Scenarios from Mr. Owens' Algebra Classes

Just a few days before Thanksgiving break, the twenty algebra students in Mr. Owens' 8:30 class enter the room--some sauntering, others rushing, all chattering. They immediately settle into seats and examine the four problems brightly displayed on the overhead projector screen. Mr. Owens calls on Bobbie for the coefficient of the variable in the first simple equation $-4\frac{2}{3}=3\frac{2}{5}n$.

Bobbie says "$3\frac{2}{5}$"and the teacher says "you're right. Class, let's solve these equations. Dennis, what's your first step?"

"Change to improper fractions. That might be easier to deal with."

A girl mumbles "do I multiply now or do I need a common denominator?"

Mr. Owens calls on a boy nearby to answer the softly spoken question. He suggests multiplying by $\frac{5}{17}$, the multiplicative inverse. The teacher nods, fills in the steps as directed by the students, and simplifies to show n = $\frac{-70}{51}$ as the solution.

Mr. Owens circulates to see student work on the other three problems and a few minutes later he asks students to assist in checking them. As one student arrives late at 8:50, the teacher flips another transparency onto the overhead projector, this time revealing five simple equations all to be solved in one step using reciprocals. The class settles to work on the quiz, demonstrating the adage prominently posed in the room "Thinking Allowed Here." At 8:58 some students are finishing and by 9:05 the teacher urges them to 'jot their solutions onto their cover sheet' as a reference when they begin to check.

The teacher collects all papers as students quickly check their work, volunteering values of reciprocals and identifying final solutions. Students smile and quietly note the correctness of their work. By 9:15 the opening interval of focusing student attention, the quick questioning episode, a short quiz, and the check of results are complete.

> "The only thing I say is typical is I have to plan at least three things. Three different things. There might be a section where we have a discussion…that would last maybe twenty minutes, maybe less. There might be…a group or cooperative learning activity, something to get them a little more physical [involved.] And then there may be a type of evaluation, quiz, or some kind of activity that is more calming and quiet."

Mr. Owens directs student attention to homework when a girl asks him to review the three possibilities that exist when solving equations. Owens says, "Think about our quiz. Some equations have only one solution.--Matt, can you give me an example?"

"13t = 0" is his reply.

"That's true. {0} is one solution."

A young man in the back of the room says "there aren't any more [solutions.]"

"You're right. But suppose, instead of 13t = 0, our equation was 0t = 0?"

A girl quickly responds "any number multiplied by zero is zero."

Mr. Owens feigns a shocked look as he says "you mean any number?"

Another boy says, "yes, all numbers will check in this equation."

Mr. Owens agrees and writes {**R**} to represent the solution for the second example because "you say that any real number will solve the equation. Can anyone tell me what other possibility exists? We've seen 13t = 0 (with one solution) and 0t = 0 with many (actually an infinite number of) solutions. What else?"

> Mr. Owens rarely provides content information to students using a lecture approach. Rather, he probes student thinking by directing questions to each individual in the class. (Q28; Q42)

After a short pause, one girl says "How about 0x = 4?"

"I like your example. Zero times what value of x equals four? Sometimes there is no solution." Heads are nodding as the class agrees that there is no value that solves this example.

"So" says Mr. Owens, "if you understood these three possibilities, you would have been set for your homework last night. Any questions we need to consider?"

Voices suggest numbers 15 and 18 and everyone takes a quick look at the solutions. Mr. Owens pauses when Linda asks for number 12.

She says "What is $\frac{1}{2}$ cubic meter anyway?"

A boy in the next row says "a cube is a box."

"Let's draw a box," says Owens, drawing on the whiteboard as he speaks. Next to the sketch of the box (rectangular prism) he writes "V =" and pauses as Matt says "volume equals length times width times height." The teacher completes the equation and pauses to say, "Linda, so what do we know about a cube or box?"

"V = lwh"

"And volume is $\frac{1}{2}$ cubic meter, so that really means what?"

