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ABSTRACT

This handbook is the third in a series of five competency-based resource guides on microcomputer applications for vocational teachers. The 13 units of instruction in this handbook are concerned with the content of the 14 competencies included in the category, "Planning, Executing, and Evaluating Competency-Based Instruction." Units are designed to prepare teachers to do the following: (1) differentiate among applications of computer-based instruction (CBI), (2) assess students' needs for specific CBI applications, (3) develop lesson plans for incorporating CBI, (4) select appropriate software for specific instructional purposes, (5) modify software, (6) design software, (7) prepare instructional materials to accompany software, (8) modify software documentation for specific instructional use, (9) orient students to CBI, (10) execute CBI, (11) individualize instruction with CBI, (12) assess students' microcomputer skills, and (13) evaluate and modify CBI based on student achievement. Components of each unit include unit and specific objectives, informative material, sample forms and evaluation measures, examples, a summary, achievement indicators, and a list of references. (YLB)

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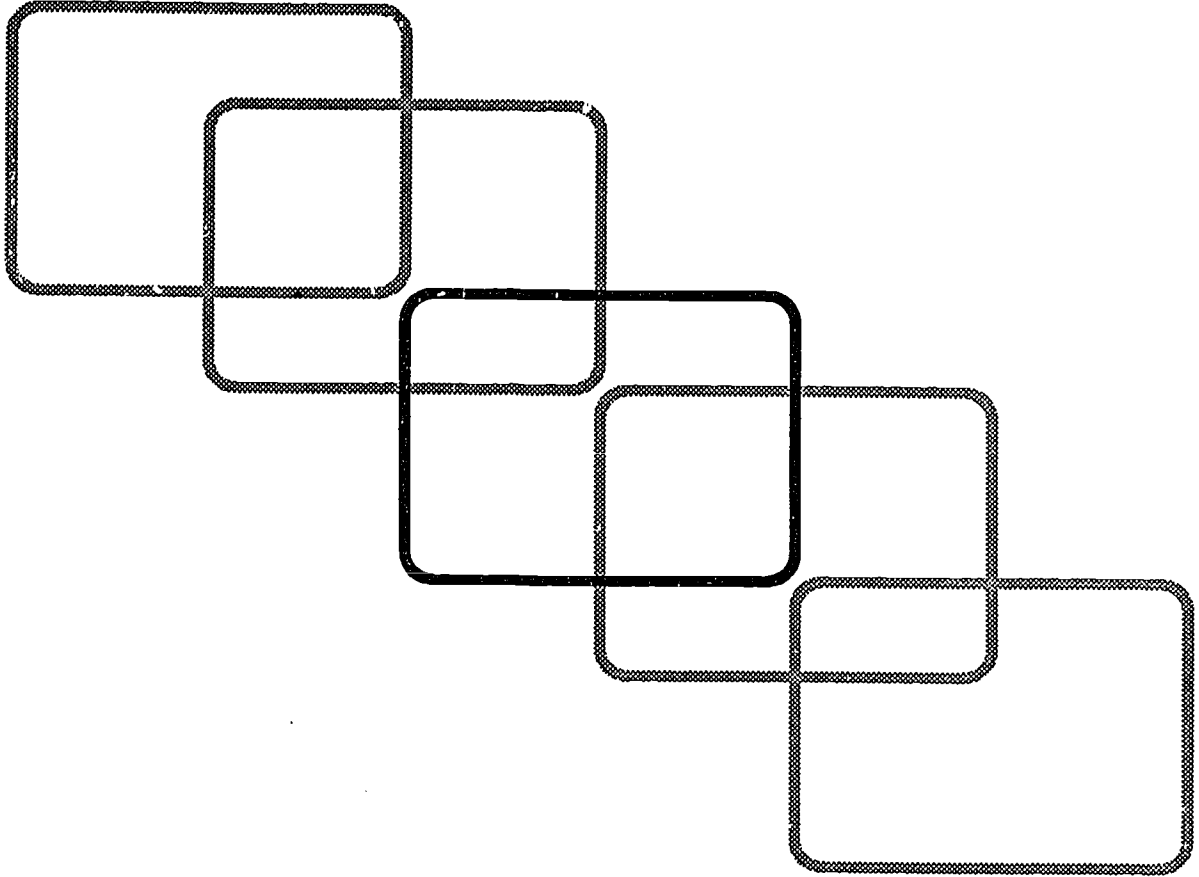


**Planning, Executing,
and Evaluating
Competency-Based
Instruction**

Illinois
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Education

Adult,
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Microcomputer Applications for Vocational Teachers: A Competency-Based Approach - Book C

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**Planning, Executing, and
Evaluating Competency-Based
Instruction**

**Illinois
State Board
of Education**

**Department of
Adult,
Vocational and
Technical Education**

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In cooperation with

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Department of Adult, Vocational,
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June, 1986

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The foundation for this handbook was laid by a panel of Illinois vocational educators. Individuals were selected to serve on this panel on the basis of demonstrated leadership in the use of microcomputers. Utilizing a structured process known as DACUM (Develop A Curriculum), this group developed the initial competency list for the handbook and field tested the product. The DACUM participants included:

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INTRODUCTION

Microcomputer Applications For Vocational Teachers: A Competency-Based Approach

BY:

DR. GENE L. ROTH

DR. DENNIS G. TESOLOWSKI

Historically, vocational educators have had to cope with the problem of keeping pace with technology. Preparing students for a workplace that is continually changing is a constant reminder to vocational instructors that they do not have the luxury of resting on previously learned work skills and knowledge. Vocational educators must keep abreast of contemporary developments within their vocational area of expertise.

This concern for technical updating is not limited to industrial or business applications of technology. In addition to concerns about preparing students for a changing world of work, vocational teachers must contend with applications of new instructional technologies. Many vocational teachers are currently struggling with how to integrate computer-based instruction into their classrooms and laboratories.

The rapid influx of microcomputers into vocational classrooms and laboratories has caught many vocational educators unprepared to effectively utilize this contemporary instructional technology. As educational systems continue to acquire computer technology, many vocational instructors are saying, or at least thinking, "Where do we start with these machines?" Microcomputers are often purchased for vocational programs which are staffed by personnel that have not been appropriately trained in the technology. Their knowledge of hardware and software may be quite limited. A resulting danger is that microcomputers will be misused or not used at all because vocational teachers have been inadequately acquainted with educational computing (Pratscher, 1983).

This concern about providing vocational educators with pertinent information related to microcomputer applications has brought about a collaborative effort between two state offices of vocational education. The Illinois State Board of Vocational Education, Department of Adult, Vocational, and Technical Education and the Idaho State Board of Education, Division of Vocational Education are jointly supporting this research and development project entitled "Microcomputer Applications for Vocational Teachers: A Competency-Based Approach." This project, which has been conducted at Idaho State University, features a systematic approach to the identification of microcomputer competencies for vocational instructors (Roth & Tesolowski, in press).

This is a shortened version of an article that appeared in *The Computing Teacher*, 12(3), November 1984. Reprinted by permission.

The DACUM Process: A Method for Identifying Microcomputer Competencies

The DACUM (Developing A Curriculum) process (Adams, 1975) was utilized by this project as a foundation for the development of competency-based materials on microcomputer applications for vocational instructors (Rott Tesolowski, Rankin, & Blackman, 1984). This procedure is based on three assumptions: (a) expert workers can define and describe their job more accurately than anyone else; (b) any job can be effectively described in terms of the tasks that successful workers in that occupation perform; and (c) all tasks, in order to be performed correctly, demand certain knowledge and attitudes from workers (Miller-Beach, 1980).

Utilization of the DACUM process required the project to assemble a panel of 12 vocational educators. The 12 members, all from Illinois, included 4 secondary vocational instructors, 4 post-secondary vocational instructors, 2 secondary vocational administrators, and 1 representative of the Department of Adult, Vocational, and Technical Education. In addition to being practitioners in the field of vocational education, these individuals have been recognized as leaders in the state of Illinois at applying microcomputers in their work. The challenge for the DACUM panel was to identify competencies specific to the application of microcomputers in vocational education. This was accomplished through a process of competency identification and consensus decision-making. The activity involved the panelists and the facilitator in two days of difficult work. However, the panelists were rewarded for their efforts as competencies were established for each category and the final profile of microcomputer applications for vocational educators unfolded. Furthermore, the panelists began to realize that they had increased their own personal levels of knowledge about the application of microcomputers in vocational education.

RESULTS OF THE DACUM PROCEDURE

Most vocational teachers recognize the vast potential of microcomputers in vocational education. However, many professionals have had difficulty identifying the precise role of the machine in their professional lives. The DACUM profile provides teachers with a graphic portrayal of how the microcomputer integrates with the overall schema of vocational instruction and curricula. The profile consists of 47 competencies clustered within the following 5 categories (Table 1):

- A. Developing a personal plan for microcomputer competency.
- B. Integrating computer-based instruction (CBI) into vocational curricula.
- C. Planning, executing, and evaluating CBI.
- D. Planning and organizing vocational education learning environments for CBI.
- E. Performing classroom management functions with CBI.

VOCATIONAL TEACHER COMPETENCY PROFILE FOR MICROCOMPUTER APPLICATIONS

Illinois State Board of Education
Department of Adult, Vocational and Technical Education

Dr. Gene L. Roth
Project Director

Idaho State Board of Vocational Education
Division of Vocational Education

Dr. Dennis G. Tocolowski
Dr. Roger A. Rankin
Dr. Harold S. Blackman

Competencies

Category										
A	Developing a Personal Plan for Microcomputer Competency	A.1 Define Elements of a Local Education Agency (LEA) Plan for Computer Based Instruction (CBI) 3.67	A.2 Define the Vocational Instructor's Role in the LEA Plan for CBI 4.00	A.3 Conduct a Personal Assessment of Microcomputer Competency 3.90	A.4 Set Personal Goals for Microcomputer Competency 4.11	A.5 Construct a Personal Plan for Microcomputer Competency 4.06	A.6 Implement a Personal Plan for Microcomputer Competency 4.16	A.7 Evaluate Personal Plan Based on Computer Innovations 3.87	A.8 Modify Personal Plan as Needed 3.97	
B	Integrating CBI into Vocational Curricula	B.1 Identify Job-Specific Applications of Microcomputers for Inclusion in Vocational Curricula 4.42	B.2 Identify Educational Applications of Microcomputers for Inclusion in Vocational Curricula 4.37	B.3 Develop a Plan to Apply CBI to Vocational Curricula 4.38	B.4 Demonstrate an Awareness of Microcomputer Software for Developing Computer Based Vocational Curricula 4.22	B.5 Write Specifications for Hardware/Software Based on Vocational Curricula Requirements 3.77	B.6 Implement a Plan to Apply CBI to Vocational Curricula 4.26	B.7 Evaluate Applications of CBI in Vocational Curricula Based on Innovation in Computer Technology & Work 3.95	B.8 Modify Applications of CBI in Vocational Curricula as Needed 4.04	
C	Planning, Executing & Evaluating CBI	C.1 Differentiate Among Applications of CBI (Such as Drill & Practice, Tutorial, Simulation & Problem Solving) 3.84	C.2 Assess Students Needs for Specific CBI Applications 4.15	C.3 Develop Lesson Plans Incorporating CBI 4.22	C.4 Select Appropriate Software for Specific Instructional Purposes 4.61	C.5 Modify Simple Software for Specific Instructional Purposes 3.71	C.6 Develop Software for Specific Instructional Purposes 3.38	C.7 Prepare Instructional Materials to Accompany Software 4.22	C.8 Modify Software Documentation for Specific Instructional Purposes 3.77	
	Planning, Executing & Evaluating CBI (Con't)	C.9 Orient Students to CBI 4.43	C.10 Execute CBI 4.39	C.11 Individualize Instruction with CBI 4.17	C.12 Assess Student Microcomputer Skills 4.02	C.13 Evaluate Effectiveness of CBI Based on Student Achievement 4.21	C.14 Modify CBI as Needed 4.10			
D	Planning & Organizing the Vocational Education Learning Environment for CBI	D.1 Develop a Plan to Implement CBI in Vocational Education Learning Environments 4.11	D.2 Schedule CBI Activities 3.97	D.3 Project Resource Needs (Supplies, Materials, Equipment) for CBI 4.02	D.4 Provide Microcomputer Maintenance 3.69	D.5 Establish Microcomputer User Security 3.72	D.6 Establish Microcomputer Hardware/Software Security 3.84	D.7 Create Authorized Back-up Copies of Microcomputer Software 4.40		
E	Performing Classroom Management Functions with CBI	E.1 Determine Classroom Management Activities to be Performed with CBI 4.13	E.2 Select Software for Classroom Management Activities 4.28	E.3 Prepare Software for Classroom Management Activities 3.57	E.4 Maintain Classroom Rosters 3.44	E.5 Maintain Attendance Records 3.39	E.6 Generate Tests 3.83	E.7 Score Tests 3.53	E.8 Record Grades or Performance Progress 3.88	
	Performing Classroom Management Functions with CBI (Con't)	E.9 Maintain Inventory of Teaching Supplies, Materials & Equipment 3.91	E.10 Manage Vocational Student Organizations 3.49	Competency Rating Scale The relative importance of these 47 competencies was determined by surveying a national sample of 134 vocational educators. Vocational instructors included in this sample were identified as experts at applying microcomputers in their programs by their respective state supervisors. Ninety-seven (97) vocational teachers (72%) responded to this survey. The following vocational disciplines were represented by this sample: agriculture; business; home economics; marketing and distribution; trade and industrial; and health occupations education. Mean (x̄) competency ratings were derived from respondents' ratings based on the following scale: 1 = No Importance 2 = Minimal Importance 3 = Average Importance 4 = High Importance 5 = Extreme Importance						

The content of these 47 competency statements was refined and validated through a formative process. After the DACUM panel had generated the core of this profile, the competency statements were scrutinized and revised by: (a) members of the project team at Idaho State University; (b) a group of vocational educators in Idaho; (c) consultants of the Illinois Department of Adult, Vocational, and Technical Education; and (d) supervisors and staff members of the Idaho Division of Vocational Education.

A survey was conducted by this project's research team to ascertain the relative importance of each of the 47 microcomputer competencies. The survey population consisted of a national sample of 134 vocational educators. These instructors were identified by their respective state supervisors as leaders in their states at applying microcomputers to the roles and responsibilities of their teaching jobs. Ninety-seven vocational teachers (72%) responded to the survey.

Ratings for each competency are listed on the *Vocational Teacher Competency Profile for Microcomputer Applications* (Table 1). Mean (x) competency ratings were derived from respondents' ratings on the following scale: (1) no importance, (2) minimal importance, (3) average importance, (4) high importance, and (5) extreme importance. Vocational teachers can consider these ratings as benchmarks as to how their peers view microcomputers in vocational teaching.

Instructional units have been packaged in this competency-based resource guide on microcomputer applications for vocational teachers. This handbook is being disseminated by the Curriculum Publications Clearinghouse, Western Illinois University, Macomb, IL 61455.

UTILIZING A "PROFESSIONAL DEVELOPMENT PLAN" TO INTEGRATE MICROCOMPUTERS INTO VOCATIONAL CURRICULA AND INSTRUCTIONAL STRATEGIES

Vocational educators can carefully examine Category A in the profile (Table 1) and begin to envision how the content of the eight competencies included in this category will enable them to develop a personal plan for microcomputer competency (Tesolowski, Wallin, Roth, & Rankin, 1984). Competency A.1 defines the elements and planning strategies involved in developing a comprehensive plan for implementing computer-based instruction (CBI) in a local education agency (LEA). This instructional unit presents practices that have been implemented in select exemplary programs in the nation. Competency A.2 explores the vocational instructor's role in the plan identified for implementing CBI in the LEA (A.1). Varying practices are reviewed in Unit A.2, which will assist vocational teachers in preparing a microcomputer implementation plan.

The content included in Competency A.3 enables vocational educators to assess their personal levels of microcomputer competency. Self-report test items are included for a representative set of pertinent content areas or domains related to computer literacy. Vocational teachers can identify their strengths and weaknesses on the basis of this self-assessment measure. Upon completing this diagnostic-prescriptive instrument, vocational educators can profile their results on a chart. On the basis of their strengths and weaknesses, vocational instructors can set initial personal goals (Competency A.4) for microcomputer competency.

