

## **Master Scheduling Takes a Giant Step Forward**

By George Burnett<sup>1</sup> and Richard D. Hamlin<sup>2</sup>

Over the past 30 years, methods and procedures for creating master schedules have changed many times. Schedules have been built on paper, on magnetic boards, on shared computer systems, on in-house computer systems, and on standard and custom database systems. No matter the method used, trial and error based scheduling was time consuming, labor intensive, and frustrating—as often as not producing perplexed professionals and dissatisfied students as workable, sound schedules. .

Now, technology has produced a better method to develop the master schedule: a schedule to enhance professional pride and ease student pain. A method that takes into account all scheduling factors and weaves them seamlessly into a comprehensive whole.

This new scheduling technology delivers schedules that typically have at least 50% fewer unsatisfied student requests and roughly half the number of unsatisfied students relative to other methods. It allows much of the manual work to be completed before student requests are obtained, and builds the master schedule based on course requests and student, teacher, and room availability.

This multiphase process,

1. Defines scheduling criteria,
2. Assures the capability to satisfy those criteria,
3. Creates and optimizes the schedule,
4. Modifies the results or criteria as needed, and
5. Re-optimizes or re-balances the schedule as needed after receiving final changes,

The new method allows the work of creating a master schedule to be spread out over the year and produces schedules with fewer conflicts and better balance. The 2006-7 school year is the fourth year Brockport High School has used this new, innovative approach: they finished their work much earlier than thought possible with fewer conflicts at completion.

Automated Scheduling's applied, modern technology has enabled this remarkable change. We have created programs that analyze your scheduling problem and report whether a workable schedule is possible even before student requests are imported. This is the feasibility phase of the process. Our technology can interface with almost any school's database. With our almost intuitive graphical user interface (GUI), all the necessary information— periods, days, teachers, rooms, courses, and restrictions— can be entered well before student requests are available. We then analyze the data for feasibility, determining whether a feasible (usable) master schedule (i.e., one that does not violate any criteria) can be built from the information available. If a feasible schedule cannot be produced, our infeasibility analyzer identifies and reports the reasons (such as a teacher with too many assignments or a course restricted to inappropriate rooms). Identifying and pinpointing data inconsistencies enable school professionals to appropriately correct them with minimal effort before even beginning to create a schedule. That saves much valuable time over the trial-and-error approach. What makes this infeasibility analysis a remarkable improvement over the warnings generated by other programs is that the latter identify only limited, preprogrammed, very

specific types of errors, whereas comprehensive infeasibility analysis catches inconsistencies that are much more subtle and complex including those that are obscure and not previously considered.

Depending on the kind of schedule used, this program can pick periods or days, or period and day combinations for each course without limitation. When entering data during the feasibility phase, it is not necessary to know the number of sections each teacher will have. One only needs identify the teachers who will be teaching the course. During the creation -optimization phase, our software determines the best use of the staff to achieve the greatest student satisfaction.

Once the process of obtaining student requests is complete, they are imported into this system and the creation-optimization phase begins. This is where our advanced technology really comes into play. In the past, much administrative time was used to place courses where the administrator thought they would schedule best. Once placed and loaded with students, the administrator would then try moving certain sections to see if the schedule could be improved.

With our new technology, the program assigns the courses to the periods where they work best to schedule the most requests. The administrator has no involvement in this process and is freed to do his or her everyday work. Our much more sophisticated software can create schedules of any type (traditional, block, hybrid) and has the capacity to choose periods, days, or any combination of days and periods needed. It can determine how many sections of a course are needed to best serve the student population and how many sections of a course a teacher might be assigned. For example, if allowed the flexibility, it may determine that English 1 needs 14 sections and English 2 can serve its students with 12 where in the past there would have been 13 of each because the numbers for each course are the same. To accomplish this it will assign one teacher one less English 1 section and one more English 2 section. Having the ability to make these kind of assignments creates a much more 'student-friendly' schedule. Our new software suite also has the ability to look at the balance of students assigned to sections and change section assignments to achieve better balance without creating more conflicts. The schedule returned to the school is nearly optimal for the school's student body based on the information provided.

The resulting schedule can be influenced by the weighting of certain courses or students or both. Each school can decide on its own weighting scale based on the needs and restrictions of its students and staff. Our programs will give higher priority to scheduling requests for courses with a higher weight, e.g., a course required for graduation over an elective. It will also give priority to students given a higher weighting over others, e.g., seniors before underclassmen or special education students before regular students. The weights determine not only whether one course request is more important than another, but also the degree to which it is more or less important, thus providing a means to exercise enormous and precise control without artificially limiting with any manual prescheduling. This weighting process is extremely important because it allows the school to dictate what is most important to that school in building a master schedule and each school may have different needs and therefore different priorities.

Once the optimized schedule has been created and returned to the school the final phases, modification and re-optimization or re-balancing, begin. Remaining conflicts can be resolved by selecting alternatives. Adjustments can be made for course and exam failures and new entrants can be placed. That is not the end of this new scheduling technology and its usefulness to the schools, however. Once the school is satisfied that all the students have

been appropriately scheduled, the schedule can be returned to the program for final optimization. The program will again look at the balance of students in sections of courses and make the possible changes that will bring about an even better balance without impairing any student's schedule. It will also identify any problems created with the hand scheduling of new entrants and resolve conflicts such as a student being double booked for one period or not having anything scheduled for a period. This process would be impossible to complete by any number of individuals as no human can consider all the schedule possibilities to balance sections as a well-designed computer program can.

The major improvements in master scheduling Automated Scheduling offers gives schools the opportunity to create much more efficient and workable schedules in a time frame that fits the schools need and with much less time and work for the administrators and other school personnel responsible for master scheduling. In the future, this will be how schools build their master schedules.

The technology is here now.

The techniques for using our tools and methods are continually being developed and refined. Brockport has used this new method now for over four years and has seen, first hand, the difference it makes in both the end-product and the reduced work involved in getting to that end-product.

So, be on the lookout. Somebody has to be the last to use the best—don't let it be you!

Automated Scheduling offers you these capabilities now. Our technology is tested and sound and will grow in use and popularity as school after school discovers and adopts the benefits of its awesome analyzing power.

<sup>1</sup> George Burnett has been building master schedules for Brockport High School since 1975, over which time he has used a variety of methods. For the last four years, he has used Automated Scheduling's system.

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