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ABSTRACT

A review of the data processing operations used by the Tacoma, Washington School District to process its student records is presented. The first section of the paper provides some pertinent statistics about the district's student population and its hardware, software, and computer personnel. Next, a brief review of the results of a computer-usage and attitude survey in the state is offered. The final part of the discussion focuses upon the current status of the districts' data processing operation, including how it has developed and where it is heading. (PB)

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INTRODUCTION

It has been my good fortune over the years to attend most of these annual meetings. The sessions attended, the informal discussions and the opportunity to hear about, question, and think seriously about our plans and progress have been truly inspiring for me. We all need a time now and then to get away from our ever-demanding desks and phones and reflect not only on our own jobs and responsibilities, but on our personal philosophy as it relates to our organizational goals and to our methods for achieving them. My sights have always been raised by hearing about and examining the plans, hopes and sometimes the operations of our more forward looking members. Somehow, however, there always looms the reality of next Monday morning and that other real world in which we operate.

This is not to suggest that goals in this real world differ from those discussed in our meetings or as presented in our excellent professional journals. Certainly our broad goals generally coincide and, simply stated, must always reflect the goals of our own organizations which probably differ very little from each other. I do suggest that there may be many ways of achieving desired results and that for each of us these are more a function of our local environment than the formal and logical models so favored by planners and authors of many publications.

Permit me then to take a few minutes of your time this afternoon to present some very honest facts, feelings, and opinions based on experience in my own organization. If we are inspired by these sessions in this truly magnificent setting, then somehow we should attempt to carry these feelings home with us in a more lasting form. Somehow all of this inspiration has a tendency to melt away once we face next Monday morning. It is my hope then, that the remarks I make will somehow convince you that we are making significant progress, each in his own way, which is goal-oriented in the most positive sense. I hope you will return to your job with a good feeling about what you are doing even though your methods may not conform to textbook standards and all of your results may not display the glitter that characterizes the new approaches and systems we are hearing about this week.

It is significant I'm sure, that our conference theme is "Humanizing Education". I don't know what this term means to you because it is vague to me. Many of the sessions listed in our program use the term so I have hopes that its meaning will become clear as the week progresses. Personally, I prefer to try to humanize people so that they can humanize education. Certainly no one can deny that education needs humanizing now as never before. When I hear Bob Gates or Sylvia Charp or others relate how students identify with a computer terminal because "it is the only thing that ever said I did something well" I confess to being nervous. We have had similar experience with our own CAI system. If, however, we think

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of last year's theme in St. Paul, "People make it work", I believe we can put the two together in a more meaningful way. This certainly verbalizes not only our feelings, but the feelings of the general educational community and indeed our entire society. Perhaps I am stepping on toes, but I shall continue to resist the urge to personify machines.

In any presentation of this type one must make some basic assumptions. I make only two. First, I assume that the Tacoma Public School system is generally similar to most other school districts of approximately the same size. Second, I believe that we all wish to do the best job possible in our respective environments. We must somehow achieve the goals of our organization to the best of our ability.

So that my remarks may be placed in proper perspective, let me describe briefly the Tacoma system. We are an urban district with about 35,000 students in 42 elementary schools, ten junior highs (7-9) and four high schools. A fifth high school is under construction and will be operational in September. We also have a large vocational-technical institute. We have a current annual budget of just under \$48,000,000 of which a little less than one percent is allocated to the total data processing operation.

Hardware wise we started with a 402, moving to a 360/30 in December of 1967, a 360/40 in January of 1969, and a 370/135 (145K) in November of 1972. We have the usual peripheral equipment including a IBM 123i on-line mark reader. We run under DOS in three partitions one of which supports a Course-writer CAI system with 25 terminals. This system typically logs about 15-20 thousand responses per day. We currently log about 300 hours per month on the CPU in a bit over two shifts. We have some on order equipment including a core upgrade to 196K, 3330 drives and new mark reader, a 3881.

My staff consists of three keypunch operators, three computer operators, five programmers, an operations supervisor, a systems and programming supervisor and part-time control clerk. I report to the District Business Manager who is very supportive of data processing as is the Superintendent and other administrators. I should also mention that I entered the business through the classroom and mathematics supervision.