Competency A.5 facilitates the development of a personal plan for microcomputer competency. Vocational teachers who participate in this unit of instruction are encouraged to develop a Professional Development Plan that includes long-range goals; short-term objectives; and the identification of instructional strategies, methods, techniques, materials, and resources that will facilitate the accomplishment of these goals and objectives. In addition, participants will monitor their timeline in regards to when they initiate and conclude selected learning activities. Finally, vocational teachers will record whether or not they believe they have successfully achieved their goals and objectives. Competencies A.6, A.7, and A.8 assist vocational educators in working through the processes of implementing, evaluating, and modifying their personal plans for microcomputer competency.

After vocational instructors construct their Professional Development Plans for microcomputer competency (A.5), they can implement their plans by fully utilizing all of the units of instruction for the 39 competencies clustered in Categories B, C, D, and E. An alternative to using all of the units of instruction is to selectively choose units based on the needs identified in the personal plans, their districts' or schools' needs, and their personal interests (Roth, Tesolowski, Rankin, & Blackman, 1984).

THE NEED FOR A PERSONAL COMMITMENT TO APPLY MICROCOMPUTERS IN VOCATIONAL EDUCATION

Competencies identified for this handbook can serve as an invaluable starting point for vocational instructors who want to integrate microcomputers into their professional future. Vocational educators can visually inspect the categories and respective competencies, examine their own teaching situations, and begin to formulate their own individualized plans for applying microcomputers in their programs as well as in their personal lives.

The stage is now set for vocational educators to decide where and how microcomputers will fit into their teaching futures. Competencies identified through this research project can enhance their perspectives of the potential of microcomputers in vocational education. However, vocational teachers must individually develop personal plans for microcomputer competency that will serve their professional needs as well as the needs of their respective programs.

The decision to develop a plan or not is of utmost importance. Plans can be modified as teachers' computing interests and programmatic needs change with the times. Whatever vocational educators personally decide to do, they should not allow this contemporary technology to pass them by. All vocational teachers must critically examine the role of microcomputers in their professional lives.

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Unit 1

Differentiate Among Applications of Computer-Based Instruction

UNIT OBJECTIVE

Upon completion of this unit, the learner will be able to differentiate among different applications of computer-based instruction

SPECIFIC OBJECTIVES

Upon completion of this unit, the learner will:

- 1) Describe how educational computing relates to the concept "time on task" of vocational students in the learning environment.
- 2) Explain how the limitations of existing software affect educational applications of microcomputers in vocational education.
- 3) Differentiate (in terms of educational applications) between tutorial software and drill-and-practice software.
- 4) Discuss how problem-solving software can be integrated into vocational curricula and instruction.
- 5) Provide examples of how gaming software may be implemented in vocational education.
- 6) Discuss the use of simulations in vocational curricula and instruction.

Differentiate Among Applications of Computer-Based Instruction

BY: DR. ROGER A. RANKIN

Vocational teachers should subscribe to one important belief: microcomputers are effective tools in vocational curricula and instruction. Teachers need to gain insights regarding the value of using microcomputers for instructional purposes. Microcomputers are not mysterious configurations of chips, drives, and screens that solve the problems generated by learning situations. Microcomputers are, however, tools that contribute to improved learning when they are appropriately applied.

The nature of vocational education creates a favorable learning environment for meshing CBI and vocational curricula. The focus of vocational curricula is a set of predetermined competencies that enable students to develop marketable job skills. The competency-based method for vocational curricula permits instructors to identify specific applications of microcomputers in curricula and instruction. The knowledgeable teacher working within a well defined curriculum can identify meaningful uses of computer hardware and software. Vocational instruction (especially CBI) can double student achievement found with traditional instructional methods when materials are carefully selected in advance and when lessons are based upon parameters of student performance (McKeachie, 1974).

The advantage of using microcomputers as learning tools revolves around the concept of "time on task." Educational computing affords students ample opportunities to maintain direct contact with vocational curricula. When students expend more time and effort learning, their levels of achievement increase. The concept of time on task is a more accurate predictor of achievement than many other variables. Microcomputers are very effective for creating high levels of attention in students. Educational computing features visual and other sensory feedback as well as capabilities to provide immediate responses to students. Microcomputers can and do demand high levels of engagement from students (Jernstedt, 1983).

As with any teaching method, the use of microcomputers cannot stand alone, inclusive of the total instructional needs of students, and independent from other segments of the educational setting. Vocational teachers play key roles in the application of microcomputers. Instructors should promote the transfer of knowledge students gain from educational computing to other components of vocational curricula.

PROBLEMS ASSOCIATED WITH EDUCATIONAL SOFTWARE

The history of educational computing indicates that the application of microcomputers in schools has not reached its instructional potential. In fact, educational computing is a relatively new endeavor that continues to evolve and expand at a rapid pace. Yet computer-based instructional materials and methods appear to be having a minimal impact on the problems which plague vocational instructors. There are numerous explanations for this lack of success, but a readily identifiable reason is the deficiency in the quality and range of software for vocational curricula and instruction (Roblyer, 1983).

Perhaps the most obvious problem with existing software is not that it is ineffective, but that it is limited in what it addresses. Tutorials and software series which thoroughly cover select topics are not as common as one-skill modules and lessons (Becker, 1983). Quite frankly, much of the educational software developed has proven to be ineffective in the classroom.

It is possible that instructors who experimented with early software packages became disenchanted with what was available at the time. Vocational teachers are encouraged to keep up-to-date with the software market. The potential for microcomputers to contribute to vocational curricula and instruction is tremendous. A handicap has been and continues to be a limited supply of software for vocational education. However, as more research and development is devoted to the role of CBI in vocational education this problem will recede.

EDUCATIONAL APPLICATIONS OF MICROCOMPUTERS

Five educational applications of microcomputers are addressed in this unit:

1. Drill and practice
2. Tutorial
3. Problem solving
4. Simulation
5. Gaming

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Drill and Practice

Historically, most CBI activities have been drill and practice or question and answer tutorials. These software designs continue to be major modes for educational computing (Zinn, 1978). As the name implies, this type of software provides drill or practice exercises for learning facts or principles. Drill-and-practice software functions best as a supplement to other forms of vocational instruction. These software packages permit students to master or refine vocational education concepts or principles at a microcomputer work station. Teachers who use drill-and-practice programs assume that learners possess a certain degree of knowledge and that this type of software will reinforce that knowledge.

Drill-and-practice programs have considerable merit for learning mathematical concepts in vocational education. For example, after receiving instruction in trigonometry functions, a machine shop student may use a drill-and-practice program at a microcomputer station to reinforce this recently acquired knowledge. The program can branch to a prescribed level of mastery of select trigonometry concepts. The machine shop instructor can verify the student's attainment by a quick check of the response rate (Blum, 1982). Students can use the drill-and-practice programs prior to applying trigonometry in the machine shop laboratory.

Tutorial

Tutorial programs are designed to teach students in similar fashions as instructors. This type of software attempts to simulate a tutor as it introduces lessons, explains, provides hints and examples, asks questions, and evaluates student responses. Additionally, tutorial software gives reinforcement and feedback, and chooses the proper placements for students based on their achievement levels (Hudson, 1980).

Quality tutorial packages demonstrate goal oriented and carefully sequenced patterns. Tutorials are capable of presenting questions, analyzing student answers for patterns of error, and providing remedial instruction to eliminate those errors (Rodrigues, 1984). It is not necessary to augment tutorial software with other types of instruction. Tutorial programs function independently within vocational curricula and do not supplement classroom teaching as do drill-and-practice programs.

Vocational instructors may incorporate tutorial programs for three specific purposes:

- 1) To assign vocational students to tutorial programs if they need enrichment or reinforcement,
- 2) To individualize instruction in order to increase the instructor's role as a facilitator of instruction, and
- 3) To incorporate group discussion and guidance while the course is ongoing on the terminal (Blum, 1982).

Tutorial software and drill-and-practice programs can serve two useful functions for vocational teachers: a) tutorial programs can be used to teach vocational concepts or principles, and b) drill-and-practice programs can provide students with practice activities to reinforce the initial learning of those concepts and principles.

Problem Solving

Instructors in vocational education have a keen sense of the work skills that vocational students need prior to entering the world of work. However, a bank of knowledge or a handful of skills does not ensure a student's success in the workforce. Vocational graduates must perform in a larger arena that requires abilities which transcend all aspects of work: The ability to solve problems and the ability to think something through to its best solution. Methods by which vocational educators can improve problem-solving abilities merit discussion. Some authors believe that the mathematical solution to a problem constitutes a small portion of problem-solving in the real sense. Problem-solving involves gaining an accurate understanding of a problem and identifying realistic alternatives that will lead to the most effective solution of that problem.

For vocational students to develop problem-solving skills, they must deploy a type of cognitive strategy. This strategy will depend to a great extent upon previously learned rules and upon a type of intellectual skill that governs the learner's thinking process. Problem-solving involves the gleaning of sets of rules that the student has previously developed and then creating a new set of rules to solve the problem. The student can then apply this new set of rules to future situations which resemble the newly solved problem (Gagne, 1977).

Problem-solving situations occur when instructions that students receive do not include stated solutions and learners are required to develop them. Solutions which a student must develop have a high rate of retention in the student's memory. Once students have struggled to develop higher order rules to solve a problem, they will not be easily forgotten (Gagne, 1977).

Problem-solving activities in CBI are of two kinds. First, there are problems students can solve with the skills they currently possess. Second, there are those problems that are not readily solved. To solve these problems, the

students must create a higher order of rules, relying on rote memory, experience, and drill-and-practice exercises the student has previously performed. The importance of good problem-solving skills cannot be underestimated because these skills build the cornerstone of an effective worker.

Computer-based instruction provides the potential to create student insights regarding how problems are solved with components of problem-solving models. Microcomputers can acquaint students with a systematic approach to problem-solving. This approach is significantly different from offering students solutions to textbook problems without identifying the steps that lead to the solution of that problem. Problem-solving activities in educational computing can greatly enhance vocational training.

Simulation

The capstone for vocational education is in place when vocational graduates enter the workforce and apply learned skills, knowledge, and attitudes. Vocational teachers strive to provide meaningful learning experiences which "pull together" the ideas presented in curricula and instruction. In accounting, typewriting, and office procedures, business education teachers utilize practice sets. Agricultural teachers utilize student projects. Trade and industry teachers require that students construct something. Many students develop and refine vocational skills through contests in student organizations and through opportunities with cooperative education programs. On a new learning horizon, simulated activities with educational computing provides students with additional opportunities for learning vocational skills, knowledge, and attitudes.

Computer simulations can be valuable learning activities for students who are developing vocational skills. Simulations help students study situations which they would normally be unable to examine because of danger, expense, or length of time. Computer simulations make abstract subjects more concrete, promote learner inquiry, and spark interest in learning (Roberts, 1983).

Vocational instructors can integrate computer simulations into vocational curricula and instruction where they recognize patterns for problem-solving activities. Simulation software can be infused into the classroom or laboratory setting to simulate a real situation. It can dramatize the components of a problem in detail, introduce randomly selected values and events, and predict the results of a particular series of decisions. Simulations can greatly extend and broaden the learning experience of vocational students (Hudson, 1980).

Gaming

Anyone associated with a laboratory of microcomputers, or anyone with a microcomputer in the home, can attest to the fact that playing microcomputer games is extremely popular. Many teachers and administrators are quick to eliminate gaming from computer laboratories. This policy may be at the expense of valuable educational experience for students.

Gaming can be a useful component of an educational program if it provides types of experiences similar to those gained in problem-solving and simulations (Stowbridge & Kugel, 1983). While the exact educational consequences of gaming are difficult to identify, there appear to be intangibles that benefit vocational students. Regardless of the game, students learn strategies for improving their success. These games provide ample pressure for students to win, and yet they do not create excessive worry over failure, as do certain testing situations (Seidner, 1976). Games contribute to the improvement of memory and recall, and require students to think about outcomes before initiating actions.

Additionally, gaming encourages students to formulate more than one approach to problem-solving. Gaming activities challenge students by suggesting that an unsuccessful solution for one problem may be applicable in the next similar situation (Stowbridge & Kugel, 1983). With the right approach, the benefits of games can be combined with educational needs to provide learning alternatives for vocational students.

SUMMARY

This unit explains the educational applications of computer-based instruction. Five applications are discussed:

1. Drill and practice
2. Tutorial
3. Problem solving
4. Simulation
5. Gaming

Drill-and-practice programs require students to have a previous knowledge of fundamentals, rules, or concepts. Drill-and-practice software reinforces the competency levels of users within a given subject.

Tutorial software teaches users the fundamentals, rules, or concepts of a subject without the requirement that students already have knowledge of the topic. Tutorial programs actually work as tutors (or teachers), introducing the subject and providing opportunities for students to initially learn the subject.

Problem-solving programs provide opportunities for students to apply fundamentals, rules, or concepts to situations and to gain additional insights regarding the subject. Problem-solving is not restricted to the mathematical solution of a problem. It includes a greater understanding of a problem and the realistic alternatives that lead to an effective solution of that problem.

Simulations can be the capstone to training in vocational education. Simulation activities require students to apply learned skills, knowledge, and concepts. Simulations provide meaningful exercises which involve students in analysis and synthesis of the elements of a vocational discipline.

Gaming is a broad area which provides entertainment via microcomputers. While games are not specific to vocational curricula, gaming warrants consideration as a learning activity for students on a controlled basis. Gaming provides opportunities for students to learn strategies for success in an atmosphere which is not threatening. In addition, students can learn that a single approach to problem-solving may not be realistic. Gaming may be employed by vocational teachers as a motivational tool with select students.

ACHIEVEMENT INDICATORS

- 1) Describe how educational computing relates to the concept "time on task" of vocational students in the learning environment.
- 2) Explain how the limitations of existing software affect educational vocational education.
- 3) Differentiate (in terms of educational applications) between tutorial software and drill-and-practice software.
- 4) Discuss how problem-solving software can be integrated into vocational curricula and instruction.
- 5) Provide examples of how gaming software may be implemented in vocational education.
- 6) Discuss the use of simulations in vocational curricula.

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Unit 2

Assess Students' Needs For Specific Computer-Based Instruction Applications

UNIT OBJECTIVE

Upon completion of this unit, the learner will be able to make curriculum and media decisions based upon student needs and desired learner behaviors. This knowledge will be demonstrated through completion of the achievement indicators at the end of this unit.

SPECIFIC OBJECTIVES

Upon completion of this unit, the learner will be able to:

- 1) Choose appropriate media (microcomputer software) to match student needs.
- 2) Organize curriculum material according to appropriate CBI tasks for learners.
- 3) Organize instruction into learning objectives which facilitate media, teaching, and student performance divisions.
- 4) Develop a preassessment instrument with regard to a unit of instruction which reflects predetermined objectives.
- 5) Place students in competency settings which reflect the knowledge levels which students bring to learning settings.

Assess Students' Needs for Specific CBI Applications

BY: DR. JOHN A. PIEL

One of the most important practical teaching decisions made by vocational instructors is the choice of instructional media. Language media, test media, and CBI media are examples of curriculum and instruction alternatives which teachers encounter. The delivery of instruction language media is often combined with actual objects. Vocational instruction relies heavily on this combination of media because vocational students are often required to develop motor skills which will prepare them for the world of work. It is this combination which permits CBI to be best put to use by vocational teachers. Vocational instruction which closely approximates the real world of work enhances learning (Gagne, 1977). Unit B.2 and C.1 present a myriad of educational applications for microcomputers. As these applications move closer and closer to paralleling computer applications within the workforce, students will significantly surpass the instructional effectiveness of traditional passive models of instruction which rely on teacher centered lecture methods.

For teachers to best decide how or when to incorporate CBI, the requirements of learning tasks must be analyzed. This analysis includes task description, learning analyses, deriving external conditions, and evaluation. These procedures are presented in this unit to help vocational teachers develop strategies for assessing students' needs for CBI applications.

Task Description

Students are capable of performing a multitude of tasks from simple tasks, such as opening a door, to complex tasks of intellectual abstraction, such as mastering calculus or trigonometry. Describing a task may be as complex as the task itself. Describing tasks for workers in job settings is a means of specifying the exact roles and responsibilities of employees. It is a process of matching interests, skills, and aptitudes of workers with the performance requirements of jobs within an organization. Vocational teachers would use a similar process to delineate learning tasks for students enrolled in vocational programs. Describing the tasks of a learning process

can enhance learning efficiency within a classroom and lead to a smoother and more productive curriculum and instruction process. From the standpoint of learning analysis, expected learning outcomes should be described to students in advance of instruction.

A detailed description of learning tasks will help optimize student performances. First, learning tasks should be categorized according to expected outcomes which can be grouped into one of five categories (Gagne, 1977): a) intellectual skill, b) cognitive strategy, c) information, d) motor skill, or e) attitude. As an example of one of these categories, CBI can assist learners in the development of computer programming skills, which requires students to employ analytical approaches to problem-solving. Students engage in a definite and detailed cognitive strategy or information processing as they develop a computer program which commands a computer to perform an assignment. As students become proficient at educational computing and interact more with CBI programs, they will become less dependent on instructors as sole sources of information. Microcomputers will then serve as information processing agents with students working as the consumers of that information.

