Although computers have potential applications in the elementary and secondary physical education curriculum, current usage is minimal when compared to other disciplines. However, present trends indicate a substantial growth in the use of the computer in a supportive role in assisting the teacher in the management of instructional activities. Toward this end, computer programs can help solve problems such as the handling of data and the organization and scheduling of school facilities for physical education classes. Also, the information retrieval process may be used to record supplies maintained in the department. Computer data can also be used to analyze student performance in a particular activity. Athletic simulations of stop action games such as golf, softball, or volleyball are popular with secondary students and allow strategies of play to be tested and investigated for decisions. In addition, programs may be written by students to underscore the teaching of concepts. Many benefits are derived when the student via the program must teach the computer exactly what to do. Here, a necessary transition must be made from mental knowledge and benefits of an activity to the physical engagement of the activity. (WCM)
I. INTRODUCTION

The computer is described as a machine which assists us in the mental tasks thus expanding our abilities and capabilities. The computer is fast, accurate, and stupid while man is slow, inaccurate, and brilliant. Although its application to the "physical" world is not readily apparent, the computer can serve as a viable instructional tool in this process of educating the physical being of each individual student. By the very nature of activities related to physical education, the role of the computer is supportive in nature with respect to the curriculum. Physical education implies physical activity, and normal computer use is not characterized as a physical activity. The purpose of this article is to explore various applications which either could be or are being accomplished using the computer in the physical education curriculum.

When one examines the amount of time spent in a life span of seventy years, some interesting statistics emerge. The average person spends one thirty-fifth (3%) of their life on formal education preparing them for the one-seventh (14%) of their life spent working at some occupation. Figuring in one-third of a lifetime for biological necessities such as sleeping and eating; fully, one-half (50%) of our life is left to discretionary activities and recreation. Thus, there exists a need in the formal education process for preparing students for half of their lives. This need is partially served by physical education and recreation courses offered at both the elementary and secondary levels. In this presentation, discussion will center on computer applications relative to physical education and related recreational activities.

Typically, education in a physical activity incorporates not only the actual play, but instruction of rules, optimal strategies, general feel of play, physical as well as other benefits, and skills development. The computer is not directly involved in the play of the activity, hence it serves a supportive function. In
the area of developing an understanding of rules, strategies, and benefits the computer can make significant contributions via similar modes of instructional applications used in other areas. Transfer of the learning must take place when the student applies the training to an actual physical activity. Because there does not necessarily exist a direct correlation between the acquisition of intellectual concepts necessary to function in an activity and the actual application of these principles in the participation of the activity, the computer assisted instruction type of uses are more prevalent in other areas than physical education. Knowledge of the skills does not imply the ability to effectively execute skills (acquisition of a kinesthetic sense). In general, strategy execution and skill development areas of instruction are best left for students to be directly involved in the activity as opposed to forced computer usage where the computer is not necessarily the best mode for teaching these facets. Physical education courses provide their own laboratory experience via the physical education facilities thus not needing the "computer lab" as in many other subject areas. However, this does not mean that there do not exist constructive instructional computer uses where the computer is used directly in the physical education curriculum.

II. Role of the Computer in Physical Education

When examining types of computer applications in the physical education curriculum, not all modes of usage are applicable to this field. Both the drill and tutorial uses appear to offer few benefits in this area. Rules for an activity may be learned via computer drill however, the amount of the necessary time utilized to accomplish this for a class will probably be too great to consider this as a viable use. Individualized computer drill on exercises and their physiological benefits can be useful as an instructional means of learning activities which strengthen all areas of the body for maintaining life-long physical fitness. To reiterate, for this instruction to be effective the necessary transition must be
made from the mental knowledge and benefits of the activity to physically doing the activity.