So much for our Tacoma system. As implied earlier, I believe we are fairly typical of those districts too large to do things manually or through a service bureau or cooperative approach, and too small to be a part of the large groups such as the Council of Great City Schools.

In our state no school district is involved in formal cooperative efforts at the national level, and though our state is small, we still have seventeen public school districts with operational computer installations. I am describing the "do it yourself" world, and yet this is the world in which the vast majority of our nation's students are enrolled. Furthermore, the funding of these systems is nearly 100% from local sources placing the responsibility at the district level and requiring precise justification for funds in a somewhat competitive situation. Since the computer has long since vanished as a pure status symbol, we must assume that most of our installations are doing a reasonable job and are considered essential for district operations.

A recent use and attitude survey of 218 of our state school districts revealed the following about the districts in the group using computer services.

1. The question "are computer services necessary?" was answered as follows: Very necessary - 66%, Helpful - 30%, Supportive - 3%, A luxury - 3%.
2. The question, "are computer services accepted by staff?" was answered as follows: Enthusiastically - 58%, as inevitable - 38%, Grudgingly - 4%.
3. The question, "are data processing reports accepted as:" Primary source of information - 86%, Secondary source of information - 5%, Verification - 9%.
4. The question about cutting back data processing if overall funding were reduced was answered as follows: The last place to reduce - 51%, reduce less than other areas - 22%, reduce proportionally to other departments - 24%, one of the first to be reduced - 3%.

These results were even more supportive of data processing for the district of 15,000 students or more.

My remarks will be based only on the Tacoma system and its operation. I am going to describe briefly where we are, how we got there, and perhaps where we hope to be in the near future.

I am sure that many of you are ahead of us in both planning and operation. Some of you may have a different set of priorities and have perhaps developed along other lines. Whatever course you have set, however, we do have common needs and we share common goals. Further, each time we reach a partial fulfillment of a well-defined goal or a significant landmark, we find that the goal has either changed or has been pushed further out. Either our planning was inadequate or conditions and requirements changed while we were busy getting the system working, generally the latter.

We have in our state (and in Tacoma in particular) a species of fowl called the brown-billed duck. You may have them in your area as well. This duck flies just as fast, just as far and just as high as any other duck. His one distinguishing characteristic is that he can't stop as quick. Sometimes I feel that we in data processing bear a remarkable resemblance to this species.

We, like everyone else, have a seemingly endless number of things we do. The complexity of our financial and payroll system is staggering when you consider our sources of funding, our reporting requirements, and what seems to continual change. We have an inventory system, a very active research department, food services, CAI, audio visual, test scoring, student programs, and others. I will say very little about these tasks except to indicate that they are operational and require continual attention and maintenance. It is true that we have been "discovered" during the past few years and that the requests in all areas have been greater than our ability to produce.

My story will center on the student administrative system, which in our case accounts for about 70% of our work. I will trace this from a historical point of view as briefly as possible. My purpose is not to hold us up as a shining example. In fact, the sequel may well establish us as just the opposite, for I intend to be candid as I describe how planning and operations take place in Tacoma. Perhaps you will see parallels as you mentally compare our approaches with your own development. While I hope this is not the case, you may even leave feeling better because you know for sure that someone is in worse shape than you are.

Please bear in mind, as I said earlier, that this is the real do-it-yourself world. It is not the world of the Council of Great City Schools, or the world of Total Information Educational Systems in Minnesota, or the Oregon Total Information System. It is the world of "Make progress as best you can and don't plan too far ahead because it will change before you get there". I firmly believe that this is the world most of us live in, and in particular, it is a world where the line between planning and operations is not always distinct.

Until December of 1967 we operated with an IBM 402 system. At that time we installed a 64K 360/30 system, having planned for two years for its arrival. While this was a big jump, we were fortunate in that we had no body of programs for earlier computers. We were able to operate initially in a native 360 environment and, in fact, established multiprocessing at installation time. We had converted the 402 jobs and were able to retire it shortly after installation of the 360. The only student application on the 402 was a report card system based on mark sensing, and this for only two of our secondary schools.