A distinct set of motor skill requirements must be developed in order for students to be proficient users of CBI materials and methods. Keyboarding skills will probably be the most important set of skills for vocational students to develop. Students can still be computer users without keyboarding skills, but their proficiency will be significantly diminished.

Task Description as Learning Objective

The purpose for using learning objectives in a computer-based instruction program is to specify those student performances which are appropriate for the select content of vocational curricula. This process solidifies the relationship of Task Description to learning objectives. Using the Task Category of Intellectual Skill as an example, a behavioral objective is not only valuable in planning for student performance, but, when correctly written, can be beneficial in charting teacher performances and evaluating the appropriateness of selected media for a given unit of instruction. The following narrative is intended to aid vocational teachers in comprehending the relationship between the learning objectives of a CBI program and the educational effectiveness of teachers and media in the vocational education setting.

Writing Learning Objectives

Learning objectives include three distinct components which relate to the instructional effectiveness of the teacher: a) media selection, b) implied or described teacher behaviors, and c) measurable student performances relative to a predetermined criteria of behavior. The following statement is an example of an objective which pertains to the Learning Category **intellectual skill knowledge** for the vocational education discipline of office occupations:

Upon completion of the IBM Assistant Series Software package and a discussion regarding implications for today's business community, the student will be able to match a specific office job with an assigned work task.

The three components of the preceding learning objective are easy to identify. The media component is identified by the statement stem . . . "completion of the IBM Assistant Series Software package." This stem implies that teachers will go beyond the lecture method and include media which more closely replicate an automated office. Not only will students become involved with technology presently employed in many offices, but valuable initial bits of vocational information can be represented and developed in an individualized manner.

The second component of the learning objective is an implied or described teacher behavior. This is inferred by the phrase . . . "discussion regarding implications for today's business community." This phrase implies that the completion of the computer software package is not a sufficient development of intellectual skills.

A final concern for instructors when writing instructional objectives is to ensure that traditional teacher behaviors are defined. After students have developed **base line** skills through completing the software package, this information must be related to a job-specific application. In other words, vocational instructors must relate general information of the software program or its documentation to specific job applications through discussion, lecture, or hands-on activities. This third component of a properly written learning objective can be identified in the preceding example by distinguishing student performance. This performance is specified by the statement . . . "the student will be able to match a specific office job with an assigned work task." This match may take place by completing a written test, by working through a learning activity packet, by participating in a group discussion, or by interfacing with another software package. The assessment strategy is usually selected by the instructor.

All curriculum planning for the educational computing segments of a vocational program can be organized around instructional objectives regardless of the learning tasks. A prerequisite task for vocational teachers as they develop CBI materials and methods is to write and use learning objectives which can be precisely and distinctly

measured. Regardless of the level of the learning task, this precise measurement is required for instructors to assess the level of student performance. Measurable objectives permit teachers to assess the necessity for follow-up activities with supplemental materials or media packages that will help students meet predetermined curricular objectives.

The work of Gagne and Briggs (1974) can help vocational instructors examine the capabilities of students and associate those skills with learning tasks. Learning tasks can then be incorporated into the learning objectives of a CBI program. The following chart presents human capabilities, verbs which depict those capabilities and examples of phrases which may be used to form learning objectives:

CAPABILITY	VERB	EXAMPLE
Intellectual Skill Discrimination	DISCRIMINATES	Discriminates, by matching hard lead pencils with desired line widths for a mechanical drafting project.
Concrete Concept	IDENTIFIES	Identifies, by responding to a graphic display on a microcomputer monitor, the lubrication points of a truck chassis.
Defined Concept	CLASSIFIES	Classifies, by using predetermined characteristics of metals as ferrous or non-ferrous.
Rule	DEMONSTRATES	Demonstrates, by solving problems presented through a software package, the ability to read a micrometer.
Higher-Order Rule (Problem Solving)	GENERATES	Generates, by synthesizing applicable rules, a paragraph describing a dental assistant's reaction to a patient exhibiting fear.
Cognitive Strategy	ORIGINATE	Originates a solution to reduce a customer's hostility by applying learned concepts for effective interpersonal communication skills.
Information	STATES	States orally procedures for installing wiring for a specific type of low voltage control.
Motor Skill	REPLACE	Replaces a thermocouple.
Attitude	CHOOSES	Chooses technician's apparel which portrays a neat and professional appearance.

The preceding examples contain verbs which describe student performances in measurable terms. Verbs such as "appreciate," "understand," or "know" should be avoided by vocational instructors due to their lack of precision when it is time to determine satisfactory levels of performance. It is very difficult to measure how much a student **appreciates** the application of a specific learning task to a specific job performance.

Similar procedures for planning and implementing instruction may be followed for the other four instructional task areas. Vocational teachers should follow the behavioral objective format using the three component model. In addition to the three component areas, teachers must continually scrutinize the verbs which they select for the learner objectives of educational computing instructional packages.

Examining Learning Tasks With Regard to Prerequisites

When learning is to take place, vocational teachers should have an overall concern for what learners bring to respective learning situations. In short, instructors should know what learners presently know regarding what is to

be taught. Glaser (1967) discusses entering criteria for successful behavior to occur. To gain necessary information, teachers may use pretesting.

This concern may best be addressed with an example. Student A enters an office occupations program with work experience as a secretary and an understanding of how an office should be organized and managed. Student B enters the same class without prior knowledge or experience concerning office management. A preassessment of each student's knowledge and skills can help teachers place them in logical levels within a vocational program.

Once students have been preassessed, two distinct programs will appear: a) a program for those learners who have essential prerequisite capabilities, and b) an additional program organized to branch prerequisites in a sequential fashion. In both cases, curriculum and media discussions should be based upon a learning task analysis and a classification of the five identified learning task headings. Preassessment material should be developed from the formation of questions developed directly from instructional objectives. It is part of the role and responsibilities of the vocational instructor to preassess the knowledge and skills which students bring to a vocational program. By developing appropriate preassessment techniques, needless relearning of old material can be minimized and the appropriate placement of students within the program becomes much more manageable.

SUMMARY

Computer-based instruction is a new wave crashing the gates of vocational education. A great deal of the features of CBI—the jargon, hardware, materials, and methods—are unfamiliar to vocational educators. However, instructors should not disregard the concepts which have been used for many years to formulate quality vocational curricula and instruction. Teachers will be able to employ those traditional approaches to developing curriculum and instruction in assessing student needs for specific CBI applications. Microcomputers are tools for educational applications—decisions for their usage should be based upon instructional objectives which delineate media, teacher, and student performance requirements.

ACHIEVEMENT INDICATORS

- 1) Choose appropriate media (microcomputer software) to match student needs.
- 2) Organize curriculum material according to appropriate CBI tasks for learners.
- 3) Organize instruction into learning objectives which facilitate media, teacher, and student performance divisions.
- 4) Develop a preassessment instrument with regard to a unit of instruction which reflects predetermined objectives.
- 5) Place students in competency settings which reflect knowledge levels which students bring to learning settings.

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Unit 3

Developing Lesson Plans For Incorporating Computer-Based Instruction

UNIT OBJECTIVE

Upon completion of this unit, the learner will be able to develop lesson plans to incorporate CBI into a vocational program. This knowledge will be demonstrated by the development of appropriate lesson plans for the classes taught by the instructor and through completion of the achievement indicators at the end of this unit.

SPECIFIC OBJECTIVES

Upon completion of this unit, the learner will be able to:

- 1) Discuss the four stages of the teaching-learning process.
- 2) Organize components of a lesson plan into proper sequence.
- 3) Identify various instructional methods which can be used to incorporate CBI into the vocational program.
- 4) Identify various types of software which can be used to teach CBI concepts to students.
- 5) Select appropriate software to use with various methods of instruction.
- 6) Develop lesson plans which could be used to teach:
 - a. introduction to computers
 - b. keyboarding skills
 - c. drill-and-practice skills
 - d. financial applications
 - e. communicating skills
 - f. simulation activities
 - g. task performance skills

Developing Lesson Plans For Incorporating CBI

BY: DONALD ESHELBY

The teaching-learning process consists of four distinct parts which comprise a successful lesson plan:

1. Preparation
 2. Presentation
 3. Application
 4. Evaluation
1. The preparation stage includes tasks such as: review the objectives and unit content, read suggested activities, and select and disseminate student material.
 2. The presentation or delivery stage includes tasks such as: provide activities for motivation, use appropriate teaching strategies, demonstrate procedures, and explain safety rules and precautions.
 3. The application stage takes place during the time students practice skills, participate in learning activities, complete job or assignment sheets, or perform other activities as provided in the objectives.
 4. The evaluation stage takes place during the time students take tests and demonstrate motor skills, and teachers document proficiency or note progress. The teacher reteaches if and when necessary.

These four stages are generally known as the Four Step Lesson Plan or Four Step Method of Teaching.

COMPONENTS OF A LESSON PLAN

A typical lesson plan consists of a list of items an instructor intends to teach when setting up a classroom or laboratory activity for students. Every aspect of the activity should be identified. A lesson plan is generally prepared for one period of instruction, but may be designed for a series of related activities which cannot be completed in a single class period. A lesson plan differs from a Unit of Instruction in that a Unit of Instruction provides material for an entire group of related assignments or tasks. There may be many lesson plans for one Unit of Instruction, depending on the topic to be covered and the depth of instruction needed.

The components of a typical lesson plan include:

1. Topic
2. Objective(s) to be covered
3. Material, supplies, or equipment needed
4. Assignment (usually given beforehand)
5. Introductory information
6. Presentation or demonstration
7. Applications or student performance desired
8. Evaluation
9. Time elements

Lesson plans are designed to provide teachers with road maps of activities which are essential to providing meaningful learning experiences for students. Some instructional packets include a suggested activities page which includes references to source material. This provides the instructor with material from which to assign reading activities for in-depth learning or for remediation.

It is an excellent idea to include a checklist of tools, supplies, equipment, and visual aids needed for the lesson. Most instructional packets provide job sheets on which these items are listed for the student. However, an instructor's needs are generally more substantial than a student's. Instructors should review this list and test all equipment before class begins.

Content specification and content analysis are best done before classroom activity begins. Content analysis is divided into two blocks: concepts and tasks. The teaching of tasks is generally easier than the teaching of concepts. Tasks are best taught by demonstration. Concepts may be taught through class discussion and visual presentations. If different teaching methods are involved, they must be noted in the lesson plan.

During the delivery stages of the lesson, instructors should be flexible and thorough in covering topics. Individual learning styles can be accommodated by adjusting lesson plans to provide the necessary review of difficult topics or to establish large and/or small group instruction.

INSTRUCTIONAL METHODS OR STRATEGIES

An array of instructional strategies can be used to present classroom material using CBI formats. The method to be used should be consistent with the content of the topics being discussed and should complement the learning styles of the students. CBI is an excellent way to motivate nonachievers or underachievers. Sample teaching methods which can be used include:

1. Small group activities
2. Peer teaching
3. Simulations
4. Gaming
5. Drill and practice
6. Dialogue
7. Individualized instruction

Small and large group activities for CBI do not differ significantly from traditional activities except that some form of microprocessor is utilized in the classroom rather than textbooks or lectures. The lecture is still the most effective method of providing general information to a large group, but it should be used sparingly. The general pattern to establish is to rotate two or three students using one piece of equipment to ensure that each student is able to use the equipment.

Peer teaching is particularly attractive in CBI because, quite often, students have more knowledge about computers than a beginning CBI teacher. Because some students acquire computer skills very quickly, it is more efficient to allow these students to share their abilities with other students. This further reinforces their learned skills and provides a teacher's aide for the classroom.

Simulations are effective methods of teaching when the material or topic being covered is hazardous, supplies are expensive, or sensitive equipment must be used for final results. For example, a chemistry experiment can be performed by simulation using the appropriate software packages. This approach helps to prevent costly accidents in the classroom. Testing a piece of electronic equipment which is both expensive and scarce can, likewise, be conducted under simulated conditions. Experience or encounter simulations, such as a stock market activity, foreign country travel, or becoming a parent, can be implemented in a vocational program.

Other simulations can be set up to prepare a student to drive, operate equipment, construct a building, make a medical judgement, alter an ecosystem, or explore human anatomy. These surrogate experiences can prepare students for hands-on practice without costly supplies being wasted. Task performance simulations, such as driving or construction, are goal oriented. Systems simulations are usually process oriented. Encounter or experience simulations can be set up to provide opportunities for students to internalize feelings or to expand ideas and concepts.

Gaming activities are excellent motivational devices for all types of students, from the slow learner to the gifted. A common stock market game allows students to make a million dollars or lose their resources without consequence. Simple exercises can be used for word usage, spelling, mathematics, and social skills.

There are two types of games: instructional and recreational. Both are useful and can teach competitiveness, personal achievement, and individuality. Instructional games with content closely related to the objectives of the lesson can be more rewarding than conventional classroom motivators. Many games also require cooperation from two or more students to achieve the objective of the game. In particular, games can teach problem-solving skills.

Drill and practice, a common teaching strategy, is well suited to the traits of the computer. A computer never tires of repeated exercises and will always provide encouragement if it is programmed to do so. Paired associate materials (such as those explored by Skinner in stimulus/response situations) are related to drill-and-practice exercises. For example, learning French/English vocabulary or technical terms are applications of this type of teaching technique. Drill-and-practice exercises can provide material from stored lists of items, or they can generate materials according to a formula or a set pattern.

Dialogue approaches to CBI are probably the most common applications of computer assisted instruction. These programs are designed to emulate the dialogue between a teacher and a learner. Interaction is required to obtain the desired information. There are two types of dialogue used in CBI: tutorial and inquiries. Tutorials are computer-controlled, while inquiries are learner-controlled. Tutorial methods generally give the answers to students. Inquiry packages generally require learners to extract information through a series of responses and alternative actions.

Individualized instruction is another method of utilizing CBI in the classroom. It is an efficient way to provide remedial instruction to students who need additional assistance or to provide students who have mastered concepts an opportunity to advance to other topics. The early use of computer assisted instruction involved individualized instructional methods which were, for the most part, programmed learning or page turning exercises without dialogue. Poor teaching practices resulted in little or no learning taking place. In fact, interaction with the computer and instructor is critical to individualized instruction. The learner may progress at a rate consistent with his or her abilities, but the whole process is dependent on the sound educational principles of the student/teacher relationship.

Types of Software to Teach CBI

Five major types of software are in general use in industry and schools (for further information, see Unit C.1):

1. Tutorial
2. Spreadsheet
3. Simulation
4. Application
5. Data Base Management

All five software types can be used in vocational programs. The simplest type is tutorial software, which can be either very elementary or very complex. It is most often used at the beginning level. Drill and practice is a common application of this software. The more effective packages allow for learner interaction and both correct and incorrect responses by the user. The keyboarding skills needed by students can be effectively taught using this software. A step-by-step procedure will teach even the most complex financial or word processing concepts to novices if the package is properly developed by the software publisher. Most software packages are equipped to handle a multitude of educational levels in a single application.

Spreadsheet software is very popular with financial or accounting teachers because of the versatility of the material. The software can handle hundreds of rows and columns of data, both verbal and numerical, and can provide equation results, along with sorting and filing functions. Instructors can utilize these software packages to produce reports as well as charts and graphs. As a rule, the more capabilities they have, the more expensive they are. These integrated packages approach the level of database management packages, although they don't have the capacity to handle as much data and they don't process those data as rapidly. They are best used for accounting applications.

Simulation software packages are very diverse in their applications to educational fields. They can range from a simple game to psychometric application. A number of advanced packages are utilized by industry to train personnel managers and salesforce people to deal with problem situations. There are three basic types of simulation materials: a) task performance, b) systems models, and c) experience or encounter types.

The task performance types are designed to assist a person to learn a specific task or series of tasks. They are generally set up to increase the student's level of learning through continued practice of the tasks. Models of systems are used to simulate a real situation in a controlled environment. Students are provided an opportunity to manipulate various parameters of the system and examine the results of those changes. They can learn to understand the operations and processes involved or they can grasp the concept as a whole after they have completed the exercise.

Experience or encounter simulation packages allow for the unknown to enter the classroom through such applications as family relationships, financial forecasting, or for something as simple as clothes choice. Industry applications can be made to manufacturing schedules and cost studies. Diagnosis in the mechanical fields is a natural application of this type of software package, as are drafting and design applications. The "what if" application is a powerful teaching tool.