Computer problem-solving uses fall into two categories. Programs which have been written to solve a particular problem may be continually used as the same situation is confronted. These uses require no knowledge of programming by the user. The following is a sample run of a program which generates round robin schedules for an entered number of teams.

```
GET SCHEDL1
RUN SCHEDL1

ROUND ROBIN SCHEDULE
INPUT # TEAMS? 6

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PERIOD 1
GAME HOME AWAY
1   1  2
2   5  3
3   6  4

PERIOD 2
GAME HOME AWAY
4   3  1
5   6  2
6   4  5

PERIOD 3
GAME HOME AWAY
7   1  4
8   2  3
9   5  6

PERIOD 4
GAME HOME AWAY
10  5  1
11  4  2
12  3  6

PERIOD 5
GAME HOME AWAY
13  1  6
14  2  5
15  3  4

DONE
```
Other management types of assistance can be offered the physical education teacher such as using the computer to schedule the various school facilities with the physical education classes. Although the computer is not being directly used in the instructional process, it is supporting and assisting the teacher in performing the task of teaching. Additionally, programs may be written by students to underscore the teaching of concepts. Many benefits are derived when the student via the program must teach the computer exactly what to do. An example is included of a student-written bowling scoring program.

```
10 DEF A(25)
20 FOR X=1 TO 22 STEP 2
30 LET A(X)=INT(15*RND(0))
40 IF A(X)<4 OR A(X)>10 THEN 30
50 IF A(X)=10 THEN 110
60 LET A(X+1)=INT(15*RND(0))
70 IF A(X+1)>9 THEN 60
80 IF A(X)+A(X+1)>10 THEN 60
90 NEXT X
100 GOTO 130
110 LET A(X+1)=0
120 GOTO 90
130 PRINT "FRAME","1ST BALL","2ND BALL","SCORE"
140 LET S=0
150 LET X=F=1
160 PRINT F,
170 IF A(X)=10 THEN 270
180 PRINT A(X),
190 IF A(X)+A(X+1)=10 THEN 330
200 PRINT A(X+1),
210 LET S=S+A(X)+A(X+1)
220 PRINT S
230 IF F=10 THEN 360
240 LET X=X+2
250 LET F=F+1
260 GOTO 160
270 PRINT "STRIKE","***",
280 IF A(X+2)=10 THEN 310
290 LET S=S+A(X)+A(X+2)+A(X+3)
300 GOTO 220
310 LET S=S+A(X)+A(X+2)+A(X+4)
320 GOTO 220
330 PRINT "SPARE",
340 LET S=S+A(X)+A(X+1)+A(X+2)
350 GOTO 220
360 IF A(19)=10 THEN 390
370 IF A(19)+A(20)=10 THEN 460
380 GOTO 540
```

CONTINUED ON NEXT PAGE
390 IF A(21)=10 THEN 430
400 IF A(21)+A(22)=10 THEN 510
410 PRINT "EXTRA BALLS:"A(21),A(22)
420 GOTO 540
430 IF A(23)=10 THEN 530
440 PRINT "EXTRA BALLS: STRIKE",A(23)
450 GOTO 540
460 IF A(21)=10 THEN 490
470 PRINT "EXTRA BALL:"A(21)
480 GOTO 540
490 PRINT "EXTRA BALL: STRIKE"
500 GOTO 540
510 PRINT "EXTRA BALLS:"A(21),"SPARE"
520 GOTO 540
530 PRINT "EXTRA BALLS: STRIKE STRIKE"
540 PRINT
550 PRINT "END OF GAME"
560 END

RUN

<table>
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<th>SCORE</th>
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<td>***</td>
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END OF GAME
DONE
RUN

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EXTRA BALL: 6

END OF GAME
DONE
The backbone of many competitive game-type activities to assist in sustaining interest is the myraid of statistics which are maintained. The process of storing, cumulating and calculating data, and printing formatted reports are comfortably handled by the computer. The information received from the data not only may be used for dissemination purposes but for analysis of a student's performance in a particular activity. The following program on individual basketball statistics is part of a package of athletic statistics programs for a variety of activities.

The 16 data items for the respective players are entered in the following order:

3 Defensive categories
3 Neutral categories
3 Minus categories
5 Offensive categories
   (Assists, FGM, FGA, FTM, FTA)
2 Time categories
   (Quarters, Games)

The three specific items to be measured in the first three general categories are left to the discretion of the user.

Calculated Statistics are derived in the following manner:

\[
\begin{align*}
D &= \text{Total Defense} = D1 + D2 + D3 \\
N &= \text{Total Neutral} = N1 + N2 + N3 \\
M &= \text{Total Minus} = M1 + M2 + M3 \\
O &= \text{Total Offense} = \text{Assists (A)} + \text{Points (P)} \\
\text{FGZ} &= \frac{\text{FGM}}{\text{FGA}} \times 100 \\
\text{FTZ} &= \frac{\text{FTM}}{\text{FTA}} \times 100 \\
P &= \text{Points} = 2 \times \text{FGM} + \text{FTM} \\
P/G &= \text{Points per game} \\
D/Q &= \text{Defense per quarter} \\
N/Q &= \text{Neutral per quarter} \\
O/Q &= \text{Offense per quarter} \\
+/-Q &= \text{Plus per quarter} = (D + N + 0)/Q \\
-/-Q &= \text{Minus per quarter} = M/Q \\
T/Q &= \text{Total per quarter} = (D + N + O - M)/Q
\end{align*}
\]

Team Totals for each item are calculated by taking the sum of all the players.
BASKETBALL STATISTICS

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<th>D2</th>
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DONE
An information retrieval process may be used for the storing, accessing, and examining of large quantities of data. An inventory data file sample is included to illustrate how accurate records of the numerous supplies may be maintained in the physical education department. This may be done on an interactive basis using the same programs designed for storing and analyzing survey results in a social science class. The key to this use is the coding of the data so that it may be extracted in a meaningful manner.

