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ABSTRACT

Computer-managed instruction (CMI) makes possible education which is individualized, adaptive, multi-mediated and student-controlled. CMI, however, is not yet successful and part of the reason for the failure is that the human aspects of the programs have been poorly managed. This situation can be remedied if the systems designers can learn to apply their approach not only to hardware and software, but also to the preparation of the personnel involved in CMI. In the case of teachers, this means that those responsible for instructional design should: 1) analyze the teacher's present actual role; 2) determine the teacher's new role; 3) compare the features of the two roles; 4) wherever possible restructure the emerging role to minimize the amount of change required; 5) develop detailed implementation and training plans; and 6) construct evaluation plans to monitor training materials and the actual working environment. Once followed, this approach will greatly enhance CMI's chances for success. (PB)

HUMANIZING COMPUTER MANAGED INSTRUCTION SYSTEMS:

THE DIFFERENCE BETWEEN SUCCESS AND FAILURE

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INTRODUCTION

Instructional management has always been a necessity in education. To a large degree it has always been manual with computers only being applied to grade reporting and standardized test scoring. Within the last few years, the following five educational developments have increasingly made some form of Computer Managed Instruction (CMI) a requirement.

1) The trend to individualized instruction has been increasing.

2) The practice of behavioral engineering or contingency management is expanding.

3) Multi-media approaches are being expanded to meet individual student needs.

4) The use of adaptive curricula is being expanded to meet student needs.

5) Student controlled learning is becoming increasingly important in upper grade levels.

All of these are attempts to meet more effectively the wide range of individual differences in students.

At first manual management approaches were developed to meet the above problems, but it was soon apparent that the computer was probably a requirement, if these new types of instruction were to be managed effectively. But, the computer and CMI appear to have failed to fulfill this promise. Development has been slow with only a handful of projects in CMI being even partially successful.

This paper explores what the author believes to be a major reason for this: The human aspect of the CMI systems has been poorly implemented. The author will only deal with the teacher aspect of the CMI man machine system as he feels that it is the most critical at present. Analogies are drawn from the banking industry and its implementation problems in automating to place the CMI problem in perspective.

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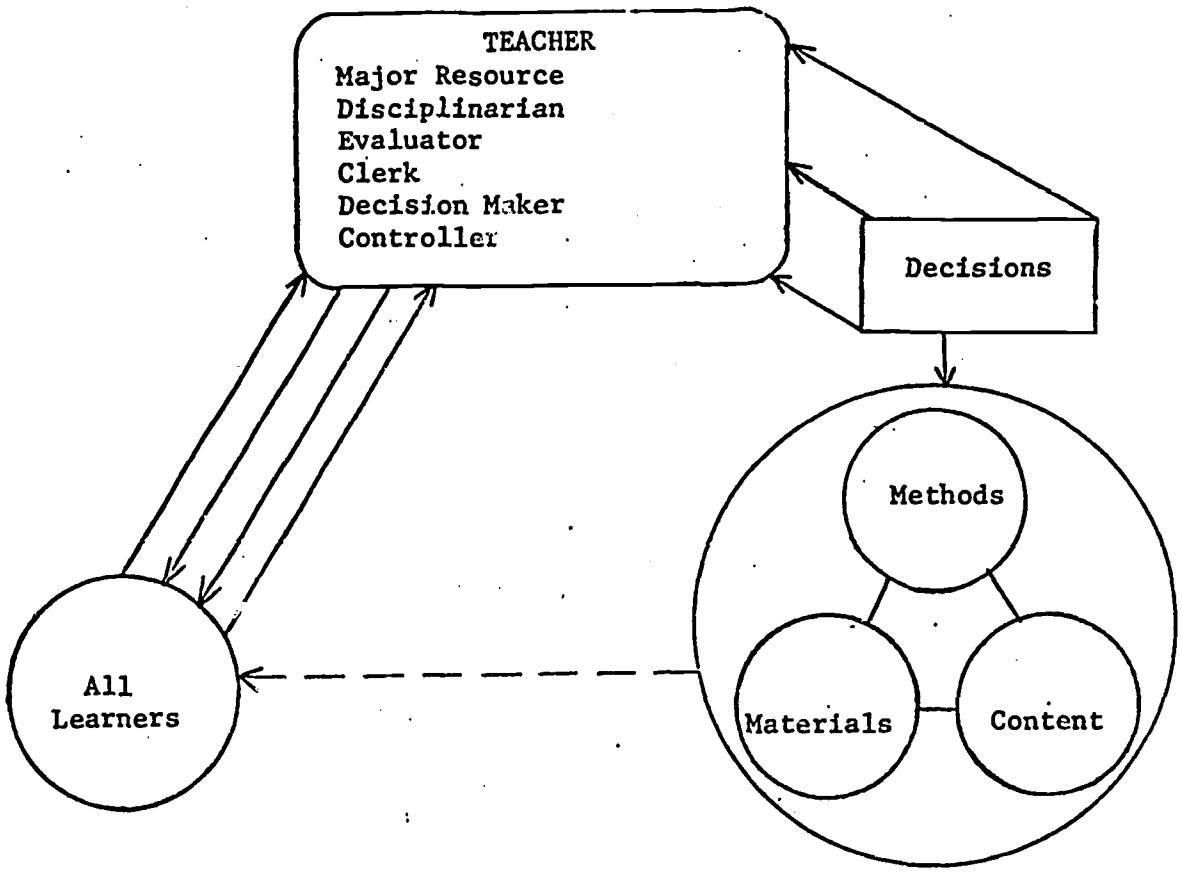
THE PROBLEM EXPLAINED