"$\frac{1}{2} = lwh$"

"You are correct. Also, anyone, what else do we know?"

Another girl points out that, in this example, length is 1.5 meters and width is 0.8 meters.

"Is this equation solvable? Is it possible? What do you think?" Mr. Owens pauses to give students time to consider. A girl expresses doubt that it can be solved, since "1.5 times .8 is larger than .5" (incorrectly implying that multiplication always produces a larger product than either factor.) A boy seated behind her says "yes, it is possible. It [height] is just small."

Damon (with his calculator) says "I'm going to multiply by the reciprocal ($\frac{1}{1.2}$). It will be .41666666." At nearly the same instant, another student says ".4 is the height."

All students have access to calculators. (Q17)

Mr. Owens picks up a yardstick, asking "if this were a meter stick, how high on the [meter]stick would our box height be?"

Damon says "about half of it."

"Great answer. .4 is not quite .5 or $\frac{1}{2}$. Let's think a minute. What could be shipped in a box like this? [1.5m x .8m x .4m]"

Girl: "an electronic keyboard"

Girl: "a really good CD player."

The teacher compliments the creative responses and explores further by asking "Wonder what job I would have if I had to deal with a problem like this?"

A boy suggests "Shipping?"

"Good answer. And now, algebraically speaking, which of our three solution possibilities does this problem represent?"

Linda responds with "one solution!"

"If I were stuck to one strategy, I suppose that the good old traditional method of demonstration and then coaching them…and then giving them independent practice…that would be the one. But if I can do some of that and then also some problems that might demonstrate an application of it…if I can get all those in, hopefully everybody will be reached."

It's 9:35 and the classroom exudes a sense of engagement and participation, with an easy flow in conversation and attention being shared among Mr. Owens and his students. After checking two more problems with them, Mr. Owens gives pairs of students a sheet of paper with a dozen problems and the warning that "you may find some of these are tricky. Do you remember how many solution types are possible when solving simple equations with one variable?"

"None, one or infinitely many" is the quick answer from Linda.

"Right. Remember that. Think about it. Work with your partner, but" Mr. Owens warns, "one thing I don't want to see is one person twiddling thumbs while the other works half the problems, then switching the paper to let the other partner complete the assignment. If I see that sort of behavior, I'll give each of you 50 points [or half credit] since you have clearly considered only half the work."

"So, we solve these together, right Mr. Owens?"

"Right Damon."

Students begin working at 9:40 and Mr. Owens circulates, stopping to give one-to-one help at each pair. Pairs work quietly with none off task. Occasionally a student's hand rises to signal a question for Mr. Owens. One girl goes quietly to another group to ask a question but quickly returns to her partner. Calculators are available in a fabric caddie on the wall and students who wish to use them simply pick one up and return to the task. There is a quiet hum of engagement as the students work together. At 10:02 Mr. Owens begins to collect work from partners who are finished. He reviews papers quickly, nodding, or adding a formal comment before moving to another pair. After gathering all papers, he points to a corner section of the board as he reminds them "you should write down this assignment for homework. The reading is important too. You may begin with the reading before the bell." Students quietly murmur as they open algebra textbooks and begin to read. A few finish quickly and take out notebooks to begin homework. Others have no time to do anything except read until the bell sounds at 10:10 a.m.

> In addition to requiring students to work independently, Mr. Owens often assigns students to work with a partner. (Q35; Q36)

Several weeks later, the same class opens with Mr. Owens' question to the class, "Have you ever heard the adage that 'a picture is worth 1000 words'?" As students' heads nod, he continues, "If that is so, what are 325 words worth?" Students quickly begin scribbling their ideas on the problem and soon are asking "Is this right?" as Mr. Owens circulates to look at the solution they offer. He makes a quiet suggestion to a student and returns to the overhead projector where he says "You seem to be thinking of ratios. That's good. I saw a proportion on several papers." He writes:

$$\frac{1\text{ picture}}{1000\text{ words}} = \frac{x}{325\text{ words}}$$

"How do we solve this?" Students obviously recall their previous experience with solving proportions and determine that 325 words are worth $\frac{13}{40}$ or 0.325 picture. Mr. Owens chuckles as he says, amid student smiles, "You're impressed, right? Now, let's take the questions from homework"--and another day in algebra begins.