INVENTORY CODING

FILE: INVENT - INFORMATION RETRIEVAL

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<th>QTY.</th>
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<th>CONDITION</th>
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INVENTORY

FILE: INVENT-INFORMATION RETRIEVAL

20 Character Name Maximum
6 Data Categories
ALPHABETIZED

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<td>2</td>
<td>10</td>
<td>69</td>
<td>3</td>
</tr>
<tr>
<td>Baseballs MA L2</td>
<td>1</td>
<td>4</td>
<td>5</td>
<td>24</td>
<td>73</td>
<td>4</td>
</tr>
<tr>
<td>Footballs MA L</td>
<td>9</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>73</td>
<td>4</td>
</tr>
<tr>
<td>Volleyballs REC R</td>
<td>6</td>
<td>7</td>
<td>1</td>
<td>9</td>
<td>65</td>
<td>2</td>
</tr>
<tr>
<td>Handballs REC R</td>
<td>7</td>
<td>7</td>
<td>5</td>
<td>6</td>
<td>60</td>
<td>3</td>
</tr>
<tr>
<td>Volleyballs WA L</td>
<td>6</td>
<td>5</td>
<td>4</td>
<td>12</td>
<td>71</td>
<td>3</td>
</tr>
</tbody>
</table>
GET-$INFRET
RUN
INFRET

WHAT IS THE NAME OF YOUR INFORMATION FILE? INVENT

OPTION? SORT

SORT ON WHICH DATA NUMBER? 5
0     GOLF BALLS REC
60    HANDBALLS REC R
63    BASKETBALLS REC R
65    VOLLEYBALLS REC R
66    SOCCER BALLS REC
66    FOOTBALLS MPE R
67    SOFTBALLS PE R
68    TENNIS BALLS PE
69    FOOTBALLS MA R
69    BASKETBALLS WPE R
70    BASKETBALLS MPE R
70    SOCCER BALLS MA
70    BASKETBALLS MA L1
71    TENNIS BALLS A
71    PUCKS
71    BASEBALLS MA L1
71    VOLLEYBALLS WA L
72    BASKETBALLS WPE L
72    BASKETBALLS WA L
73    BASEBALLS MA L2
73    GOLF BALLS A
73    FOOTBALLS MA L
73    BASKETBALLS MA L2

OPTION? STOP
DONE
Athletic simulations are very popular with many secondary students. The competitive and accurate models which approximate a game used in many simulations provide a wealth of recreational activities which stimulate and challenge the users. The best activities for simulations are stop-action in nature; by this we mean activities which have a natural pause in their pattern of play such as golf, softball, or volleyball, at which time a decision may be entered. Various strategies of play may be tested using the simulation in an investigation for a best set of decisions. The following simulation is of an 18-hole golf course of which only the first hole of play is shown in the sample.

GET-*GOLF
RUN
GOLF

WELCOME TO THE TIES. TIMESHARING 18 HOLE CHAMPIONSHIP COURSE
TO GET A DESCRIPTION OF CLUBS, ETC. TYPE 0 FOR A CLUB NK. WHEN REQUESTED

WHAT IS YOUR HANDICAP ?9
OH-OH, A HOT SHOT!
DIFFICULTIES AT GOLF INCLUDE:
0=HO[X], 1=SLICE, 2=POOR DISTANCE, 4=TRAP SHOTS, 5=PUTTING
WHICH IS YOUR WORST ?4

READY TO GO. YES
YOU ARE AT TE. OF: HOLE 1 , DISTANCE 361 YARDS PAR 4

ON YOUR RIGHT IS ADJACENT FAIRWAY.
ON YOUR LEFT IS ADJACENT FAIRWAY.

WHAT CLUB DO YOU WANT ?0

CONTINUED ON NEXT PAGE
HERE'S YOUR BAG OF CLUBS

WOODS (FULL SWING ONLY)
1. DRIVER
2. BRASSIE
3. SPOON

IRONS (FULL SWING ONLY)
12. TWO IRON

IRONS (LESS THEN FULL SWING)
22. TWO IRON - PARTIAL SWING

When you reach the green it will be assumed that you are using a putter. The putter potency number refers to the strength with which the ball is putted. Use numbers greater than zero, increasing the number for greater distance.

You will be asked for 'percent full swing' on clubs 22-29. This should be a number from 1 to 9.