In order to examine the problem more closely, it is necessary to examine the current instructional system. Figure 1 represents a standard classroom instructional operation illustrating the major teaching roles.

Figure 1

Current Instructional System



Notice that in the current environment the teacher makes basically all the decisions and performs the majority of all tasks. Because of these circumstances it is not surprising that classrooms are managed in the method that they are. In order to handle all these variables teachers have tended to do the following:

- Treat the students as a homogeneous group for any subject matter.

  NOTE! Reading with its groups is a partial exception.

- Reduce clerical loads by using the students for grading and recording.
- Restrict methods.
- Restrict variety of curriculum materials.

- Restrict curriculum content.
- Minimize evaluation.
- Reduce number of decisions.
- Exert tight discipline and controls.

The above list is not meant to be totally inclusive, but does portray the average teaching learning situation. There are many individual teacher exceptions but the above premises are meant to be looked at across the broad spectrum of all teachers at all levels.

The author assumes that the above teacher reactions are a normal outgrowth of the current instructional system.

An increasing pressure generated by the educational community itself has been the attempts to alter the current instructional system to better meet the individual needs of the student. As mentioned in the introduction this pressure has led to the increasing use of the following educational approaches.

- Individualized Instructional Packages
- Contingency Management and Behavioral Engineering
- Multi-Media Approaches
- Adaptive Curricula
- Student Controlled Learning

These developments have proved to be successful educationally in an experimental mode, but are having considerable difficulty in being brought up and used effectively in a broad - based average classroom environment. A careful examination illustrates some probable reasons for these difficulties.

- Students are no longer in large homogeneous groups.
- Clerical loads are increased significantly. (Students may not be used as effectively in these environments as this consumes too much time).
- Methods are expanded.
- Curriculum materials are more varied.
- Curriculum content has a wider spectrum.
- Evaluation is expanded.
- The number of educational decisions are increased significantly.
- Teacher control and discipline is made more difficult.

As can be seen the new developments go almost totally opposite to the outcomes of current instructional systems. With this opposition there were bound to be problems and difficulties.

