pre-test given was of greater difficulty than the final test for that unit. This if true could mean that the benefits of that strategy were greater than the data indicated. For this study to be statistically testable it would need to be replicated, a control established where neither strategy was in use and a larger data set compiled to compare each strategies performance as averaged over several units' time. This study should be considered as a preliminary work, wherein it is this researcher's belief a need for additional study is indicated by the findings.

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