WHAT CLUB DO YOU WANT?

Shot went 251 yards — is 110 yards from hole.
Ball is 1 yard off line in fairway.

WHAT CLUB DO YOU WANT?

To much club, you are past hole.
On green 60 feet from pin, putter potency number 7
Putter short.
On green 28 feet from pin, putter potency number 3
Putter short.
On green 15 feet from pin, putter potency number 3
Putter short.
On green 2 feet from pin, putter potency number 1
You holed it.

Your score on hole 1 was 6.
Many supportive curriculum computer applications are classified in the general area of management. The computer, although not directly used by the student, is used by the teacher as an assistant in handling data and organizing classes. This appears to be the general area where the computer can play a significant role in the physical education curriculum. To illustrate these types of applications, two examples will be considered.

Many schools participate in the National Youth Fitness Testing Program sponsored by AAHPER. A time-share computer program was written which stores the test results, assigns percentile ranks to these results, computes a ranking mean as an index of overall fitness, and prints both a National Youth Fitness Report Card for each student and a teacher summary report for each class.

The following is a sample report card printed by the computer:

<table>
<thead>
<tr>
<th>STUDENT NAME</th>
<th>DOE JOHN</th>
<th>SCHOOL</th>
<th>NORTH</th>
<th>CLASS</th>
<th>7</th>
<th>STUDENT NO.</th>
</tr>
</thead>
<tbody>
<tr>
<td>SEM.</td>
<td>SHUTTLE RUN</td>
<td>SIT UPS 2 MINUTES</td>
<td>PULL UPS</td>
<td>BROAD JUMP</td>
<td>50 YARD DASH</td>
<td>SOFT BALL THROW</td>
</tr>
<tr>
<td>SCORE</td>
<td>%</td>
<td>SCORE</td>
<td>%</td>
<td>SCORE</td>
<td>%</td>
<td>SCORE</td>
</tr>
<tr>
<td>1</td>
<td>9.9</td>
<td>90</td>
<td>70</td>
<td>95</td>
<td>6</td>
<td>85</td>
</tr>
<tr>
<td>2</td>
<td>9.8</td>
<td>95</td>
<td>73</td>
<td>95</td>
<td>6</td>
<td>85</td>
</tr>
</tbody>
</table>

FIRST SEMESTER MEAN = 89  
SECOND SEMESTER MEAN = 91
Physical education teachers have been leaders in the individualized approach to develop requisite skills for effective participation in an activity. The problem of grouping students for work on particular skills is often time consuming. However, the computer can offer the beleaguered teacher valuable assistance in the organization and management of a skills development period. Such a program does exist called ILA (Individualized Learning Activities). Objectives or skills are identified and status on each for individual students are monitored and entered into the computer. The teacher may then have the computer locate students needing work on a particular skill and group them together, thus scheduling students for a skills development session.

GET-ILA
RUN
ILA

UNIT NAME? JOHNS
S0 = 52 S1 = 2 T0 = 11

>ROS
NO. NAME
1 AHRENS RICHARD
2 ANDERSON MABEL
3 GREEN TIM
4 JOHNSON JAMES
5 JONES JONATHAN
6 MACK BONNIE
7 MILLER MIKE
8 RUTZ ELIZABETH
9 SCHMIDT JENNIFER
10 SMITH JOHN
11 THOMPSON NORMAN

>ADD-C,1,ON,14
>ADD-C,2,ON,6
>SIZ

GROUP SIZE
1 4
2 4
3 3

>LIST

GROUP 1
2 ANDERSON MABEL
3 GREEN TIM
6 MACK BONNIE
10 SMITH JOHN

GROUP 2
4 JOHNSON JAMES
5 JONES JONATHAN
8 RUTZ ELIZABETH
11 THOMPSON NORMAN

GROUP 3
1 AHRENS RICHARD
7 MILLER MIKE
9 SCHMIDT JENNIFER
III. SUMMARY

Current usage is minimal in physical education when compared to other disciplines, however, present trends indicate a substantial growth in the use of the computer in a supportive role in assisting the teacher in the management of instructional activities. There exists a need for the development of programs, and materials which use the computer effectively in the physical education curriculum, and the subsequent sharing of these ideas via articles and conference presentations.

NOTE: The programs used to illustrate various modes of computer usage were run on one of the Hewlett Packard 2000C/F Timeshare Systems at TIES. TIES (Total Information for Educational System) is a regional Minnesota cooperative network of thirty-four elementary/secondary and vocational-technical school districts providing data processing services for administrative, instructional, and research applications utilizing an on-line integrated data base.

JAMES SYDOW
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TIES Project
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April 1974