We had sectioned two schools prior to our computer installation using the card version of SSS/360. The results were really not satisfactory based on today's standards, but the experience was valuable not only for the two schools involved but for my staff. We had the IBM 1231 optical mark reader running in a partition and we quickly modified the input of SSS/360 to accept marked sheets instead of cards. The offline 1230 was popular with 1400 series users, but the on-line version just wasn't practical unless multiprocessing was available. You don't tie up an entire CPU with a slow speed input device. We did get it running and in a small partition it could clunk away all day. In spite of our software acquisition problems, it has been, and still is, a real work horse for us. It now clunks on the 370. As I said earlier, we have the new 3881 on order to replace it; but after all these years we will mourn its passing.

At any rate we felt the scanner would solve our input problems for sectioning. The first year we took on all fourteen secondary schools. This took a lot of coordination and training for the building administrators but we made it work and as a result were able to delay student course requests until much later than usual. The customary procedure was to get the course request scan sheets in and read so that we could run tally and conflict requests for the principals at least two weeks before school was out. They then built their master schedules in preliminary form and would have at least one sectioning run before school was out. Some schools scheduled for both semesters of the following year at that time, but several planned to re-schedule for the second semester. Our findings were that the student body we had scheduled in June was, in fact, mythical in September and practically non-existent the following January so we quickly adopted the policy of re-scheduling for each semester.

We learned, moreover, to use SSS/360 in some very effective and unique ways. It is a program, like other similar sectioners, that is easily fooled. Our principals also learned to use this program and became very skillful at "beating the sectioner", even to the point of fooling my staff at times. We became so familiar with this program that we delayed all final runs until late August, and for one insistent principal we opened school unscheduled and had them running on the third day. We were achieving above 98% of all students scheduled into all courses requested with an average of about three or four runs per school. The scan sheets, once read, were returned to the building and for students in conflict they were changed and reread to update our request file.

Neither our sectioner (SSS/360), nor our experience with it were in any way unique. Other programs were available for other machines and they all worked about the same way since generally they had the same parents.

By now you will have noted that I have not mentioned a student master record. The reason is simple. We didn't have any. Our scan sheets were pre-numbered with a six-digit mod 11 number both printed and in a binary marked form. There were places to code homeroom, grade level and sex. When the sheets were brought in we keypunched the number and name thus creating the student course request file. The student was not assigned a number because with our system the number was assigned a student. Was this cumbersome? Indeed it was! Were we planning for the future by handling scheduling this way? Were we really saving anyone any time? Were we being responsive to the needs of the schools? Were we really thinking seriously about the student master record? Did we have any thoughts at the time about grade reporting?

The answer to all of these questions was yes, and however illogical our approach from a systems point of view, the overriding consideration was that we now had a tool that would remove some of the pressure of scheduling, and we should use it. Certainly we planned for the future. Our programming was such that it could be salvaged intact when we had a student master record, suitable turnaround documents and all the rest. One of our senior high principals remarked in our earlier days as he walked out with an armload of some 200 student conflict sheets, "Sure, we have 200 students to schedule manually but here are 2,200 we don't."

As a matter of fact, and to show how dangerously we lived in those days, the students had different numbers each year for two years. The second year these numbers became the permanent student number and at that time our locator card, version one, was created. Now, just three years later we are on version 3 which is the one you have in the handout. Now that we could finally print student names on scan sheets we disregarded the mod 11 numbers and simply assigned six digit numbers as new students were entered. We used a plain ordinary six digit student number for two reasons. First, we had such advice from several large school districts, and second, because we knew they would last until my systems supervisor had retired. Now we use the social security number for historical files, making the conversion after graduation.

Our grade reporting system began to evolve about this time, and I will say more about it later. But let me continue into the next chapter on scheduling. One of our junior high principals became very interested in the Quad S program that had been developed at Stanford. This program, as you know, not only sectioned the students but built a master schedule as well. The principal supplied the information on staff, rooms, course and students and out of this came everything. Our Model 30 didn't have the core to handle either this program or the GASP program which was similar but out of MIT. We, like many others, felt obligated to look seriously at these two programs. On analysis, we tended to lean more toward GASP for two reasons. First, it was developed and written by Bob Holtz, a native Washingtonian who was then on the faculty of one of our local colleges. Second, the Washington State Superintendent of Public Instruction was talking seriously about requiring a GASP simulation, under his direction, for all new secondary schools prior to approving state matching funds for school construction.