Application type software are generally industry generated software for specific tasks within the industry (such as computer controlled machinery). Some word processing software is directly applicable to industry. If, for example, the banking industry utilized a specific brand of software in all of its offices, it would be wise for schools to prepare students with an understanding of that particular software. Very few types of software do not have some application to industrial settings. For example, tutorial applications are often used in industry to familiarize new employees with equipment. However, the applications type of software is generally associated with those specific software packages which have been tailored for a particular task using a specific machine to perform a specific function.

Communications software is another application type common in industrial settings. This software establishes a communication link between different computer related equipment. It enables equipment to communicate with other pieces of equipment, or allows two or more computers to exchange information. Database files located in a central office can be assessed by salespersons through a communications network using telephone lines and portable terminals at remote sites. Inventory can be checked routinely and replacement stock ordered as needed using this process.

Database management software, widely used in several fields, can handle many sets of data and can file, retrieve, sort, print, adjust, perform mathematical tasks, and remind people of appointments. The most common application of this type of software is in the planning and project tracking or estimation areas. Instructors can use these packages for management of classroom activity, grades, student projects, competency achievement by students, and inventory of supplies and materials used on a daily basis. Most of the computer-controlled machine software in industry is a form of database management software. Attorneys can establish pleas for their clients using information retrieved from law records in previous trials. There are unlimited applications for databased management software. The major drawback to the package is the high cost which is directly related to the quality of data which can be handled. Most integrated software packages have a strong database function as the core component.

Selection of Appropriate Software

The number of software packages available is staggering. The choice is up to the individual instructor. One should review the material before purchasing it if possible. The next best thing to reviewing it yourself is to obtain a report completed by a renowned critic in the field. The Northwest Regional Education Laboratory, which reviews software packages, publishes reviews in an electronic database, RICE (Resources in Computer Education), and provides hardcopy on request. Most computer magazines feature software reviews in a monthly column.

The critical point to remember is to purchase software designs to provide the needed instructional information. Instructors should not attempt to prepare courses on the basis of available software. Teachers should focus on the content of the vocational program. The software for CBI is simply a tool for use in the classroom. You don't buy a four wheel drive tractor and then decide to purchase a farm.

The examples which follow in this section are for references only. There are hundreds of examples to use, but these were chosen as simple applications for the methods of instruction identified in a preceding section of this unit.

A simulation package in the health field, which is based on the struggle between the body's immunization system and viruses, is titled CELL DEFENSE. The package is more of a game than a true simulation, but it is entrancing to students who learn the body's natural defense mechanisms by using the software. The manual accompanying the package does an adequate job of explaining cell structure. A beginning level software, it is an easy package to learn.

Another simulation or decision-making package, titled CHIEF EXECUTIVE SERIES, contains educational business management games designed to teach the fundamentals of decision-making and strategy through role-playing situations. Designed for more advanced instructional levels, it is suitable for Marketing and Business Education classes. Any program which provides entrepreneurial skills could be applicable to business students.

KNOWARE AT HOME is a software package designed to prepare novices with an understanding of word processing, database management, spreadsheet, and financial decision-making. It is especially written for those students or home users who are not yet familiar with their computers. It is a relatively easy package to use. For Apple users who are quite well versed in word processing using APPLEWRITER, there is MAESTRO. This package will allow the student to become proficient in word processing skills. Another typing package which is a tutorial design rather than word processing is called MASTERTYPE. This package teaches the Dvorak keyboard skills using Apple equipment.

Many software packages have been developed for the instructor's use. This type of materials include packages such as TESTMASTER, which will allow the teacher to develop test questions: multiple choice, true-false, completion, and short answer type questions. Multiple choice, for instance, can be generated by the teacher and managed in separate files. Many of these types of software are available through computer user groups developed by frustrated instructors who were searching for the perfect test package not available in commercially developed software.

Drill-and-practice material is plentiful because this was the stock-in-trade for software developers for many years. Properly selected, drill-and-practice materials can be very useful to the classroom instructor. THWART is such a package, written to develop vocabulary skills for all levels, from children to adults. It uses a crossword puzzle approach. SPELLING BEE is another drill-and-practice set for all ages. WRITING SKILLS is a package designed to provide the learner with skill in Language Arts by explaining comma, pronoun, modifiers, and other word usage.

THE OREGON TRAIL is an excellent decision-making software package used by many computer stores to show the power of the computer as a game and educational tool. This package leads students through a covered wagon expedition across early nineteenth century America. The need to stock food, ammunition, clothing, and personal items is stressed. Enroute, the user's decisions force the expedition to stray from its chosen path when detours and hardships from the elements and hostile groups are met. This software is an example of the experience simulation models available to teachers.

Many excellent financial, accounting, or spreadsheet software packages are available. The industry-related models include LOTUS 1*2*3*, MULTIPLAN, VISICALC, and PEACHCALC. VISICALC, a very popular package, is the benchmark software which made microcomputers popular in businesses. These and many others are applicable in an Office Education program as applied to accounting or bookkeeping courses. They are actual working models, not games, and can be used for making projections, balance sheets, and other industrial uses. They are a direct application of CBI because the student must learn to master the computer and the software package.

Industrial applications of word processing software include WORDSTAR, PERFECT WRITER, PEACHTEXT 5000, WORDPERFECT, and many more. Unlike the spreadsheet software previously described, only a few of these software packages have been accepted by industry. The wise vocational teacher will survey industries in the community to determine which software is being used.

The type of software which has direct industry application is task development oriented when used in an educational environment. The teaching method is performance directed and should be evaluated in an appropriate manner. For example, letter perfect or mailable correspondence is a true industry standard, as are error free account ledgers. The student should perform as an industry employee after appropriate learning or practice interval has been provided.

Programming computers to be used in a manufacturing situation is another CBI application. The software for this educational experience is generally provided by the equipment manufacturer. Many models are available to teach industry simulation, and actual CAD (computer assisted design/drafting) or CAM (computer assisted

manufacturing) software packages can be purchased from commercial sources. These are generally expensive, as is the equipment needed for the application.

The major points to consider when deciding which application to use revolve around the classroom objectives and the industrial setting in which the students will be seeking employment. Cost and equipment needed to complete the exercise are other considerations.

Lesson Plan Development

Each lesson should consist of the necessary information a teacher needs to prepare and conduct courses in the classroom, laboratory, or other setting. The lesson plan is prepared for each teacher usage. It is a guide to the structure and sequence of the topic within a specified timeframe. Nine components should be included in each plan.

1. Topic
2. Objectives
3. Material, equipment, and supplies
4. Assignments given
5. Introductory information
6. Presentation or demonstration
7. Desired student performances (application)
8. Evaluation
9. Timeframe (length of lesson)

The components do not have to appear in the order suggested, but each one needs to be described so that no element is overlooked (such as preparing overhead transparencies, or trying to use a faulty piece of equipment). Sample lesson plans are provided for various methods of instruction or CBI applications.

LESSON ONE

TOPIC:

Introduction to Computers

OBJECTIVE(S):

- a) Introduce students to the computer.
- b) Describe uses of the computer.
- c) Identify major parts of the computer.
- d) Demonstrate the operation of the computer.

MATERIAL, SUPPLIES, AND EQUIPMENT:

Introduction to Computers handout; computers and peripherals; printer paper; sample programs; list of terminology; transparencies (intro 1-7); spare computer parts; and circuit cards.

ASSIGNMENT:

Review the reading assignment and discuss terminology.

INTRODUCTORY INFORMATION:

Discuss how computers and people differ; how computers handle information; why computers are important in the lifestyles of today.

PRESENTATION/ DEMONSTRATION:

Show overheads on the evolution of computers; explain the parts of a microcomputer using examples from old machines; demonstrate how a computer is operated—use Hangman program.

PERFORMANCE/ APPLICATION:

Lecture about and demonstrate computers; show students how to turn on and operate a simple program using written directions.

EVALUATION:

Students judged on completion of assignment; answers to oral questions; ability to follow directions and operate the equipment.

TIMEFRAME:

Two class periods, second one for practice and review of information.

LESSON TWO

TOPIC:

Keyboarding Skills

OBJECTIVE(S):

- a) Discuss keyboarding and its importance to personal needs in the future.
- b) Describe and demonstrate the touch method of keyboarding skills and explain the different styles of keyboarding.
- c) Introduce students to keyboarding numeric and alphabetic information by touch.

**MATERIAL, SUPPLIES,
AND EQUIPMENT:**

Handouts on keyboarding; computers and peripheral equipment; printer paper; text; Keyboarding for Information Processing, Gregg; transparencies (8, 11-15); word and number lists; Scripsit programs.

ASSIGNMENT:

Review the reading assignment and discuss terminology.

**INTRODUCTORY
INFORMATION:**

Describe the differences between typing and keyboarding; present reasons for the need for keyboarding; explain differences between the computer keyboard and the typewriter with the related equipment.

**PRESENTATION/
DEMONSTRATION:**

Show overheads on keyboard styles; demonstrate the processes used by a computer to store and retrieve data; demonstrate the touch method of keyboarding.

**PERFORMANCE/
APPLICATION:**

After presentation of information and demonstration of touch method, the students will be expected to practice touch entry for numeric and alphabetic data.

EVALUATION:

Students judged on completion of assignment; answers to oral questions; ability to follow directions and operate the equipment.

TIMEFRAME:

Two class periods, second one for practice and review of information. Continued practice for speed and accuracy will be accomplished over a period of two weeks using advanced work lists and 9 column numbers.

LESSON THREE

TOPIC:

Drill-and-Practice Skills

OBJECTIVE(S):

- a) Improve spelling skills.
- b) Provide positive learning environment through a competitive activity.
- c) Introduce students to automechanics terminology.

**MATERIAL, SUPPLIES,
AND EQUIPMENT:**

Spelling Bee software; IBM computers; additional word lists on software (introductory level automechanics).

ASSIGNMENT:

Review mechanics terminology from Crouse text.

**INTRODUCTORY
INFORMATION:**

Outline the rules of the contest and establish teams.

**PRESENTATION/
DEMONSTRATION:**

Demonstrate operation of the software. Select teams by numeric assignment.

**PERFORMANCE/
APPLICATION:**

Students inquire about words not clear after the reading assignment. Contest will determine spelling abilities of individual members of the teams.

EVALUATION:

Students judged on performance in contest and manner of support of team.

TIMEFRAME:

One class period, depending on successful review of words at the beginning of class. May be repeated in other classes as a motivation tool.

LESSON FOUR

TOPIC:

Financial Applications

OBJECTIVE(S):

- a) Students to describe the procedures for setting up a checkbook balancing activity on the computer.
- b) Discussion of essential information regarding the proper method to use a checkbook.
- c) Utilize a computer to manage a checkbook record.

**MATERIAL, SUPPLIES,
AND EQUIPMENT:**

Apple II computers; Checkbook software programs; job sheets for checkbook data entry; printer paper; overheads 23-27.

ASSIGNMENT:

Review checkbook balancing procedures in text, pp. 56-62.

**INTRODUCTORY
INFORMATION:**

Review procedures for loading the software and basic checkbook procedures.

**PRESENTATION/
DEMONSTRATION:**

Present review of checkbook processes on overheads; describe the loading procedures for software; provide job sheets.

**PERFORMANCE/
APPLICATION:**

After presentation of information and review of the procedures, students practice activities.

EVALUATION:

Students judged on completion of assignment; answers to oral questions; and ability to follow directions and operate the equipment.

TIMEFRAME:

One class period. Review set for following week.

LESSON FIVE

TOPIC:

Communication Skills

OBJECTIVE(S):

- a) Students to describe the procedures for setting up a communication software package and necessary equipment.
- b) Discuss the equipment and relationship of each piece of equipment to the communications network.
- c) Conduct a communications session.

**MATERIAL, SUPPLIES,
AND EQUIPMENT:**

IBM computers; communications software programs; printer and paper; working telephone hookup; overheads 33-36.

ASSIGNMENT:

Read chapter eight in the text and chapter seven in IBM Asynchronous Communication manual.

**INTRODUCTORY
INFORMATION:**

Review the basics of communication networking and describe the procedures for operation of equipment.

**PRESENTATION/
DEMONSTRATION:**

Show overheads on equipment used in communications; describe the loading procedures for software; provide time to practice; establish teams for communication tag game.

**PERFORMANCE/
APPLICATION:**

After practice time has been taken, and overview of the communications network completed, teams of three students are selected to send a message to another, set up equipment, load software, send message, and sign off in specified time.

EVALUATION:

Students judged on accuracy of message; proper use of equipment; and speed of completion of task.

TIMEFRAME:

One class period following classes of explanation and demonstration. Repeat games are to be scheduled at the end of classes as appropriate for motivational use.

LESSON SIX

TOPIC:

Simulation—Management/Decision-Making Skills

OBJECTIVE(S):

- a) Provide opportunities for decision-making.
- b) Discuss situations needing agreement by others.
- c) Compare decisions to be made by various business ventures and reasons for the type of decision.

**MATERIAL, SUPPLIES,
AND EQUIPMENT:**

Computers; Chief Executive software; printer and paper; handouts on decision-making.

ASSIGNMENT:

Complete chapter 8 questions in text and prepare for class discussion and quiz.

**INTRODUCTORY
INFORMATION:**

Hand out quiz on decision-making and discuss major areas before starting computer activity.

**PRESENTATION/
DEMONSTRATION:**

Provide handout on types of businesses and different methods to deal with problems. Discuss cash flow, capital investment, risk taking, and hedging. Describe procedures for using the Chief Executive series. Show examples of responses to the program's questions.

**PERFORMANCE/
APPLICATION:**

Students will be expected to complete 3 exercises on the computer after the discussion of the various methods used to handle situations in different businesses. Students who obtain 80% or more on the quiz are to participate. The remainder review the information until sufficiently prepared. This is the first period of computer interaction. It will be repeated four times so that all students have used the computer at least three times. All students will participate in each of the three series of business situations.

EVALUATION:

Student progress to be judged on success in completing the program and on responses on quiz. Proof of success will be provided by a signed copy of a printout from the computer.

TIMEFRAME:

One class period followed by three sessions of computer interaction for each student.

LESSON SEVEN**TOPIC:**

Task Performance Skills—Sales Techniques (Level 1)

OBJECTIVE(S):

- a) To improve sales skills.
- b) To identify client analysis methods.
- c) To assess personal sales characteristics.
- d) To determine sales strategy based on customer and salesperson characteristics.

**MATERIAL, SUPPLIES,
AND EQUIPMENT:**

Sales Edge software; computers; printer and paper; handout on successful sales strategies; directions for using software package.

ASSIGNMENT:

Read chapter 6, pp. 132-150, and chapter 8, pp. 213-224.

**INTRODUCTORY
INFORMATION:**

Review of previous discussion of successful sales methods based on client assessment. Description of software package components which are to be used.

**PRESENTATION/
DEMONSTRATION:**

Students will operate the equipment using the assigned software and will rotate through four stations with four students to a station.

**PERFORMANCE/
APPLICATION:**

Small group discussion will be the main delivery used. Students will be expected to prepare a self assessment of sales characteristics to be used in the group discussion sessions and will prepare sales strategies to compare with the computer's analyses. Student results will be compared to the analyses provided by the computer software.

EVALUATION:

Students will be judged on performance using the computer analyses to compare sales styles and on discussions of reasons for differences. Computer printouts of student's self assessment will be retained for future comparison to determine growth and understanding of sales techniques.

TIMEFRAME:

Four class periods, followed by a repeat activity every two weeks to reinforce knowledge. This is level one in the software application. The package will be used in most classes on a periodic basis.

ACHIEVEMENT INDICATORS

- 1) Discuss the four stages of the teaching-learning process by giving examples of each as used in a class lesson.
- 2) List the components of a lesson plan in sequential order as you would for preparing to teach a class.
- 3) Identify four instructional methods to be used when incorporating CBI in the vocational program.
- 4) Identify four types of software which could be used in CBI by describing activities that they would apply to in vocational programs.
- 5) Select software programs which you would use to supplement your instruction for developing:
 - a) psychomotor skills
 - b) affective behavior skills
 - c) cognitive skills
 - d) problem-solving skills
- 6) Develop a set of lesson plans designed to provide an outline for teaching five different applications of CBI in vocational programs.