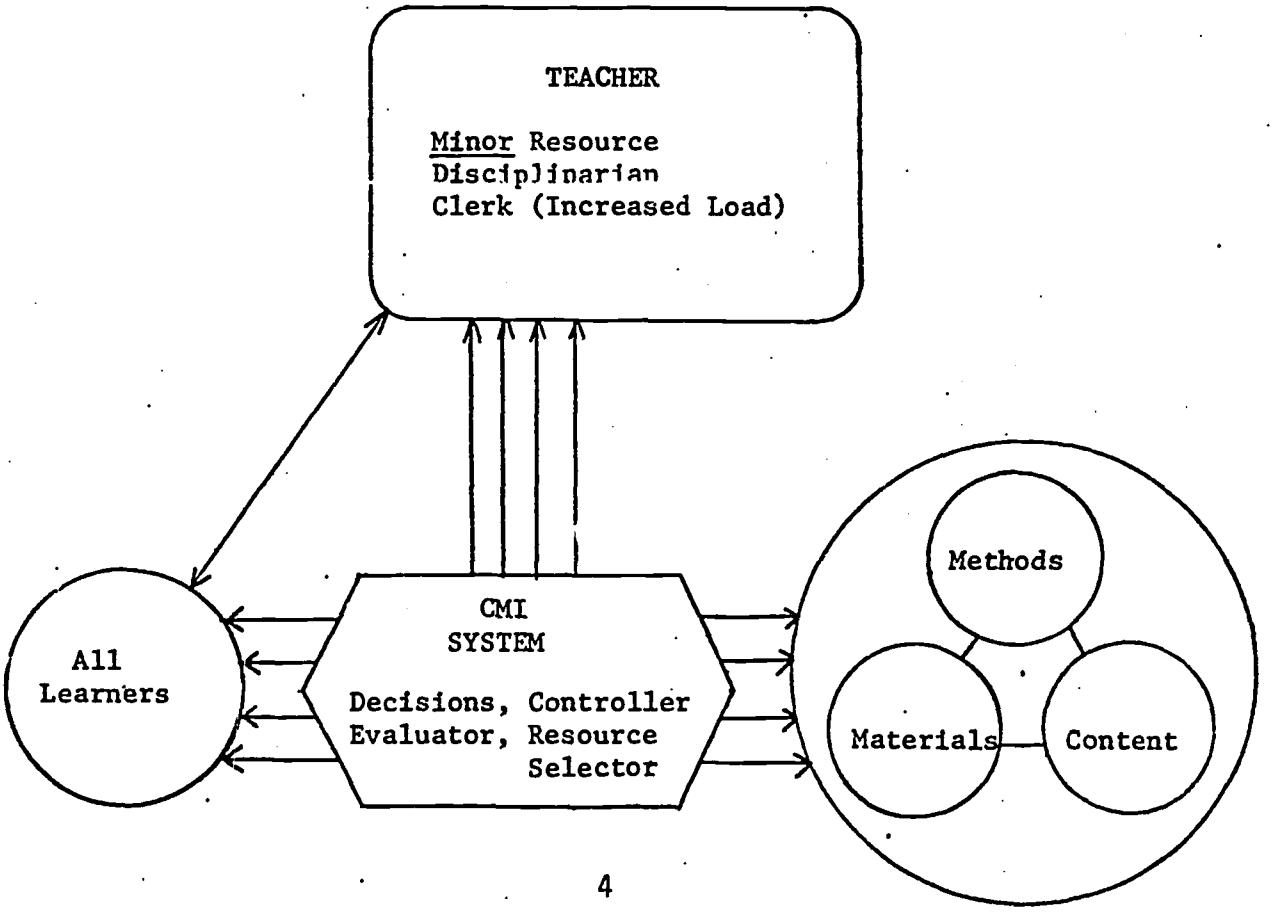
Computer Managed Instruction was proposed as the solution to many of the above difficulties. Many projects have been developed and tested in the use of CMI at all levels of education. Results have been promising on the experimental level, but have had only partial success when moved to a production status.

The major precept of the CMI system was to use the computer to aid the teacher in managing the many new individualized techniques, and to allow the reduction of her clerical loads (Figure 2 illustrates this general design). To a great degree these design needs seem not to have been met. Some of the most common criticisms heard about CMI have been:

- Is difficult to work with.
- Requires more work than previous classroom technique.
- Teacher doesn't really know where the student is.
- Too expensive for the help it provides.

Figure 2

Computer Managed Instructional System



These criticisms have been the factors that limit the acceptability of most CMI systems and the eventual rejection of many.

What causes the above problems? There are undoubtedly many reasons which are linked, but some very apparent ones are:

- Poor System Design
- Poor Human Engineering of Systems for Teachers
- Poor Implementation and Training
- Poor Follow-Up and Modification Procedures

These reasons are very reminiscent of the early problems with most major computer application system implementations in industry. Banks were among the first industries to make widespread use of computer systems. The programs listed above for educational CMI systems were especially prevalent in large branch system banks. The early banking systems were probably designed well enough from a computer point of view, but they completely lacked foresight in human engineering, training and follow-up. Most banks suffered through this era and finally evolved workable systems, but not without a lot of swearing, frustrations and tears. But remember banks had a strong profit and image motivation along with strong central management which education does not. In addition, why should each industry have to suffer anew?