Students collaborate and offer suggestions as they check the assigned problems requiring them to identify values for which a ratio's denominator would be undefined. Mr. Owens asks the students how they approach finding the value for m that cannot be used in $\frac{m-7}{m+5}$? One boy suggests substituting some numbers by trial and error. Another offers that he would consider (m+5)=0 and solve because that would tell him what not to use. Mr. Owens credits both approaches as ways to tackle the problem.

At 9:05 a.m., just after the homework check, a five-item quiz consisting of simple proportions is assigned. By 9:15 students have finished and the teacher checks results quickly with student participation. After checking, one student exclaims "Oh my gosh! I got 100 points plus the bonus! I am learnin' somethin'! I really am! Oh man, I know this stuff!" She grins broadly and Mr. Owens smiles too. He returns to the whiteboard and draws two similar stick figures, one shorter and smaller than the other, but both proportional as he says, "These are similar statues. That means they are alike, but not exactly the same size. The math term is 'similar.' If the ear length (that is, top to bottom) on the shorter statue is 5", how long is the ear on the taller one?" As he asks the question, Mr. Owens writes H = 6' under the taller model and H = 4' under the shorter one. He directs the students to "show me what you think" as he moves about to check their notes.

One girl states (in a questioning tone) "They're the same size except for height, right?"

"They are not the same size," says Owens, "but they are the same shape. The heights are different..." his voices trails off as a boy interrupts with the suggestion that "we could do that problem in here. Just take someone 6' tall and someone 4'..." Before he can finish, another boy interrupts with a laugh "but there's no one 4' tall in here."

"You know what I mean. Take two people with different heights and see if the ears are the same. I think they might be the same."

> Almost daily, Owens requires students to take notes in class. (Q33) He routinely provides specific feedback to each student after seeing his or her written work. (Q54)

A girl turns to Mr. Owens, saying "I don't think this is a ratio."

Mr. Owens suggests that they try one and see. He writes

$$\frac{6'}{4'} = \frac{x''}{5''}$$

and asks "would this ratio work? What is it saying to us?" Students confer quietly for a moment. Someone finally suggests "the tall guy on the top [numerator] in the ratio means we want the tall guy's ear first [as the numerator in the length ratio.]" Mr. Owens nods. "Does anyone see it differently?"

A girl says "I put the tall guy and x into a ratio (6:x) and the short guy and 5" together (4':5"). Mr. Owens suggests that the class solve both proportions in order to decide whether they produce the same or different values. He pauses as the students quickly solve and begin to call out "The same." "They are the same." "They both give $7\frac{1}{2}$." "The ear on the taller statue is 7.5"

It's 9:30 a.m. and Mr. Owens seems satisfied with the class responses as he asks them to open their algebra textbooks. "Who will read for us? I see that math term here. What was it?" A boy says "similar" as a girl begins to read aloud. She continues reading as the teacher responds to a knock at the door. A moment later she finishes reading as the Mr. Owens returns to the overhead projector and draws a sketch replicating the text illustration of similar scalene triangles, ABC and PQR. "What proportions do you see here? Can you match corresponding parts?"

A boy says "AC is like PR" as a girl suggests that "BC corresponds to QR." Mr. Owens writes each ratio and says "so what should we be saying here? Is there an equation?" Another boy says "the lengths are equal."

A girl disagrees, saying "the lengths are not equal."

Mr. Owens agrees with the girl by saying "the lengths are not equal (pointing to the unequal measurements labeled in the model) but <u>something</u> is equal. What?"

The same boy says "The two ratios."

"Correct! Could we use ratios to find the missing value [side]?"