REFERENCES

CELL DEFENSE:	Hesware 150 North Hill Drive Brisbane, CA 94005	THE SALES EDGE:	Human Edge Software 2445 Faber Place Palo Alto, CA 94303
CHIEF EXECUTIVE SERIES:	Lewis Lee Corporation P.O. Box 51831 Palo Alto, CA 94303	SCRIPSIT:	Tandy Corporation Radio Shack 1550 One Tandy Center Fort Worth, TX 76102
KNOWARE AT HOME:	Knoware, Inc. 301 Vassar Street Cambridge, MA 02139	SPELLING BEE:	Munn Educational Software P.O. Box 204 Groton Long Point, CT 06340
LOTUS 123:	Lotus Development Corporation 161 First Street Cambridge, MA 02142	TESTMASTER:	Midwest Software Box 214 Farmington, MI 48024
MAESTRO:	Aquila Corporation 24 Park Street Pepperell, MA 01463	THWART!:	Random House Software 201 East 50th Street New York, NY 10022
MASTERTYPE:	Scarborough Systems, Inc. 25 North Broadway Tarrytown, NY 10591	VISICALC:	Visicorp 2895 Zanker Road San Jose, CA 95131
MULTIPLAN:	Microsoft 10700 Northup Way Cambridge, MA 02142	WORDPERFECT:	Satellite Software International 288 West Center Street Orem, UT 84057
PEACHCALC:	Peachtree Software Incorporated 3445 Peachtree Road N.E. Atlanta, GA 30326	WORDSTAR:	Micropro International Corporation 1299 4th Street San Rafael, CA 94901
PEACHTEST 5000:	Peachtree Software Incorporated 3445 Peachtree Road N.E. Atlanta, GA 30326		
PERFECT WRITER:	Perfect Software 1001 Czmelia Street Berkeley, CA 94710		

Microcomputer Software Programs for Vocational Education, Rodenstein & Lanbert (1983) is available from the following source:

Vocational Studies Center
1025 West Johnson Street, Room 964
School of Education
University of Wisconsin
Madison, Wisconsin 53706

Unit 4

Select Appropriate Software For Specific Instructional Purposes

UNIT OBJECTIVE

Upon completion of this unit, the learner will be able to select appropriate software for specific instructional purposes. This knowledge will be demonstrated through completion of the unit achievement indicators.

SPECIFIC OBJECTIVES

Upon completion of this unit, the reader will be able to:

- 1) Explain the importance of selecting appropriate educational software.
- 2) Discuss the benefits for using appropriate microcomputer software in a teaching/learning situation.
- 3) Describe criteria for evaluating software for specific instructional purposes.
- 4) Evaluate instructional software for use in a specific teaching/learning situation.
- 5) Identify sources of software reviews for vocational educators.

Select Appropriate Software For Specific Instructional Purposes

BY: EMMA GEBO

Purchasing and using software developed by others can be a wise investment for vocational educators. For instructors, an important selection criterion is the appropriateness of software to specific instructional purpose.

The educational software market is changing faster than any other part of the software industry. At the time this unit is being written, the trend seems to be away from drill and practice, simple text displays, and games, and toward such uses as graphics, interaction, and simulation. Computers can be used to help test and assess student progress or to take corrective action if a student has not grasped an important concept. "Branching" software programs can be utilized to teach students at their individual "levels."

Each vocational educator should recognize that excellent educational software can turn a computer into a friendly, encouraging, and patient teacher (D'Ignazio, 1984). Quality educational software can be a significant aid to the teaching process and can provide instructors with more time to devote to individualized instruction. Vocational teachers should be critical and demanding of educational software. Before selecting a program, educators should read about it, talk to people who know it, and make sure it is the right computer program for their instructional objectives (D'Ignazio, 1984).

Selecting appropriate software for specific, instructional purposes requires an instructor's thought. However, the task of software selection is worth the required time and thought once teachers have identified specific instructional purposes. It would be senseless to have a microcomputer for a vocational program and not be able to use it for instructional purposes. The importance of educational software to computer-based instruction is paramount; without software, a computer is little more than a hunk of plastic and silicon that might as well be used as a doorstop (Taylor, 1984).

Vocational teachers must realize that educational software which is not oriented to users is virtually worthless. Teachers and students must be able to use software for their intended purposes without having to make expensive, time-consuming changes or adaptations. It is critical that software programs be analyzed for appropriate integration into the educational setting, and that vocational programs not be changed merely to meet the requirements of software.

Educators need to be assured that microcomputer software are meaningful inclusions in vocational curricula. It is essential for educators to define their instructional objectives and to identify those objectives which the microcomputer can help attain. The software then selected must be compatible with curriculum and in agreement with the philosophy of the vocational program. Educational software should feature clear and achievable goals, carefully designed reinforcement and feedback patterns, correct spelling and grammar, and content appropriate to the level and needs of the user. The characteristics and needs of the student population should be critical factors in the evaluation of software which is intended to meet specific instructional purposes.

Conkling (1983) describes the advent of Computer-Based Instruction in a county school system. The search for an innovative instructional system resulted in the implementation of Computer-Based Instruction. Following a period of use, students in the system were observed to be just as eager to sit down at the computer terminal in May as they were in September when the program was initiated. An attitude survey of students revealed that Computer-Based Instruction received the highest rating of any activity which involved academic instruction. Conkling stresses the importance of careful planning as a major reason for the success of this program. It is essential for vocational educators to identify the appropriate uses for microcomputer software in any instructional program. The

Implementation and integration of Computer-Based Instruction in an educational program can only be effective if educators learn how to implement hardware and software and then maximize their usage where they are most effective.

The Needs of Intended Populations Must Be Considered

Little has been written about the effects of computers on the ways students learn and the manner in which they perceive their own abilities. Both the cognitive (Intellectual, problem-solving) and affective (social, emotional) natures of microcomputer and user interaction seem to have a significant impact on the type and quality of learning that occurs with any one person (Ryba & Chapman, 1983). The perceptions of users concerning their personal control and effectiveness developed by use of the computer may result in psychological benefits to the student. These feelings include an improved self concept, reduction of emotional dependence, and self-management of behavior and learning.

Ryba and Chapman (1983) observe that mentally retarded students attain scores in microcomputer games that would be the envy of other students. Students have demonstrated persistence in understanding and mastering rules; have developed skills in planning, anticipating, sequencing, and executing combinations of movements; and have increased motor speed and coordination. The authors emphasize that much work is yet to be done in understanding how people learn and how microcomputers can assist learners. They observed an adult who had been labeled severely retarded and unlikely to benefit from formal training, but who was nevertheless playing a microcomputer game which required moving a cursor purposefully and making judgements about the order in which specific operations should be performed. Their contention is that this discrepancy raises the possibility that some students could be underfunctioning through lack of opportunity to demonstrate and improve their cognitive abilities with the aid of learning devices such as computers. These types of observations add fuel to the arguments against using standardized paper-and-pencil intellectual assessments (Ryba & Chapman, 1983).

The availability of microcomputers is resulting in increased exploration with computers in the instruction of handicapped learners. The individualized nature of microcomputer instruction is identified as one of the greatest potential benefits to handicapped persons. This benefit is especially true if the software developed and utilized are designed to branch to the level of instruction appropriate for the individual (Hannaford & Taber, 1982).

An exciting aspect of using microcomputers with vocational special needs students pertains to the capabilities of the machines to interact with learners. Microcomputers are able to present a stimulus, accept a response, evaluate the response, present appropriate feedback and reinforcement, and then move to the next appropriate instructional segment (Hannaford & Taber, 1982). This nonthreatening interaction can be especially beneficial to handicapped individuals who have faced failure or who have problems communicating. Autistic individuals and those with language impairments can particularly benefit from this interaction.

Obtaining software appropriate for use with vocational special needs students is not an easy task. Software may be written in the wrong computer language for a specific computer or the user may discover that more emphasis was placed on the technical aspects of the program than on the educational aspects. If microcomputer programs are to be effective with vocational special needs populations, both developers and purchasers of software must be sensitive to certain factors: (a) educational compatibility, (b) instructional design adequacy, and (c) technical adequacy (Hannaford & Taber, 1982). These three factors are mutually exclusive and should be individually considered by both developers and purchasers of software for instructional use with vocational special needs learners.

Disabled individuals who have, in the past, found themselves to be at a disadvantage are finding that they may not be at a disadvantage when it comes to working with microcomputers. Modifications to both hardware and software can be made to circumvent many physical disabilities. Touch screens, low typing tables, modems and speakerphones, and braille printouts are just a few of the modifications that have opened up the microcomputer world to disabled individuals. This can result in more independence and the possibility of new jobs for disabled individuals (Watt, 1984).

Educational software used in any teaching learning situation should be carefully evaluated and screened to be sure that it is not promoting bias in any form. The human factors involved in the program itself, as well as in the supplementary materials, are important. Vocational teachers should develop and use instructional materials which address a variety of racial and ethnic groups, as well as disabled persons and a range of ages. All instructional materials, including software, should be evaluated with criteria for bias (Rose, 1984).

Evaluating Software for Suitability

Many articles have been written to help educators evaluate software programs. Some school districts, universities, and educational agencies have developed software evaluation tools for internal use. These instruments

have developed to help educators evaluate or obtain an evaluation of software in an efficient manner. There is no single, industry-wide, evaluation method or tool that is used to evaluate software. However, several authors have developed guidelines for evaluating software. Savitsky (1984) summarizes ten criteria for judging the quality of software:

1. Has significant new content or skill-producing strategies.
2. Motivates and offers some challenge.
3. Guarantees the learner an emotionally healthy and appropriate learning environment.
4. Has educational objectives that are carefully chosen and clearly stated.
5. Has been subjected to rigorous field testing with appropriate learners.
6. Provides the learner with ease of control over the elements of the learning experience.
7. Provides a trail to permit the teacher/adult to monitor and review the learner's activities.
8. Provides clear documentation about all aspects of the program for the learner and the teacher.
9. Is accurate in the presentation of all facts and precise in the use of spelling, grammar, and usage.
10. Is free of personal abuse, sarcasm, derogatory or sexist/racist remarks.

With software for educational purposes being offered by so many different firms, the educator frequently wonders, "Is this program of high quality and will it be a real asset in the classroom?" Admittedly, some software on the market is not of high quality. The software may have been developed by people who know much about computers, but little about teaching. Or software might have been developed by someone with subject-matter and classroom experience, but little knowledge of the capabilities of the computer. Quality educational software is developed by those who have a combination of subject-matter and classroom experience as well as computer expertise.

An article in the January, 1983, issue of *Forecast for Home Economics* (p. 16) includes a list of 7 guidelines for quality educational software. The guidelines are based on a consensus of educators who use computers in the classroom, taken from *Electronic Learning* magazine:

1. **Be free of technical and educational errors.** The program should load properly and run smoothly. The information should be accurate, up-to-date, and educationally sound.
2. **Take advantage of the computer's unique capabilities.** A good computer program should be better than the traditional method of teaching the material. It should take advantage of the computer's capabilities and do some things that can't be done as well by a teacher or a text.
3. **Provide positive reinforcement and also help students to understand why their answers were wrong.** The students should feel good about themselves even if they answer incorrectly. While the program shouldn't reinforce, reward, or encourage wrong answers, it should help the students understand why their answer was wrong and then provide a concept, rule, or information that will help them to answer correctly.
4. **Include diagnostic and branching features.** Basically the program should make an attempt to determine the student's level of learning and then adapt to it. A pre-test will allow the program to branch to the student's level.
5. **Be creative, stimulating creativity among its users.** A good program should allow students to explore and ask questions and be open-minded. Students should not be locked into one right answer.
6. **Allow for easy teacher modification.** The program design should be such that the teacher can modify or change it to meet the specific needs of students.
7. **Provide clearly written support materials and activities.** The operating manual or other documentation should be written in language readily understood by the user, not computer jargon. Program prompts should be utilized so that the user does not have to keep referring to the manual to find out what to do next. Student worksheets and suggestions for supplementary activities are parts of the most valuable educational programs.

After an instructor has obtained what appears to be promising software, a decision must be made whether or not to buy the product. The criteria and guidelines presented in this unit must be considered as the teacher actually reviews or tries out a software program. As instructors review software, they must remember that the software selected must relate to the identified vocational curriculum objectives.

Vocational teachers can follow six steps that will help them in the software selection process (Kansky, Heck, & Johnson, 1981):

Step 1. Load the program into your computer system and run it briefly to become familiar with its "flow."

Step 2. Execute the program as a successful student would, avoiding intentional or careless errors. Extend the program when possible by interacting "creatively" as a good student would do in testing the cleverness of the programmer.

Step 3. Execute the program as an unsuccessful student would. Respond incorrectly to learn how the program handles student errors. If an erroneous response to a task results in the repetition of that task, make repeated incorrect responses. Be certain to repeat the same responses and also try giving different incorrect responses. Finally, make other kinds of errors such as typing mistakes, incorrect input types (e.g., "one" for "1"), content errors, and errors in following directions.

Step 4. Using criteria you've adopted, record your observations using some instrument such as a checklist.

Step 5. Compare your observations with the claims made by the vendor.

Step 6. Make a decision.

A software evaluation form is included in this unit (Neuman, 1982, pp. 45-48). A review of the form will verify that criteria identified for the evaluation of instructional software are consistent with guidelines presented in this unit. The emphasis is on the educational content presented, the manner in which the content is presented, interaction between the student and the computer, and the manner in which the teacher can use the program to complement the instructional program. Additional information on software evaluation is contained in unit B.5.

SOFTWARE EVALUATION FORM

Reviewer's Name: _____ Date of Review: _____
 Address: _____ Telephone: _____

Program Title: _____
 Medium: 5" disk 8" disk cartridge tape

Package Title: _____
 Copyright Date (if any) _____

Microcomputer (brand, model, memory) _____
 Necessary Hardware _____ Necessary Software _____
 Producer _____ Author(s) _____
 Back-up Policy _____ Cost _____

Part 1 - Program Overview and Description

1. Subject area and specific topic _____
2. Prerequisite skills necessary _____
3. Appropriate grade level(s) [circle] 1 2 3 4 5 6 7 8 9 10 11 12 College
4. Type of program (check one or more)

<input type="checkbox"/> Simulation <input type="checkbox"/> Educational Game <input type="checkbox"/> Drill and Practice <input type="checkbox"/> Tutorial <input type="checkbox"/> Problem Solving <input type="checkbox"/> Authoring System	<input type="checkbox"/> Testing <input type="checkbox"/> Classroom Management <input type="checkbox"/> Remediation <input type="checkbox"/> Enrichment <input type="checkbox"/> Other (specify) _____
---	--
5. Appropriate group instructional use of the computer? _____
6. Is this program an appropriate instructional use of the computer? _____
7. Briefly list the program's objectives. Are they clearly stated in the program or in the documentation? Are they educationally valuable? Are they achieved? _____

8. Briefly describe the program. Mention any special strengths or weaknesses.

Part 2 - Evaluation Checklist

Please check YES, NO, or NOT APPLICABLE for each question below. To add information, or to clarify an answer, use the COMMENTS space at the end of each section.

EDUCATIONAL CONTENT	YES	NO	N/A
1. Is the program content accurate?			
2. Is the program content appropriate for intended users?			
3. Is the difficulty level consistent for material, interest, vocabulary?			
4. Is the program content free of racial, sexual, or political bias?			
COMMENTS:			

PRESENTATION	YES	NO	N/A
1. Is the program free of technical problems? 2. Are the instructions clear? 3. Is the curriculum material logically presented and well organized? 4. Do graphics, sound, and color, if used, enhance the instruction? 5. Is the frame display clear and easy to read?			
COMMENTS:			

INTERACTION	YES	NO	N/A
1. Is the feedback effective and appropriate? 2. Do cues and prompts help students to answer questions correctly? 3. Can students access the program "menu" to help or change activities? 4. Can students control the pace and sequence of the program? 5. Are there safeguards against the students bombing the program?			
COMMENTS:			

TEACHER USE	YES	NO	N/A
1. Is record-keeping possible (within the program or through documentation worksheets)? 2. Does the teacher have to monitor student use? 3. Can the teacher modify the program? 4. Is the documentation clear and comprehensive?			
COMMENTS:			

Part 3 - Overall Evaluation

Check one:

- Excellent program. Recommend without hesitation.
- Pretty good program. Consider purchase.
- Fair. But might want to wait for something better.
- Not useful. Do not recommend purchase.

Where Can Vocational Teachers Learn More About Educational Software?