At the same time the Quad S program was receiving a lot of publicity through a company formed as a spin-off from the original project at Stanford. While I could spend a lot of time discussing our experience with this program, let me just say that we did go ahead with the pilot project for two years for the one junior high school under a contract with a commercial organization to use the Quad S program.

It was just prior to this time that the terms "modular" and "flexible" were combined to describe these programs. Modularity was achieved by dividing the day into modules or periods of time ranging upward from about 12½ minutes. These were what we used to call periods. Flexibility was gained because now we could have groups of any size from an auditorium type lecture group to a very small seminar group and all sizes in between. Students would have "free" mods when they could pursue independent study and other things. Daily schedules were eliminated in favor of weekly schedules and teachers could specify when they wanted to teach and how many mods per week they needed for each subject and each sized group.

Needless to say, this system turned up some difficulties. If you are interested, I can go into some of them. Because my department was not directly involved, we did not learn the system in detail as we should have. I say this because for the third year it was determined that we could bring greater controls by the simple expedient of dropping the commercial service and doing it ourselves with our little Model 30 and SSS/360.

There was, in fact, some justification for our going this way. The operation during the two preceding years was not satisfactory and by doing the job in house we could save a lot of dollars and be closer to the problems. It did mean, however, that the master schedule had to be built by hand. Again, I will not dwell on the details of this process, except to say that unless you have built a 23 mod schedule by hand you have never lived. It took a summer to do this and over fifty runs were made. We "lagged up to it" by department, and in the process had to make some internal modifications in SSS/360.

Somehow we managed it and ended up with what appeared to be an amazing result. We had successfully scheduled 93% of all student requests! The difficulty was that the seven percent of requests not scheduled represented over 400 requests and nearly 400 students, over half of the student body. We took some consolation in the fact that we had done a better job than that of the other system for the two previous years.

We all know that in education there are no unsuccessful pilot projects. This was no exception. The project was quickly phased out for the next year in favor of a very mild eight period day. In passing I must remark that SSS/360 had finally met its match. It was normally able to section about 2,500 students in 45 minutes using a six period day. Our final run with 23 mods took over seven hours for 800 students. Most of this time was taken up by printing student conflicts, however, so the CPU did get frequent rests.

I have covered this phase of scheduling to show that no amount of planning could have prepared us for the task we had to perform on rather short notice. The manpower and machine drain were significant and basically it was all for nothing. I personally, have some very strong feelings on this type of scheduling. It is modular, but in my opinion to impart the attribute of flexibility is an unforgivable error.

During this period changes were taking place in education, which were to cause changes in scheduling procedures.

- A. Faculty members were becoming more militant and insisting that a host of new course titles be introduced.
- B. Students discovered that they had rights and one of these was to select the time frames and teachers where possible.
- C. Graduation requirements were being changed.
- D. The quarter (or trimester) system was experimented with and instituted in all of our high schools and half of our junior highs.
- E. A larger number of students were in alternative type programs, most of which were community-school based.
- F. Because different programs were being offered in each secondary school, many students were requesting and receiving transfers to schools outside their primary attendance areas.
- G. A new high school was on the drawing boards for completion and opening in September, 1973. Because of this and changing residential and ethnic patterns, secondary school boundaries had to be redrawn.

It is a simple matter to section a building by computer when there are, say, 18 sections of geometry, 23 sections of sophomore English, etc. It is quite a different thing when the 23 sections of sophomore English are transformed into 23 different courses, any one of which may count as sophomore English. When we first looked at the total number of courses offered in secondary schools in 1967 we found we had just over 750. Through a lot of meetings with principals and department heads, we were able to reduce this number to just under 750. The count as of April 1, 1973, is 1,450 and since April 15 is the deadline, I expect an increase of about 50 this week. We have a formal controlled procedure for introducing new courses through proper channels and as you can see, it works well.

In order to be more responsive to the needs we, like many others, have gone more and more to the "tennis shoe" or arena type scheduling. This, as you know, allows a student to schedule himself by either picking up or depositing cards. Under a reasonably controlled situation a building will be scheduled conflict free in this way. As you know, there are two options. Under the first, and most popular, we punch a card for each period of the day for each student on color coded cards. These are deposited behind course section master cards during the process. We initially insert as many blank cards behind the course section masters as there are seats available. Each time a student card is inserted a blank card is removed. This keeps the sections balanced to some extent.