The class seems confident that they can and they do so before moving to consider another example involving similar quadrilaterals. Mr. Owens encourages them to set up some proportions on their paper. As they do so, he questions their choice of corresponding parts as well as the process of solving proportions by 'cross multiplication' [of means and extremes.] The exchange between teacher and students continues to reinforce their work for about five minutes. The class shares different proportions they used to solve the problem, discovering that each one led to the unique, yet common, solution. All students are engaged and appear to generalize from the examples that the corresponding parts may produce different proportions, but any correct correspondence produces the same solution.

"Does anyone know the height of the flagpole in front of the main office?" asks Owens.

Wayne quickly says "17 feet."

"You answered so fast. Do you know that for sure?"

Wayne smiles as he says "I am not sure."

A girl suggests "20 feet."

"How could we tell for sure?"

"Someone could climb the pole!" says another girl, "Or we could use shadows and write a problem like the one in our book."

Mr. Owens encourages her by probing how that might be done.

"Measure the shadows. Like take a yardstick and it could cast a shadow. We could measure it [shadow]. Say the yardstick casts a 4 foot shadow." Mr. Owens quickly sketches a short vertical yardstick and a much taller flagpole, then draws and labels a 4' shadow beside the yardstick. He sketches a shadow for the flagpole and asks "could we measure the shadow of the flagpole?" He labels the flagpole's shadow as 32' and then says "What are the ratios we would use?"

> Owens' algebra lesson often presents an algebra concept using multiple representations (symbolic, numeric, graphic, etc.) (Q41)

Another girl offers $\frac{4'}{32'} = \frac{3'}{h}$

"So how tall would the flagpole be, class?"

By 9:45 the episode ends as students determine that the flagpole must be 28 feet tall. Some students recall a science experiment. Billie remembers using a mirror and then a dish of water to solve a similar problem. The teacher confirms the recollections by describing an experiment that he once assigned to some of his own science students. At 9:52 he assigns several proportion problems for homework and allows students to use the remaining 18 minutes of class time to begin working. Matt and a girl seated nearby seem restless and off-task, but they, too, begin to work as Mr. Owens approaches. At 10 o'clock all students are busy and Mr. Owens takes time to move among

> "There is the opportunity [with an extended block of time] to put into effect what they [students] learn in the classroom. Getting them outside with a few basic tools and they can use the concept to find the height of a very tall building that they would never be able to measure by climbing. That is exciting."

them, stopping to give individual assistance to students or to praise them for their work.

Less than one month later, on a mid-January morning, these same students enter Mr. Owens' class complaining of the cold temperature outside. Mr. Owens welcomes them warmly and asks them to begin working the problem on the board [8x + 7 = 2x+ 9]. By 8:35, Mr. Owens calls on three students to solve the equation and he writes as they speak. After finding the solution $\frac{1}{3}$ he asks another boy to check it.

The boy responds sullenly, "I don't know. I didn't pass my test."

Another boy suggests "Plug it in; plug it in." (singing the lines from a popular TV commercial for air freshener.)

Mr. Owens returns to the first boy "How would we know if our work is correct."

"Both sides would be equal?" he suggests.

Mr. Owens nods and quickly models substituting $\frac{1}{3}$ for x to check the solution by showing that both members of the equation simplify to $\frac{29}{3}$. Once again, we see Mr. Owens drawing students' attention to a specific problem and then moving to take questions from their homework. At 8:45 students ask for #10 and #8. Mr. Owens calls on several students to contribute steps for solving 3 - 8b + 2b = 4 + 2b – b.

The problem requires students to review basic algorithms in preparation for the approaching first semester exam, including operations with integers, operations with polynomials, inverses, transforming equations in order to solve them, and checking solutions by substitution. Students questions and responses reaffirm such concepts as "negative numbers are smaller than positive numbers" and reviews properties such as the definition of subtraction as well as addition and multiplication inverses and identities. As they complete the discussion, a boy laughs and says "So get out a sheet of paper..." The class joins in the joke but Mr. Owens reminds them that they have another student question to answer and he begins reading the textbook problem describing populations in Delaware and Alaska.