There are many sources that vocational educators can utilize to help identify software, review software, and suggest appropriate uses for software. Rapid changes in software design and the volume of software available for instructional purposes make it almost impossible to keep up with the task of evaluating software. Three major sources are recommended for vocational instructors for obtaining software evaluation data (Holznagel, 1983):

1. The MicroSIFT project at the Northwest Regional Educational Laboratory (NWREL). Through this project, evaluation reports are sent to state and regional centers and school districts, who then make copies available to their constituents. The data obtained are also added to the software section of the REIC (Resources in Computer Education) database. This database is designed and maintained by the NWREL.
2. The EPIE Institute is the second major source. EPIE also uses a standard form which utilizes predefined criteria and open-ended comments. The evaluation reports, published as *Micro-Courseware PRO/FILES*, may be available in your state through the state department of education.
3. Professional journals and magazines in computer education comprise the third major source for software evaluative data. The *AEDS Monitor*, *ICCE Computing Teacher*, and *Electronic Learning* are three sources. The *Courseware Report Card* is a periodical dedicated to courseware evaluation reports.

It is important to consult a variety of sources when considering the purchase of a software package. Evaluations are generally based on the opinions of several evaluators; since opinions may differ, it is wise to consult as many sources as possible for information (Holznagel, 1983).

Although producers of software have been reluctant to allow potential purchasers to preview or try out software prior to purchase, this policy may be changing. Distributors are developing methods for prospective buyers to evaluate software prior to its purchase.

Software developers are producing incomplete reproductions of retail products for potential buyers to review. These incomplete products present samples of the total program for the customer to review prior to purchase. This practice should reduce the risk of a regrettable purchase. Some products of sample software encourage copying of the samples, in the belief that this policy will spread advertising of the product. Some samples are developed so that a prospective buyer may develop a file with data while testing the sample, and the file can then be transferred to the program disk. Purchasers should be cautioned that a demo disk may not be able to provide a realistic look at the scope or actual operation of a program (Watt, 1984).

SAMPLE LISTING OF SOFTWARE VENDORS

The following list represents a sampling of a much greater number of existing software producers. Vocational educators can use this list as a beginning point for searching for instructional software. Several of these vendors will provide teachers with free catalogs of their software products (Zahniser, Long, & Nasman, 1983, pp. 29-40).

Abbott Educational Software
334 Westwood Ave.
East Longmeadow, MA 01028
(413) 525-3462

Adventure International
P.O. Box 3435
Longwood, FL 32750
(305) 862-6917

American Analysis Corporation
655 Redwood Highway
Mill Valley, CA 94941

Applied Educational Systems
RFD 2, Box 213
Dunbarton, NH 03301
(603) 774-6151

Atari
call (800) 538-8547 for name
of nearest dealer

Acorn Software Products
634 North Carolina Ave. S.E.
Washington, DC 20003
(202) 544-4259

Alternate Source
1806 Ada Street
Lansing, MI 48910
(517) 487-3358

Apple Computer Company
10260 Bandley Drive
Cupertino, CA 95014
(408) 996-1010

Applications
21350 W. Eleven Mile Road
Suite 103
Southfield, MI 48076

Robert R. Baker, Jr.
5845 Topp Court
Carmichael, CA 95608

Basics & Beyond
P.O. Box 10
Amawalk, NY 10501
(914) 962-2355

Bell & Howell Micro Systems
Audio Visual Products Division
7100 North McCormick Road
Chicago, IL 60645
(312) 262-1600

Borg-Warner Educational Systems
600 West University Drive
Arlington Heights, IL 60004
(800) 323-7577

Business Microproducts
1838 Catalina Court
Livermore, CA 94550

Cavri Systems
26 Trumbull Street
New Haven, CT 06511
(203) 562-9873

Comm Data Systems
P.O. Box 325
Milford, MI 48042

COMPRESS
P.O. Box 102
Wentworth, NH 03282
(603) 764-5831

Computer Information Exchange
P.O. Box 159
San Luis Rey, CA 92068
(714) 757-4849

Conduit
P.O. Box 388
Iowa City, IA 52244
(319) 353-5789

Courseware Magazine
4919 North Millbrook 222
Fresno, CA 93726
(209) 225-0953

Creative Computing Software
Department 301
P.O. Box 789M
(201) 540-0445

Dallas Public Schools
Marketing Department
912 South Ervay
(214) 742-7991

Demi-Software
6 Lee Road
Medfield, MA 02052

BCD Associates, Inc.
1216 North Blackwelder
Oklahoma City, OK 73106
(405) 524-7403

Betamax, Inc.
101 Nickerson Street
Suite 550
Seattle, WA 98109
(206) 282-6249

The Bottomshelf, Inc.
P.O. Box 49104
Atlanta, GA 30359

Carta Associates, Inc.
640 Lancaster Ave.
Frazer, PA 19355
(215) 647-9600

Comalcor
25 Sunrise Ave. 1108
Toronto, Ontario, Canada M4A 2S2
phone: 751-7481

Commodore Business Machines
(contact local Commodore dealer)

**Computer Business Systems of
Myrtle Point**
1707 Viewpoint
Myrtle Point, OR 97458
(503) 572-3841

Computrex Computer Services
P.O. Box 536
Inman, SC 29349

Cook's Computer Company
1905 Bailey Drive
Marshalltown, IA 50158

Cow Bay Computing
Box 515
Manhasset, NY 11030

Curriculum Applications
P.O. Box 264
Arlington, MA 02174

Delmarva Computer Club
P.O. Box 36
Wallops Island, VA 23337

Desert Sound
16268 Main Street
Hesperia, CA 92345
(714) 244-2555

Duxbury Systems, Inc.
77 Great Road
Acton, MA 01720

Educational Activities, Inc.
P.O. Box 392
Freeport, NY 11520
(516) 223-4666

Educational Microsystems, Inc.
P.O. Box 471
Chester, NJ 07930
(201) 879-5982

Educational Services Management
P.O. Box 12599
Research Triangle Park, NC 27709
(919) 781-1500

Educational Software and Design
P.O. Box 2801
Flagstaff, AZ 86003

Edu-teck Corp.
P.O. Box 11354
Palo Alto, CA 94366
(415) 325-9965

Edu-Ware Services, Inc.
22222 Sherman Way
Suite 102
Canoga Park, CA 91303
(213) 346-6783

Fireside Computing, Inc.
MicroGonome Division
5843 Montgomery Road
Elkridge, MD 21227
(301) 796-4165

Goforth Microcomputing
329 22nd Street East
Prince Albert, Saskatchewan,
Canada S6V 1N3
(306) 763-8323

Hartley Courseware, Inc.
P.O. Box 431
Diamondale, MI 48821
(616) 942-8987

High Technology Software
Products, Inc.
P.O. Box 14665
Oklahoma City, OK 73113
(405) 840-9900

Ideatech
P.O. Box 62451
Sunnyvale, CA 94088

George Earl
1302 South General McMullen
San Antonio, TX 78237

Educational Courseware
Ten Bay Street
Design 66
Westport, CT 06880

Educational Programs
P.O. Box 2345
West Lafayette, IN 47906
(317) 463-4778

Educational Software Corp.
414 Rosemere
Maquoketa, IA 52060

EduTech
50 Putnam Street
West Newton, MA 02165
(617) 965-4813

Edu-Ware
P.O. Box 336
Maynard, MA 01754

Ellis Computing
600 41st Ave.
San Francisco, CA 94121
(415) 751-1522

Gentech Corp.
4101 N. St. Joseph Ave.
Evansville, IN 47712
(812) 423-4200

J. L. Hammett
P.O. Box 545
Hammett Place
Braintree, MA 02184

Hayden Book Company
50 Essex Street
Rochelle Park, NJ 07662
(800) 631-0856

Houghton Mifflin Company
One Beacon Street
Boston, MA 02103
(617) 725-5000

Indian Head Software
1002 Indian Head Drive
Snow Hill, NC 28580
(919) 747-2839

Instant Software
Peterborough, NY 03458
(800) 258-5473

International Micro Systems
8425 Quivara Road
Lenexa, KS 66215
(913) 888-8330

Jem Research
Discovery Park
P.O. Box 1700
University of Victoria
Victoria, BC Canada V8W 2Y2

Krell Software
21 Millbrook Drive
Stony Brook, NY 11790
(518) 751-5139

Little Bee Educational Programs
P.O. Box 262
Massillon, OH 44648
(216) 832-4097

Mastertype
P.O. Box 5223
Stanford, CA 94305

Math Software
1233 Blackthorn Plaza
Deerfield, IL 60015

Med Systems Software
P.O. Box 2674-D
Chapel Hill, NC 27514
(919) 933-1990

Mentor Software, Inc.
P.O. Box 791
Anoka, MN 55303

Microcomputer Education
Applications Network
256 N. Washington Street
Falls Church, VA 22046
(702) 536-2310

MICRO-ED, Inc.
P.O. Box 24156
Minneapolis, MN 55424
(612) 926-2292

Micro Learningware
P.O. Box 2134
North Mankato, MN 56001
(507) 625-2205

Micro Power & Light
13773 North Central Expressway
Dallas, TX 75243
(214) 234-8233

Instructional Development Systems
2927 Virginia Beach Blvd.
Virginia Beach, VA 23452
(804) 340-1977

Interpretive Education
2306 Winters Drive
Kalamazoo, MI 49002
(616) 345-8681

Jensen Software
1440 Rockway
Lakewood, OH 44107

Library Software
P.O. Box 23897
Pleasant Hill, CA 94523

Charles Mann & Associates
Microcomputer Division
55722 Santa Fe Trail
Yucca Valley, CA 92284
(714) 365-9718

Math City
4040 Palos Verdes Drive North
Rolling Hills Estates, CA 90274
(213) 541-3377

McGraw-Hill
1221 Avenue of the Americas
New York, NY 10029
(212) 99-

Mega-byte Systems
66 Church Street
Ellenville, NY 12828
(914) 647-4235

Merlan Scientific
P.O. Box 25
Depew, NY 14043
(416) 877-0171

Microcomputer Software Systems
4716 Lakewood Drive
Metairie, LA 70002

micro lab
811 Stonegate Drive
Highland Park, IL 60035
(312) 433-7877

Microphys
2048 Ford Street
Brooklyn, NY 11229
(212) 646-1040

Micropute Software
P.O. Box 1943
Rock Mount, NC 27801

Microsoft Consumer Products
10800 North East Eighth
Bellevue, WA 98004
(206) 454-1315

Milton-Bradley Company
Shaker Road
E. Longmeadow, MA 01028
(413) 525-6411

Mosaic Electronics
P.O. Box 748
Oregon City, OR 97045

NCCD (National Coordinating
Center for Curriculum Development)
State University of New York
Stony Brook, NY 11794
(516) 246-8418

OMNICO Computer Associates
3300 Buckeye Road
Atlanta, GA 30341

Program Design, Inc.
11 Idar Court
Greenwich, CT 06830
(203) 661-8799

Project COMCAL
Commack Public Schools
Hauppauge Road
Commack, NY 11725

Quality Educational Designs
P.O. Box 12486
Portland, OR 97212
(503) 282-4906

Rainbow Micro Software
1650 Piikea Street
Honolulu, HI 96818
(TRS-80 Programs)

School Microware
P.O. Box 246
Dresden, ME 04342
(207) 737-4466

Shafer Software
465 South Mathilda Ave.
Suite 202
Sunnyvale, CA 94086
(408) 730-0179

The Software Exchange
6 South Street, Box 68
Milford, NH 03055
(603) 673-5144

Milliken Publishing Company
1100 Research Boulevard
St. Louis, MO 63132
(314) 991-4220

Minnesota Educational Computing
Consortium Publications
2520 Broadway Drive
St. Paul, MN 55113
(800) 631-8112

MUSE Software
330 North Charles Street
Baltimore, MD 21201
(301) 659-7212

National Software Marketing
4701 McKinley Street
Hollywood, FL 33021
(305) 625-6062

Petsoft
Radclyffe House
66-68 Hagley Road
Birmingham, England B16 8PF

Programs for Learning, Inc.
P.O. Box 954
New Milford, CT 06776

Project LOCAL Software
c/o Dresden Associates
P.O. Box 246
Dresden, ME 04342
(207) 737-4466

(Radio Shack - sold through local
Radio Shack retail outlets)

Scharf Software Services
P.O. Box 18445
Irvine, CA 92713
(714) 557-9206

Science Research Associates
155 North Wacker Drive
Chicago, IL 60606
(800) 621-0664

Sheridan College
c/o F. Winter
1439 Trafalgar Road
Oakville, Ontario
Canada L6H 2L1
(416) 845-9430

Software Industries
902 Pinecrest
Richardson, TX 75080

Special Delivery Software
10260 Bandlely Drive
Cupertino, CA 95041
(408) 996-1010

The Teaching Assistant
22 Seward Drive
Huntington Station, NY 11746

T.H.E.S.I.S.
P.O. Box 147
Garden City, MI 48135
(313) 595-4722

Teacher's Pet
c/o Glenn Fisher
1517 Holly Street
Berkeley, CA 94703

Tycom Associates
68 Velma Avenue
Pittsfield, MA 01201
(413) 442-9771

Unicom Division of United Camera
297 Elmwood Avenue
Providence, RI 02907

Whitney Educational Services
2071 Tenth Ave.
San Francisco, CA 94116

Stoneware Microcomputer Products
1930 Fourth Street
San Rafael, CA 94901
(415) 454-6500

Teaching Tools
P.O. Box 12679
Research Triangle Park, NC 27709
(919) 851-2374

3R Software
P.O. Box 3115
Jamaica, NY 11341

Time Share Corp.
Hanover, NH 03775
(603) 488-3838

TYC Software
40 Stuyvesant Manor
Geneseo, NY 14454
(716) 243-3005

Westinghouse Learning Corp.
5005 West 110th Street
Oak Lawn, IL 60453

Rodenstein & Lanbert (1983) authored *Microcomputer Software Programs For Vocational Education*, a document highly recommended for vocational instructors who are just beginning the search for software for vocational programs. It is one of the few resources solely devoted to software specific to vocational education. Software is categorized in the document by the name of the program, its distributor and the vocational discipline that it represents. As examples, the following excerpts from the document list software for distributive education (Rodenstein & Lanbert, 1983, pp. 35-36) and trade and industrial education (pp. 32-34).

DISTRIBUTIVE EDUCATION—GENERAL

Name of Program	Distributor
PAYFILE (for small businesses)	Dynacomp, Inc., 1427 Monroe Avenue, Rochester, NY 14618 (800) 828-6772
SALE I (sales analysis)	Micro Architect, Inc., 96 Dotha Street, Arlington, MA 02174
CALC I (business package)	
COSTING	Computer House Division, 1407 Clinton Road, Jackson, MI 44202 (517) 782-2132
RETAIL MANAGEMENT SYSTEM	Charles Mann and Associates, 7594 San Remo Trail, Yucca Valley, CA 92284 (714) 365-9718
PORTFOLIO	Southeastern Educational Software 3300 Buckeye Rd., Atlanta, GA 30341 (404) 457-8336

LEMONADE STAND

Creative Computing
Software, 39 E. Hanover
Ave., Morris Plains, NJ 07950

CARTELS & CUTTHROATS

Strategic Simulations
465 Fairchild Dr., Suite
108, Mountain View, CA
94043

CONGLOMERATES COLLIDE

Rockroy, 7721 E. Gray
Rd., Suite 103
Scottsdale, AZ 85260

MANAGEMENT DECISIONS

Hayden Book Company
50 Essex Street
Rochelle Park, NJ 07662

MARKET

Creative Computing
Software, 39 E. Hanover
Ave., Morris Plains, NJ 07950

MICRO MILLIONAIRE

Softside, 6 South St.
Milford, NH 03055

PRODUCTION COSTING

Curriculum Publications
Clearinghouse, Western
Illinois Univ., 46
Horrabin Hall, Macomb,
IL 61455

INVENTORY ANALYSIS - REORDER POINT

- Projected use
- Turnover rate

Curriculum Publications
Clearinghouse, Western
Illinois Univ., 46
Horrabin Hall, Macomb,
IL 61455

JOB PRICE/BIDDING

Curriculum Publications
Clearinghouse, Western
Illinois Univ., 46
Horrabin Hall, Macomb
IL 61455

FORECASTING - LEAST SQUARES

- Regression
- Moving Average
- Exponential Smoothing

Curriculum Publications
Clearinghouse, Western
Illinois Univ., 46
Horrabin Hall, Macomb,
IL 61455

TRADE AND INDUSTRIAL

Name of Program

Distributor

GENERAL APPLE DISKETTE ON
INDUSTRIAL ARTS

Minnesota Curriculum Services
Center, 3554 White Bear Ave.
White Bear Lake, MN 55110
(612) 770-3943