The other option produces a single student master card and as many course section master cards as there are seats. The student then picks up course cards and turns them in at the end of the process. The first option gives the input by class and the second, by student. Either way has worked well for us and gives a definite advantage in timing since the scheduling for the next semester or quarter can be done in a day or so ahead of the starting date for that period.

I hasten to add that under either of these options the building master schedule is created in SSS/360 style, using scan sheets for student requests. These, in turn, provide the tally and potential conflict information from which the building master schedule is created.

I realize that many of you are way ahead of me in this discussion. I have gone through this to simply show that we do respond to the needs and changing conditions. Implicit in this discussion is, I believe, the obvious fallacy of attempting too much planning in advance. When I hear about the long planning efforts which may span several years, I wonder just how effective they will be when implementation time comes. The world moves so quickly. This is not to put down long range planning per se. Nor does this suggest that long range planning groups are not helpful. Certainly we look forward to seeing their plans and we freely utilize those ideas that will assist. The fact remains that long range planning is based on the assumption that we can define now what will take place tomorrow and I question the validity of this assumption.

Planning in our case consists of looking ahead as best we can at the time, evaluating all requests for changes or new applications with a view toward how they fit our goals. We then design so that most of what we do is still usable as we reach toward that ever-receding goal. It is a step by step, inch by inch process but it seems the only alternative when we are faced with production as well as planning.

Let me give you one final example to illustrate my point. In January, 1973, our school board established a policy of optional enrollment at the high school level to begin with the 1973-74 school year. This means that any high school student may opt to any one of the five high schools in the district as long as certain limits on total and minority enrollment are not exceeded in any one school. This policy also maintained our existing policy which gives our central area students the option to attend the school of their choice. This previous policy was aimed at the de-segregation issue and has as matter of fact worked well. In addition, we are opening a new high school in the fall of 1973. This meant that new boundaries had to be drawn for the existing high schools. In view of the optional enrollment policy we call the boundaries "primary attendance areas" now. Further, we have many students attending schools at all levels under what we call special purpose transfers. Still further, we have an extensive and exciting program for handicapped students which draws not only from our school district but also from the county at large. Then too, we have regular students attending our district who live outside the district. These students have official releases from their home school district.

What we now have is something we could not have anticipated. The student master record now must contain two additional items. The first is his next year's school of assignment and this must be provided for on the locator card. This will be version 4 which is now at the printers. The second item must also appear on both the locator card and master record. This is an item called "authority for enrollment." It must be one of the following:

- A. He is attending the school because he lives in the primary attendance area of that school.
- B. He is attending under the central area option.

- C. He is attending under optional enrollment.
- D. He is attending under a special purpose transfer.
- E. He is attending under the handicapped program.
- F. He is attending under a release transfer from another district.

Several other longer range solutions had to be considered in the planning for this. First, the school board asked for a recommendation on extending the optional enrollment policy to all grade levels and all schools. Second, there is the very real possibility that some students will be in attendance at more than one school at the same time.

It is a massive job. We will accomplish it and may perhaps even make it look easy "out front"; but again the point comes through clearly. We could never have planned for this in advance. Like the brown-billed duck, we are not the prime movers for change. Our job is to react as quickly as possible to meet the needs of our own organizations.

The time has long since passed when we have to sell our product. Now we have to do our best to keep it directed toward those long range goals however elusive. Our new high school will go on-line so far as scheduling and grade reporting are concerned. The new principal insists that he cannot operate his building without computer control in what amounts to a real-time system. We will accomplish this, but in such a way that we can generalize to any other school.

In closing let me say that other factors have a profound effect on our long range plans. One is our funding. Because of our taxing procedures, we in Washington never know from year to year whether we will be able to maintain our programs. We always have cut-back plans somewhere in our desk and hope we don't have to use them. The other major factor is equipment and control software. We came very close to developing some terminal control software on our own that was recently announced by our prime vendor. We could have used a lot of time and dollars on this.

We have reason to believe that our way of doing things is quite normal. We and you are making progress and as you get back to your desks next Monday, I hope you will keep this progress in mind. The daily frustrations and emergencies must be taken care of, for that too is our job, and an essential part of the real world. But let us feel proud that we have made the progress we have and let this progress continue in the best way we know, to the best of our abilities and within our own organizational structure and limitations.