> The lesson often demonstrates that learning algebra involves learning a specific set of rules. (Q39) More often, the lesson demonstrates that algebra is generalized arithmetic. (Q38)

> If Delaware's population continues to grow at a rate of 4000 people each year while Alaska's population increases by 6000 people per year, when will the two states have the same population?

Mr. Owens calls on a student to "express the population of each state any n years from now." After getting the response, he writes

Alaska: 480,000 + 6000n
Delaware: 600,000 + 4000n

"When will the populations be the same?" he asks. A girl waves her hand and a boy says "I know!" Mr. Owens calls on Dale, who says "when 480,000 + 6000n equals 600,000 + 4000n"

As the girl protests that "I wanted to do it," Mr. Owens smiles at her and says "What have I said is the most important thing you'll learn to do this year in algebra?" The girl nods and says "write an equation."

More questions and responses alternate from Mr. Owens to the students and back as the equation is solved to reveal that 60 years from now, if the population change remains constant, Alaska and Delaware will have the same population. It is 9 a.m. and a boy enters, hands a pass to Mr. Owens, and takes his seat. Mr. Owens directs the class to read another problem in the textbook. This problem contains a chart showing track records for men and women. He asks students "what are we trying to find here?" Keisha reads the problem aloud. Bobbie says "When will the men's and women's times be the same?"

Mr. Owens writes

Women: 54.73 sec.
Men: 49.36 sec.

"The table of values seems to show that women are getting faster every year," says Mr. Owens. A boy who runs cross country and outdoor track says "I know! I hate that!"

"In fact," says Owens, "what is happening to the best times for women each year, according to the data in our table?"

A girl says "They are decreasing .33 seconds each year." Mr. Owens expands what he had written earlier to show

Women: 54.73 sec. - .33n

"Who can tell me about the men's record?" and he writes

> On occasion, the algebra lesson provides the opportunity for students to experience a real-life application of an algebra concept or skill. (Q44) Students sometimes use real data during the lesson. (Q48)

Men: 49.36 sec. -.18n as directed by one of the boys. "And the most important thing we can try to do..."

"....write an equation!" says another girl.

"Who can do that?"

"54.73 - .33n = 49.36 - .18n" says Wyatt.

At that point, Devon offers to solve the equation. As he describes each step, a girl checks the arithmetic with a calculator. "In 35.8 years, the times for men and women will be equal," he says.

"And then the women will be faster," says Owens. He tells the class that, at one time, experts believed that the human body could not run a mile in less than four minutes. Some laugh at the statement and nod as Mr. Owens continues. "Finally, someone did it. That same year, after the first man ran a mile in less than four minutes, others managed to do it too. Why do you think that happened?"

"[It was] because people are competitive."

"I think because they knew it could be done."

Owens nods. "Someone showed it was possible."

At 9:15 he asks students to solve and check a simple equation as he circulates to observe the work. An intercom announcement calls six seniors to order graduation caps and gowns. For the next half-hour students solve progressively more complex single variable equations at their desks as Mr. Owens presents ten problems at a rate of one every two minutes or so. The teacher circulates, answering student questions, offering suggestions, and asking students questions. Each student has Mr. Owens' undivided attention at some point. The class is the scene of quiet activity with the teacher circulating randomly or responding to a student's raised hand. Students work individually or quietly confer with the person next to them. There is time for one-to-one help and even a personal anecdote as Mike (a member of the indoor track team) shares his experience in the 300m event. Mr. Owens exchanges a personal anecdote from his college track days. Mike smiles and nods with understanding to his teacher. At that moment, another student calls "Hey, Mr. Owens! I didn't do something right." and Owens moves to assist. "Why do you think so? Look at your work. What did you do here (pointing to the student's paper.)"