THERMODYNAMICS

MicroLearningWare, P.O. Box 2134
North Mankato, MN 56001
(507) 625-2205

ELECTRICITY

MicroLearningWare, P.O. Box 2134
North Mankato, MN 56001
(507) 625-2205

MACHINE PART QUOTING	Computer House Division, 1407 Clinton Road, Jackson, MI 44202 (517) 782-2132
PRINT SHOP JOB ESTIMATING/ SCHEDULING	California Micro Products, 795 West Imperial Highway, Brea, CA 92621 (714) 990-4014
CONSTRUCTION COST/PROFIT ANALYSIS	Realth Software, 2045 Manhattan Ave., Hermosa Beach, CA 95014 (408) 996-1010
DESIGNER TOOL KIT (drafting)	Realth Software, 2045 Manhattan Ave., Hermosa Beach, CA 95014 (408) 996-1010
CACTUS PLOT	Southwest Educational Psychology Services, Inc., P.O. Box 1870 Phoenix, AZ 85001 (602) 253-6528
ELECTRONIC ENGINEER'S ASSISTANT	Opportunities for Learning, Inc. 8950 Lurline Ave., Dept. 390 Chatsworth, CA 91311 (213) 341-2535
ELECTONICS I	Opportunities for Learning, Inc. 8950 Lurline Ave., Dept. 390 Chatsworth, CA 91311 (213) 341-2535
PRACTICAL DIGITAL THEORY & TROUBLESHOOTING TIPS	Opportunities for Learning, Inc. 8950 Lurline Ave., Dept. 390 Chatsworth, CA 91311 (213) 341-2535
UNI-SOLVE	Opportunities for Learning, Inc. 8950 Lurline Ave., Dept. 390 Chatsworth, CA 91311 (213) 341-2535
HAM PACKAGE	Opportunities for Learning, Inc. 8950 Lurline Ave., Dept. 390 Chatsworth, CA 91311 (213) 341-2535
50 HI-RES ELECTRONIC DESIGN	Avant-Garde Creations, P.O. Box 30160, Eugene, OR 97403 (503) 345-3043
TEACH YOURSELF MICROPROCESSORS	Integrated Computer Systems 3304 Pico Blvd., P.O. Box 5339 Santa Monica, CA 90405
HI-TECH EDUCATIONAL EQUIPMENT -microprocessor systems control systems, applications modules, CNC machines, interface boards, instrumentation, and control	Feedback, 620 Springfield Avenue, Berkeley Heights, NJ 07922 07922 (201) 464-5181
ROBOTICS -Armover, Robert Armberg, Genesis Armatrol, Armadilo, Armsort, Armdraulic	Feedback, 620 Springfield Avenue, Berkeley Heights, NJ 07922 (201) 464-5181

SHORT CIRCUITS	Keenan Educational Games, Inc., 95 Ponderosa Dr., Hanover, MA 02339 (617) 878-7341
SUPER SHORT CIRCUITS	Keenan Educational Games, Inc., 95 Ponderosa Dr., Hanover, MA 02339 (617) 878-7341
EDUCATION TRAINING PACKAGES	E & L Instruments, Inc., 61 First Street, Derby, CT 06418 (203) 735-8774
HICKOK TEACHING SYSTEMS -Hickok Micro Trainer software, courseware, & are for digital & ter technology	Allison Associates, Box 313, Troy, MI 48099 (313) 689-2990
TEACHMOVER (developmental robotic arm)	Allison Associates, Box 313, Troy, MI 48099 (313) 689-2990
MINIMOVER—5 GRIPPER	Allison Associates, Box 313, Troy, MI 48099 (313) 689-2990
TEN POSITION ROBOTICS LABORATORY	Allison Associates, Box 313, Troy, MI 48099 (313) 689-2990
FIVE POSITION ROBOTICS LABORATORY	Allison Associates, Box 313 Troy, MI 48099 (313) 689-2990
MICROBOT ALPHA	Allison Associates, Box 313 Troy, MI 48099 (313) 689-2990
LENNOX ROBOTICS TRAINING PROGRAMS & TRAINING AIDS	Lennox Education Products P.O. Box 400450, Dallas, TX 75240 (214) 783-5463
SINGLE ARM SLIDE ROBOT	Lennox Education Products P.O. Box 400450, Dallas, TX 75240 (214) 783-5463
DOUBLE ARM SLIDE ROBOT	Lennox Education Products P.O. Box 400450, Dallas, TX 75240 (214) 783-5463
BOX ARM SLIDE ROBOT	Lennox Education Products P.O. Box 400450, Dallas, TX 75240 (214) 783-5463
STEPPER MOTORS ROBOT	Lennox Education Products P.O. Box 400450, Dallas, TX 75240 (214) 783-5463
ELECTRIC SERVO CONTROLLED ROBOT	Lennox Education Products P.O. Box 400450, Dallas, TX 75240 (214) 783-5463
HYDRAULIC SERVO CONTROLLED ROBOT	Lennox Education Products P.O. Box 400450, Dallas, TX 75240 (214) 783-5463

BASIC ELECTRIC TRAINER

Lennox Education Products
P.O. Box 400450, Dallas, TX
75240 (214) 783-5463

RELAY TRAINER

Lennox Education Products
P.O. Box 400450, Dallas, TX
75240 (214) 783-5463

MICROCOMPUTER APPLICATIONS IN
VOCATIONAL EDUCATION: TRADES
AND INDUSTRY

Western Illinois Univ.
Macomb, IL 61455

CADAPPLE SOFTWARE

T & W Systems, Inc.
18437 Mt. Langley
Suite B, Fountain
Valley, CA 92708
(714) 963-3913

CAT-1 COMPUTER AIDED DESIGN
SYSTEM

Catoonix Corporation
151 Sixth St., N.W. Suite
039, Atlanta, GA 30313

INDUSTRIAL EDUCATION

Name of Program

Distributor

GENERAL APPLE DISKETTE ON
INDUSTRIAL ARTS

Minnesota Curriculum Services Center
3554 White Bear Avenue, White Bear
Lake, MN 55110 (612) 770-3943

THERMODYNAMICS
NORTH

MicroLearningWare, P.O. Box 2134, North
Mankato, MN 56001 (507) 625-2205

MACHINE PART QUOTING

Computer House Division, 1407 Clinton
Road, Jackson, MI 44202
(517) 782-2132

PRINT SHOP JOB ESTIMATING/
SCHEDULING

California Micro Products, 795 West
Imperial Highway, Brea, CA 92621
(714) 990-4014

CONSTRUCTION COST/PROFIT
ANALYSIS

Realth Software, 2045 Manhattan Ave.
Hermosa Beach, CA 90254

CIRCUIT ANALYSIS

Apple Computer, 2045 Mariani Ave.
Cupertino, CA 95014
(408) 996-1010

ELECTRICITY

MicroLearningWare, P.O. Box 2134,
North Mankato, MN 56001
(507) 625-2205

CACTUS PLOT

Southwest Educational Psychology
Services, Inc., P.O. Box 1870,
Phoenix, AZ 85001 (602) 253-6528

ELECTRONIC ENGINEERING
ASSISTANT

Opportunities for Learning,
Chatsworth, CA 91311 (213) 341-2535

ELECTRONICS I

Opportunities for Learning,
Chatsworth, CA 91311 (213) 341-2535

DESIGNER TOOL KIT (drafting)

Apple Computer, 20525 Mariani Avenue
Cupertino, CA 95014
(408) 996-1010

AGRICULTURE HERD PERFORMANCE PROGRAMS

Name of Program	Distributor
CATTLE FEEDING ECONOMICS	AG-Com, Muscatine, IA 52761
COW-CALF PROFITABILITY	AG-Com, Muscatine, IA 52761
DAY-ADJUSTED WEANING WEIGHTS	AG-Com, Muscatine, IA 52761
FARROW TO FINISH SWINE PRODUCT	AG-Com, Muscatine, IA 52761
FINISHING FEEDER PIGS	AG-Com, Muscatine, IA 52761
NET ENERGY FOR FEEDLOT CATTLE	AG-Com, Muscatine, IA 52761
PROTEIN BALANCE FOR FEEDLOT	AG-Com, Muscatine, IA 52761
SHEEP PRODUCTION—ECONOMICS	AG-Com, Muscatine, IA 52761
SWINE RATION ANALYSIS	AG-Com, Muscatine, IA 52761
SWINE RATION FORMULATION	AG-Com, Muscatine, IA 52761
AGRICULTURE—VOLUME I DISKETTE	MECC, 2520 Broadway Drive, St. Paul, MN 55113 (612) 376-1118
Software in Cost Tracking	
FERTILIZER, HERBICIDES, MARKETING, PLANTS BREAKEVENS, ANALYSIS, LEASES, WEATHER, DAIRYING, HARVESTING, IRRIGATION, INVENTORY, STORAGE, FUNGICIDES, INSECTS	AGPROS MicroSystems, Box 64539, Lubbock, TX 79464 (808) 745-3011
FARM PROGRAMS	MicroLearningWare, P.O. Box 2134, North Mankato, MN 56001 (507) 625-2205
LIVESTOCK MANAGEMENT	MicroLearningWare, P.O. Box 2134, North Mankato, MN 56001 (507) 625-2205
BEST CROP, FINISHING HOG PLANNER, FEEDER SPECIFICS, PIG PRODUCTION PLANNER, BEEF FEEDER PLANNER, DAIRY COW PRODUCTION PLANNER, CASH FLOW SUMMARY, INVENTORY SUMMARY	F.A.R.M. Aids (for Apple II), Specialized Data Systems, Box 8278 Madison, WI 53708 (608) 241-5050
CATTLE BREEDING RECORDKEEPING SYSTEM FOR MODEL III	F.A.R.M. Aids (for Apple II), Specialized Data Systems, Box 8278, Madison, WI 53708 (608) 241-5050

Microcomputer Software Programs for Vocational Education, Rodenstein & Lanbert (1983) is available from the following sources:

Vocational Studies Center
1025 West Johnson Street, Rm 964
School of Education
University of Wisconsin
Madison, Wisconsin 53706

SUMMARY

Although it may be tempting to obtain and use specific software because it has been developed by a particular company, or because it was obtained from another educator who liked it, DON'T! Vocational educators must evaluate microcomputer software for use in the specific instructional program based on the suitability and the appropriateness of the software for teaching specific instructional objectives. The software selected, purchased, and used in any vocational program must be suitable to the needs, interests, levels, and abilities of the students for whom it is intended.

Cognitive, affective, and psychomotor skills can be gained using appropriate software in an instructional setting. Research has shown this to be true with many different populations of students. The key appears to be to use programs that can "branch" to the educational levels of the students using the programs.

Evaluating software, although a time consuming process for the vocational educator, is an essential process. Criteria to consider, steps for evaluating a piece of software, and a specific evaluation tool are presented for the vocational educator in this unit of instruction. Utilization of these tools will help assure vocational educators that their decisions regarding software are intelligent and thorough.

Reviews of software by other individuals and sources can be a valuable aid for the vocational educator. These reviews should be regarded thoughtfully, keeping in mind that the reviews are the opinions of other individuals.

ACHIEVEMENT INDICATORS

- 1) Explain why software selected by vocational teachers should be appropriate to the instructional setting.
- 2) Describe an example of a cognitive, affective, and psychomotor learning outcome that may result from the student using an appropriate software program in a teaching/learning situation.
- 3) List at least 8 criteria to consider when evaluating a piece of microcomputer software for inclusion in an instructional program.
- 4) State at least three sources of software reviews available to the educator.
- 5) Obtain a piece of software and evaluate it for inclusion in teaching a specific instructional objective. Use the evaluation form provided in this unit to review the software.

REFERENCES

- Computer Savvy: How to evaluate software. (1983). *Forecast for Home Economics*, 28(5), 16.
- Conkling, R. (April, 1983). The nuts and bolts of selecting a computer assisted instructional program. *T.H.E. Journal*, 101-104.
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Unit 5

Modifying Software

UNIT OBJECTIVE

Upon completion of this unit, the learner will be able to modify software. This knowledge will be demonstrated through completion of the achievement indicators at the conclusion of this unit.

SPECIFIC OBJECTIVES

Upon completion of this unit, the reader will be able to:

- 1) Explain four reasons why instructors may need to modify software.
- 2) Describe five fundamental rules of software modification.
- 3) Correctly use nine statements of the basic programming language.
- 4) Modify computer program listings of up to one page which may contain minor errors or be in need of improvement.

Modifying Software

BY: DR. ROBERT WATTS

]RUN LADDER ANGLE SAFETY

***** LADDER ANGLE SAFETY *****

LADDED BASE MUST NOT BE OUT FROM	THE HOUSE IN FEET:	
	NOT LESS THAN—NOT MORE THAN—	LADDER LENGTH
8.71	9.32	36
8.23	8.8	34
7.74	8.28	32
7.26	7.76	30
6.77	7.25	28
6.29	6.73	26
5.81	6.21	24
5.32	5.69	22
4.84	5.18	20

Assume that the above is a program with minor errors. Although the program contains useful information for students, it needs correction. If the instructor corrects the spelling and improves the format, then this simple program will illustrate an important point and be useful in class.

The ladder safety example is simple to understand and to change. Vocational instructors may very well assume that the results are worth the time spent in making corrections. However, instructors will soon see that not all programs are so easily modified, so why bother?

Software modification is an interesting way to improve programming skills and to appreciate how others solve programming problems. Furthermore, a large quantity of good software exists in the public domain. Instructors may use, modify, or copy these programs to meet their instructional needs. Instructors will usually modify public domain software rather than use the \$150.00 copyrighted commercial software.

There are four reasons why vocational teachers may wish to modify software:

1. The vocational teacher has a program which runs, but which includes an error.
2. The program runs satisfactorily and is correct, but the instructor would like to improve it or customize it for a specific teaching situation.
3. The program does not run, but might be useful if it could be corrected.
4. An instructor finds a good program, but it runs on another type of computer. The instructor desires to transfer the program to a different make of computer.

Rules

Before modifying a program, whether it is a simple one with 10 lines of programming code or a more complex one with several pages, consider some fundamental rules.

Understand What the Program Does (Or What It Is Supposed to Do)

If a program runs and is not very complex, then the purpose of the program is usually obvious. It is useful, especially with more complex programs, for instructors to make a rough diagram, or *program logic chart*, to show what the program does from the standpoint of the student (i.e., what the learner will see on the computer screen). Teachers should run the program, stopping at each logical place where the computer stops, and diagram what happens on the screen. When the program gives two choices, or branches, teachers should illustrate the branch on the diagram and run through each branch on the computer continuing the program logic chart. This process provides teachers with a good idea of what the program does and may suggest modifications which are needed.

Make One Modification at a Time

It is tempting to make several changes at the same time in the program code when the changes seem so obvious and time can be saved. However, teachers should be cautioned against this practice. One of the changes may affect another part of the program or even many different areas in the program. Instructors should make one modification or change at a time because they will then have a much better opportunity for observing the impact which each change may have on the total program.

Document Changes

Internal documentation includes the REMark statement which the computer ignores as part of the program listing. Instructors should use REM statement liberally to explain and track their programming efforts. These statements should be made to stand out in the program listing by using a series of asterisks (*****) or other characters which will call attention to the statement as the instructor reads the program code.

At this stage of the programming process, external documentation (information which may help one understand the program) may simply be on scratch notes and output from sample runs. Instructors should always date, number, and sequentially order in folders sample runs so as to trace through modifications if necessary.

Keep Old Program Listings

If instructors attempt to modify more complex programs, it is possible to get completely lost as to what they are attempting to do; this is especially true when instructors perceive themselves as "advanced" and start trying to move ahead quickly by making multiple changes.

Instructors should always keep a source code listing of the original program and make new listings each time they have made major modifications or a number of minor ones. How often should a new listing be saved?

Instructors can answer that question with another one: "How much of your time and effort are you willing to spend if your diskette is lost or ruined?" Instructors should make it a practice to date and number each program listing.

It Always Takes Longer Than You Expected to Modify a Program

Minor program changes often become major ones. Major program modifications may take longer than it would take to write a new program. Vocational teachers should consider how much the program is worth in its current state and the potential worth of the program if modified. Considerations such as time, new learning opportunities, frustrations, challenges, joys of success, peer recognition, and new teaching aids should be a part of the instructor's judgement regarding whether a program should be modified.

Modifying Sample Programs

With these rules in mind, instructors can examine some programs and consider how they might be modified.