To illustrate that this problem is not going away even for industry, a recent article in Datamation has the quote (5, p. 78):

> "One of our staff recently came back from an AMA seminar with an extreme example of this syndrome. One of the participants told the story of an attempted accounts payable system. The trouble was though that Matilda, who has been doing the jobs manually for 14 years, was determined that the computerized system wouldn't work. So, she sabotaged the system whenever she could, and bad mouthed it to management to the point that it was abandoned after a year, in favor of the old manual method. In this case, the clerk was entrenched so strongly that management was reluctant to remove her. It looks like top management wasn't sold in the first place either."

Sound familiar, which of us have not seen an individualized system installed that was being run just like the standard 30 student homogeneous classroom. Examples could be proliferated from both education and industry, but let's examine a proposed solution.

PROPOSED SOLUTION

If CMI systems are ever going to be successful in a production sense within the next few years the above problems will have to be solved. The technological problems have been solved and so have cost problems (1,2,3,4), but education must humanize their CMI systems both for students and teacher. This paper will consider only the teacher problem since it

appears to be the most significant. The following steps need to be taken to insure that any CMI system will be implementable from the teacher's point of view.

Step 1: Analyze the teacher's real role in current instructional systems. This analysis should include both her perceived role and her pragmatic role. Education has the difficulty of theoretically holding to certain principles (individualization, best interest of children) but in reality not practicing them. Thus, you might get teacher to say yes to working an extra 10 minutes per subject in order to get individualization, but pragmatically any system which requires greater effort than is currently being expended for the same equivalent task will likely fail unless tangible rewards (dollars, time-off) are offered.

NOTE! This is why short experimental programs often are successful where the reward is the recognition for being in a special project. But this usually disappears with extended time frame or widespread application.

Step 2: Determine the roles as required by the new individualized instructional system and/or required by the CMI system being utilized to aid the teacher.

It is important to break the roles down minutely and to put them in terms recognizable by current classroom teachers. "Information Manager" is not understood by most teachers. Definitions should be made as much as possible by comparing with current practices. (Preparation of assignments, testing, etc.). The use of behavioral definitions here is often helpful. Ask the question "What are the behaviors expected in the proposed CMI system?"

Step 3: Draw a cross comparison between the pragmatic roles of the teacher in the current system to the proposed role in the new CMI system. Try to match similar roles and estimate the percentage of similarity. If there is no new role to match an old role - reconsider it carefully in your new design, if still not there mark it for special handling as it will cause difficulties later on. Often it is desirable to place this old role in the new system in order to make transition easier. For example, in the development of new banking systems, old reports that were no longer meaningful were kept to make transition easier.

If there is a new role without an old role, mark it for special handling. These will be problem areas. Record the comparisons on a tally sheet.

Step 4: People don't really like to change and if any new system requires over 50% change it is probably doomed to failure from the start. The greater the percentage of change the greater the chance of failure. It is desirable to get the initial system change down to 25% or less. This step often calls for re-analysis of the new system to reduce the percentage of difference.

NOTE! This does not mean that you will not eventually make all the changes, but it should be done in stages with the initial stage less than 25% from current roles. For example, banks did not convert all their systems at once, but only one at a time allowing each conversion to settle in.

Step 5: Develop detailed implementation and training plans based on the roles and functions defined in Steps 1 and 2. These training plans should contain at least the following:

- All new roles should be taught based on their relationship to current roles.
- Old roles no longer in existence should have definite training materials to extinguish the behavior no longer needed. (The pragmatic vs perceived or theoretical position of the teacher is important in this.)
- Extensive and definitive training materials should be developed for all new roles or functions not previously known. These should include simulation level as well as actual practice.
- Attitudes are just as important as knowledges and skills and should be closely defined and taught.
- The greater the percentage of change, the more detailed and definitive should be the training.

Step 6: Develop on going evaluation procedures to monitor not only the training materials but the actual working environment.

SUMMARY

The above six steps illustrate the application of the systems approach to the implementation of a new instructional system. Too often systems people do not apply their own technology to all aspects of a problem. They use it to solve the computer problem, but then let the human problems fend for themselves. The above approach does work and has worked in both industrial and educational settings. The application of systems technology to the human side of CMI systems will greatly enhance those systems chance of success. As other industries have discovered, successful computer systems require successful human systems engineering.

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