"Oh, I see. I should be adding -10, not 10. So now I get..." and the student corrects his work. All students are working on the assignment. At approximately 9:40, Mr. Owens directs the attention of the students to problem #5. "Some of you are having trouble with this one. [17 + 2x = 21 + 2x]"

A girl suggests "It's because they are not equal."

"You are right," he says. "If your equation simplifies to something like this [17 = 21] then the original statement must be false. There is no solution. The contradiction is our clue. Let's see how #6 is the same or different."

A boy says, "No, it is not like #5. This one [-5x-1=-5x-1] is true."

A girl quickly adds "So any real number is possible for this one."

Mr. Owens agrees with them and, hearing no indication from the class that they have further questions, moves to help Matt who seems to be off-task and talking at the back of the room. He spends a few moments reviewing Matt's work and asking him questions. Mike comments that "I think I need to take my test over. I know what to do now. I'm not confused any more. Sorry I am slow, but I just saw it. Man, there's hope!" Mr. Owens smiles and moves to another student who wants to ask a question about #9. Owens addresses his answer to the whole class. "#9, a hint, if you need it...You can work to avoid it if you hate work with fractions. True or false: I'm allowed to do anything to this side of the equation (pointing to the left member of $\frac{2}{3}x+8=\frac{1}{3}x-2$) as long as I do the same thing to this side (pointing to the right)?" The students nod and answer "True." "Right."

"Let's see what happens if I use multiplication by 3 on both sides. Help me simplify." Two students respond and complete the solution, finding that x = -30.

By 9:50 most students are finishing the ten problems and three students have their heads down on their desks. Mr. Owens gives them three more equations to solve as he continues to offer one-to-one assistance to students. The variety of equations offers an opportunity to review for the exam. One boy says "All these problems are stressin' me out," but he continues to work quietly. At 10 a.m., Mr. Owens collects the papers from each student and then asks them to copy another problem [13x + 18 > 10x + 12] on a clean sheet of paper. "What is different about this problem?"

"Even with good planning and variety of strategies, often the last 30 minutes of class, I just don't have their best attention."

Matt says "it's the > [greater than] sign" as he reads the inequality statement aloud. "Wouldn't I add 13x to 18 and get 31x?"

Another boy shakes his head. "No! Those are not like terms."

A girl suggests adding -10x to both sides of the inequality. "And then add -18" says another girl. Owens transforms the inequality as directed, producing 3x > -6.

"Change greater than [>] to less than [<]," says a boy. But a girl disagrees, saying "Not yet. Only when you divide by a negative. That's next."

Owens continues writing as students explain. When x > -2 remains, he asks "Could you graph this?" and listens as a boy describes the process he uses to graph a simple inequality statement on the real number line.

The time is 10:07 and Mr. Owens tells the class to "get things wrapped up. There is a homework assignment on the board. Please put the calculators away." Students close their books, return the calculators to the wall caddie, and pack their backpacks and bookbags. Matt goes to the computer with Mr. Owens to check on his current grade. He quietly murmurs to Mr. Owens "If I do all my missing homework tonight...." as the bell rings. Mr. Owens smiles and nods, suggesting that would be a good idea. Matt joins other students in the hall as the talking, laughing, rushing masses of teenagers hurry to reach the next class before the bell sounds again.

*Teacher Background*

Mr. Owens has nine years of mathematics teaching experience; eight have included at least one algebra class as part of his teaching assignment. His experiences as algebra teacher in junior high school, middle school, high school, and summer school have demanded planning daily algebra lessons as short as 45 minutes or as long as $5\frac{1}{2}$ hours as well as the current 100 minute lessons every other day. He felt prepared, ready, even comfortable with his ability to cope with the block schedule. He enjoyed the flexible middle school schedule where the combined math and science block allowed him (as teacher of both disciplines) to shrink or stretch aspects of the lesson to meet the demands of the topic or the students. Although the high school block is rigidly structured, he views having a longer block as an opportunity that fits his teaching style because it does give flexibility to probe "deep into something and spend more time if needed."

## Distinctive Features of the Case

*Variety*

Mr. Owens' interview responses indicate that time is "something he has to be conscious of every day--keeping their [students'] attention for 100 minutes. You cannot sit down and plan for one thing to last 100 minutes. Their attention span is not going to do that." Visits to his classroom confirm that he chunks time in segments and changes the activity or focus every 20 to 30 minutes or less.

*Student Engagement*

Owens does not find that the extended block of time contributes to greater student learning in algebra because "even with good planning and a variety of strategies, often the last 30 minutes of class, sometimes more, I just don't have their best attention." Despite his perception, there was a high level of student engagement in each of the observed lessons. It was rare for more than one or two students to be off-task and when that occurred, Owens was prompt to recognize the distraction and he would move quickly to regain the attention of the student(s.) His lessons included direct questioning of individuals as one means of keeping students engaged. He rarely uses lecture but prefers active student participation in questioning, reading, taking notes, and solving problems (individually or with a partner.) Calculators are available and there is one computer in the classroom. Owens indicates that he "wishes he could get to the computer lab more often, but that is a goal that I have not had the time to do." He assigns at least one project each nine-week grading period (a mathematics department policy at his school). His students do not keep algebra journals or portfolios, although they do have algebra notebooks.

*Examples and Applications*

Owens notes that he would like to use more hands-on activities, but he most often uses "that good old traditional method of demonstration and then coaching [students] through the concept [followed by] independent practice." He values using "some word problems that might demonstrate an application of [the concept.]" Observed lessons included at least one problem that required the student to connect the concept or skill to an application or "real-life" situation (from packaging/shipping, sports (track) records, predicting growth, and measuring objects.)

*Assessment*

A typical lesson in Owens' class includes some type of evaluation activity. The evaluation may be formal (a short quiz collected and graded by the teacher) or informal (a problem or two worked independently and graded by a partner or a problem worked with a partner and then checked with whole-class participation.) The design of the assessment might vary as well as its placement within the lesson timeline.

*Individual Perspective*

Mr. Owens believes that he is providing the "basic skeleton" of algebra as required by the [Virginia] Standards of Learning objectives. There are "limitations, by his observation, to how much enrichment can be put around the skeleton." Although the current schedule gives more time on the day that the class meets, the alternate day arrangement "seems to take away the time we can spend making the basic concept meaningful." Owens spoke with teachers from other schools at a conference he attended in Chicago last August and agrees with sentiments overheard there that "100 minutes every other day do not equal 50 minutes every day." He suggests that students may need day-by-day digesting of what they are learning in algebra. Missing a day between classes may be comparable to meeting with them less time. If he had a choice to go back to a [daily] 50-minute block, he would choose it. The current schedule is too long to maintain active student attention. "The first 40-50 minutes of class are the most productive." Given the opportunity to change the schedule, he "would certainly want to meet [students] every day. Often though, we have to balance our needs with the needs of an art department or a science department that really likes the block schedule. If we could find a compromise where they get a day or two that gives them the block and we can see our kids four out of five days a week, that might be better for the big picture. Compromises are often complicated. I am always interested in what others have experienced. We don't have to reinvent the wheel."

> When describing one impact of the block schedule, Mr. Owens notes that "It is too easy for students to say 'well, I don't have to worry about this for two days…"

*Advice to Algebra Teachers Beginning a Block Assignment*

"Value your plan time. It can be misused. You will not get another planning block for two days and you've got five long blocks to teach. Planning time is all the more valuable [in an alternate-day block schedule.]" There are opportunities to do "things that take more time--going outside the classroom, hands-on activities in the room, projects that require research in the library. All those things can be accomplished a lot easier." On the other hand, you may sit down at the beginning of the year and prepare a timeline, only to find that "student attention [is] a constant frustration. You have to choose: press on or slow down?"

*Student Achievement*

At the end of the year, none of Mr. Owens' students earned an A in algebra, although 10 earned B or C. Twenty-three students received a D and the remaining 15 failed algebra (31%.)