LIST

```
2     HOME
4     PRINT "***** LADDER ANGLE SAFETY *****"
5     PRINT : PRINT
10    LET C = 3.14159 / 180
20    LET L = 36
30    PRINT "LADDED BASE MUST NOT BE OUT FROM THE HOUSE IN FEET:"
35    PRINT
40    PRINT "NOT LESS THAN-NOT MORE THAN-LADDER LENGTH"
45    FOR L = 36 TO 20 STEP - 2
50    PRINT INT (L * SIN (C * 14) * 100 + .5) / 100, INT (L * SIN (C *
15
        ) * 100 + .5) / 100,
51    PRINT L
55    NEXT L
60    GOTO 327 67
327 67  END
]
```

The preceding program listing, or source code, is written in the computer language BASIC. The program is rather easy to understand with only seven statements or commands. Very long BASIC programs often use only 12-15 different statements, suggesting that they are not as complex as they may initially appear. Some computers accept or understand both upper and lower case letters. This example uses only upper case letters.

Instructors should read a program listing just as they would read a book: one line at a time in sequence. A program listing differs from a book due to the possibility of it jumping forward or backward from a line of code. In a way, this is similar to a programmed instruction booklet. The computer "reads" the BASIC program listing in order, just as ones reads the program.

The numbers on the left are **line numbers**. In BASIC, each line of code must have its own unique number in sequential order. The numbers in this list seem to have been chosen rather randomly and it is difficult to determine if some lines of code have been left out or deleted. The code could be numbered sequentially 1, 2, 3, . . . n, but that would not allow room for modifications. A common numbering sequence is 10, 20, 30, . . . n, which allows room for inserting additional statements. Most computers have small helper programs, or utilities, called RESEQUence or RENUMber, which automatically renumber the lines of code and make other modifications.

Next to the line number is a **command** or a word which tells the computer what it is to do next. The first command at line 2 is HOME. This command tells the **cursor** (a small blinking light on the monitor screen) to go to the upper left hand corner of the screen and also commands the computer to clear or erase the screen. The HOME statement will create a clean work space on the screen.

The PRINT command will print on the screen or on paper anything that is put between the quotation marks (""). Some computers require **both** the opening and the closing quotation marks, while others require only the first set. On more complex programs, one will need to learn how to format, or place the information within the quotation marks, in specific locations on the screen.

Line 5 may seem confusing, as though the computer stutters. There is nothing behind the PRINT statement and no quotation marks. There is a simple explanation for this line. The PRINT command is a simple way of leaving a blank line on the screen or on a printout. The colon (;) tells the computer that there is more than one command on line 5, so the programmer has told the computer to save two blank lines between the title and the next feature. This will be seen on the terminal at line 30 of the listing.

The third statement is LET at line 10. This is a simple method for assigning or changing one entry to another so that it may be used later more easily by the programmer and the computer. Line 20 means that any time L is used in the program, it represents or is equal to the number 36 and can be used in calculations, as in lines 45 and 50, or to print a result, as in line 51.

The first change instructors may wish to make is at line 30. Readers have learned three command statements, HOME, PRINT, and LET, which make up most of this program. In fact, these are common commands which will be seen in most BASIC program listings.

The commands at line 45 and 55 work together as a pair. The FOR command instructs the computer to begin a sequence of activities, or a loop, and the NEXT command informs the computer to continue this loop. The loop includes lines 45, 50, and 51. The command NEXT L at line 55 instructs the computer to go back and re-execute lines 45, 50, and 51.

If instructors were to run a printout of this program, they would see the results of the calculations done by lines 45 and 50. Can you discover where the three columns came from?

Line 60 is an unnecessary GOTO statement which tells the computer to go to line 32767. This takes the reader to the last of the seven new commands of this unit, the END statement. Why is the GOTO statement unnecessary? Not all computers require an END statement, but it is a good idea to state exactly when one has reached the end of the program. The END command may be located anywhere in the program and does not necessarily have to be at the end of the program listing.

Improving a Program

It is up to teachers to find programs which run, but which they would like to expand, improve, or customize for specific teaching situations. For example, what does the next program, RECIPE COST, do? How could the program be improved? Could it be changed to find other costs?

]RUN

RECIPE COST

NUMBER OF INGREDIENTS?2

INGREDIENT 1:

COST FOR BULK UNIT IN STORE? 50

NUMBER OF UNITS IN BULK? 2

NUMBER OF RECIPE UNITS PER BULK UNIT? 25

NUMBER OF RECIPE UNITS CALLED FOR? 1

INGREDIENT 2:

COST FOR BULK UNIT IN STORE? 50

NUMBER OF UNITS IN BULK? 40

NUMBER OF RECIPE UNITS PER BULK UNIT? 1

NUMBER OF RECIPE UNITS CALLED FOR? 1

NUMBER OF SERVINGS? 1

TOTAL COST FOR 1 RECIPE? \$6.25

54

CHANGE NUMBER OF SERVINGS (1 = YES, 0 = NO)? 0

]

LIST

```
10 PRINT "RECIPE COST"
20 PRINT
30 PRINT "NUMBER OF INGREDIENTS";
40 INPUT N
50 FOR I = 1 TO N
60 PRINT "INGREDIENT"; I; ":"
70 PRINT "COST FOR BULK UNIT IN STORE";
80 INPUT C
90 PRINT "NUMBER OF UNITS IN BULK";
100 INPUT U
110 PRINT "NUMBER OF RECIPE UNITS PER BULK UNIT";
120 INPUT F
130 PRINT "NUMBER OF RECIPE UNITS CALLED FOR";
140 INPUT R
150 P = P + C / U / F * R
160 NEXT I
170 PRINT "NUMBER OF SERVINGS";
180 INPUT S
190 PRINT
200 PRINT "TOTAL COST FOR 1 RECIPE = $"; INT (P * 100 + .5) / 100
220 PRINT
230 PRINT "CHANGE NUMBER OF SERVINGS (1 = YES, 0 = NO)";
240 INPUT N
250 IF N = 1 THEN 170
```

]

Examining the program listing for **RECIPE COST**, you see that there are only two new commands: **INPUT** and **IF**. The computer will wait patiently for the user to input or type in information which the computer needs to do its job. Line 30 asks the user to type in the number of ingredients. The computer will store the information given, such as the number 5, in a location in the computer memory which the programmer has named **N**. At line 80 the cost for bulk unit in store has been named **C**.

Notice line 150. The letter **P** equals or stands for the calculation which follows it on that line. In the first program, the programmer would have said **LET P =**; this illustrates that the optional **LET** statement can increase the readability of the program listing.

At line 250, the **IF** statement provides the computer with a way of making a decision. Line 230 asks whether to change the number of servings by answering 1 for **YES** and 0 (zero) for **NO**. If the answer is yes (1) the computer "jumps" to line 170 and runs again.

There is a **N** at line 40 and another one at line 240. Are these the same number? Could these numbers be mixed up in the program? What if the programmer lost track of where and how the letter **N** was being used? A **very useful** command which has not been used in these programs is the **REMark** statement. If the programmer had written

- 2 REM N = number of ingredients
- 4 REM C = cost of bulk unit store
- 6 REM S = number of servings
- 8 REM N = change number of servings

He/she might not have used the letter N a second time. REMark statements are ignored by the computer, which allows the programmer to interject remarks or reminders in the program listing without changing in any way what the program executes or does. REM statements take additional room or memory in the computer, but they are important for improved readability or internal documentation.

A Bigger Challenge

By this point in this unit, readers have had opportunities to look at a small program, find an error, and correct it. Programs have been presented which run satisfactorily, but can be improved for specific teaching situations with better on-screen instructions, improved formatting, or greater complexity. Since these tasks can be accomplished fairly easily, readers are encouraged to learn more BASIC, either through a workshop or by using one of the many manuals which are available.

The next two reasons for modifying software may lead vocational teachers to spend an unexpected amount of time and effort for which they may not be prepared. With fair warning given, readers should consider the potential success which may result. These challenges for the intermediate programmer are modifying a program which doesn't run and modifying a program which runs on one brand of computer, often from a listing in a book or magazine, so that it will run on a different brand of computer.

One of the greatest challenges to the programmer is a program which does not run, but looks interesting. If the program listing is rather long, perhaps several pages, and is poorly documented without REM statements, analyzing the intended purpose of the program can be comparable to solving an intricate puzzle. Perhaps this explains the fascination some people find in programming; it may be an interesting feature for readers of this handbook.

The following is a more complex program listing for the testing of woodworking knowledge. Other than a DIMension statement which saves some storage space in the computer, a CALL statement which obtains information from the computer, and TAB and CTAB which control the horizontal and vertical tabs in a manner similar to that of the tab key on a typewriter, there are no new commands. If the program is entered correctly, it will run. Perhaps this will give readers some idea of how difficult it can be to find only one error which might cause a program not to run.

```
>LIST
100 R=O
110 DIM N$(15)
120 CALL -936
130 VTAB 10
140 INPUT "WHAT IS YOUR NAME?", N$
150 CALL -936
160 VTAB 5
170 TAB 14
180 PRINT "HELLO,"; N$; "!!!"
190 FOR I=1 TO 1500
200 NEXT I
210 VTAB 10
220 PRINT "THIS IS A TEST OF YOUR KNOWLEDGE OF THE"
230 PRINT "REQUIRED WOODWORKING PROJECT."
240 PRINT "THIS IS A MULTIPLE CHOICE QUIZ. YOU"
250 PRINT "WILL BE GIVEN FOUR QUESTIONS."
260 PRINT "TYPE A 1, 2, 3, OR 4 AFTER THE"
270 PRINT "QUESTION MARK"
280 PRINT: PRINT "GOOD LUCK,"; N$; "!!!": PRINT: PRINT
290 PRINT "WHAT TYPE OF JOINT IS USED FOR THE LEG?": PRINT
300 PRINT "(1) DADO 2) LAP 3) BUTT 4) MORTISE AND TENON";
310 INPUT A: IF A = 1 THEN 350
320 PRINT
```

```

330 PRINT "SORRY . . . IT IS A DADO JOINT. YOU SHOULD"
340 PRINT "HAVE ANSWERED WITH A 1.": GOTO 380
350 PRINT
360 PRINT "VERY GOOD, ";N$;"! HERE'S ANOTHER."
370 R = R + 1
380 FOR I = 1 TO 3000: NEXT I
390 CALL -936: VTAB 12
400 PRINT "WHAT TYPE OF SCREW IS USED IN THE"
410 "BOOKSTAND?": PRINT
420 PRINT "(1) ROUND HEAD 2) FLAT HEAD 3) OVAL HEAD"
430 PRINT "(4) SCREWMATE";
440 INPUT A: IF A = 2 THEN 460
450 PRINT: PRINT "TOO BAD . . . IT IS A FLAT HEAD SCREW.": GOTO 490
460 PRINT
470 PRINT "PRETTY GOOD! LET'S DO ANOTHER ONE."
480 R = R + 1
490 FOR I = 1 TO 3000: NEXT I
500 CALL -936: VTAB 12
510 PRINT "WHAT GRIT OR SANDPAPER DID YOU FIRST"
520 PRINT "USE ON YOUR BOOKSTAND?"
530 PRINT: PRINT "(1)802)1003)1804)240";
540 INPUT A: IF A = 2 THEN 590
550 PRINT
560 PRINT "NO! YOU SHOULD USE 100 GRIT PAPER"
570 PRINT "FIRST, THEN GO TO A HIGHER GRIT AS THE"
580 PRINT "SURFACE OF THE WOOD GETS SMOOTHER.": GOTO 620
590 PRINT
600 PRINT "RIGHT!! LET'S MOVE ON, ";N$
610 R = R + 1
620 FOR I = 1 TO 3000: NEXT I
630 CALL -936: VTAB 12
640 PRINT "WHAT TYPE OF WOOD IS USED FOR THE"
650 PRINT "BOOKSTAND?": PRINT
660 PRINT "(1)WALNUT 2)CHERRY 3)MAHOGANY 4)PINE";
670 INPUT A: IF A = 4 THEN 710
680 PRINT
690 PRINT "ABSOLUTELY NOT! WHITE PINE SHELVING IS"
700 PRINT "USED FOR THE REQUIRED PROJECT.": GOTO 740
710 PRINT
720 PRINT "GOOD GOING, PAL!"
730 R = R + 1
740 PRINT: PRINT
750 IF R = 4 THEN 800
760 IF R = 2 THEN 910
770 PRINT "NOT BAD, BUT YOU NEED TO SPEND A LITTLE"
780 PRINT "TIME STUDYING THE PROJECT PLAN SHEET."
790 END
800 PRINT "WOW!! THAT'S SUPER, ";N$;"!!"
810 PRINT "YOU REALLY KNOW YOUR STUFF!!"
820 PRINT: PRINT "THAT'S ALL WE WILL DO FOR NOW."
830 PRINT "I'LL THINK UP SOME MORE QUESTIONS FOR"
840 PRINT "YOU TO TRY LATER. I HOPE I CAN HELP"
850 PRINT "YOU LEARN MORE ABOUT WOODWORKING."
860 PRINT: PRINT "SEE YA' LATER, PAL!"
880 PRINT "YOUR NEXT QUIZ WILL BE ON CALCULATING"
890 PRINT "THE AGE OF PETRIFIED LOGS (HA! HA! HA!)"
900 END
910 PRINT "YUCHH! THAT WAS DEFINITELY NOT TOO"
920 PRINT "SWIFT! BACK TO THE BOOKS FOR YOU,"
930 PRINT N$;"!!"

```



```
940 PRINT
950 PRINT "BETTER LUCK NEXT TIME!"
960 END
```

>

A Program Logic Chart

Examine the program listing from the beginning. Begin with line 140, which asks for a name and waits for a response from the Keyboard. At 180, the computer prints HELLO and continues. Begin drawing a program logic chart attempting to predict what one would expect to see on the screen if the program were running. Where does the program branch or change direction? What parts of the program seem to connect in logical ways? Complete a logic chart for the woodworking program and add REM statements which would improve the readability of this program. Sketch a form or template which shows what might be printed on the screen.

Once readers understand what the program is designed to do and how it is programmed to complete the task, they will be better prepared to attempt to get the program to run. Beginning with a logic chart, make an effort to get each logical section or sequence to run on the computer. This cannot be done without some knowledge of programming, but it is a good way to learn. At this stage, one often begins to ask for help from more experienced programmers. A caution, please: don't expect miracles from programmers, even experienced ones. It is almost as difficult for them to understand a program the first time as it is for the instructor. First, display the logic chart and screen template in order to help explain what the program should do. The REM statements should stand out clearly. The programmer might then be able to understand the program logic and see why it will not run.

BASIC Isn't

The last type of modification, transferring or translating a program listing from one type of computer to another, is also very common. Many magazines, books, and proceedings have useful program listings. Sometimes a program which an instructor would like to use is being used at another school, but runs on a different type of computer.

Transferring a program written in BASIC from one computer to another seems as if it should be easy, but often turns out to be more difficult than expected (see pg. 4). The BASIC language on each brand of computer is far more difficult than one might expect, given the name of the language and the original purpose for which it was developed. Transferring programs is a good way to learn a bit more about programming, usually all the things that instructors would not have done if they had been the original authors.

When instructors begin to transfer BASIC programs from one brand of computer to another, they should obtain one of the useful books listed in the Resource Section of this unit.

SUMMARY

Program modifications can be quick and easy or take an agonizingly long amount of time. They can be a simple fix or provide an innovative and complex new teaching resource. Vocational teachers can learn something new, have some challenging fun, or be the start of the building for a time. Teachers should be encouraged to try making those little changes which they know will improve a computer program.

ACHIEVEMENT INDICATORS

- 1) Explain four major reasons why instructors may need to modify software.
- 2) Describe five fundamental rules of software modification.
- 3) Correctly use nine statements of the basic programming language.
- 4) Modify computer program listings of up to one page which may obtain minor errors or be in need of improvements.

RESOURCES

Radin, S. & Fayvian, L. (1984). *Computers in the classroom—a survival guide for teachers*. Chicago: Science Research Associates.

Walter, B. (1984, May). Keeping what works working. *Today's Office*, pp. 23-24.

Watt, P. (1984, June). Software for a donation. *InfoWorld*, pp. 36-38.

Public Domain Software

American Software Publishing Co.
1010 Sixteenth Street, NW
Washington, D.C. 20036
202/887-5834

P.J.S. Co.
1062 Taylor St.
Vista, CA 92083
619/727-1015

PC-SIG
1556 Halford Ave.
Suite 130Z
Santa Clara, CA 95051
408/730-9291

Unit 6

Designing Software

UNIT OBJECTIVE

Upon completion of this unit, the learner will be able to apply simple skills for designing educational software. This knowledge will be demonstrated through completion of the achievement indicators at the end of this unit.

SPECIFIC OBJECTIVES

Upon completion of this unit, the reader will be able to:

- 1) Define the role of the teacher in the software design process.
- 2) Define the role of the computer programmer in the software design process.
- 3) Describe 12 steps in the design process in preparation for the actual coding of a computer program which might be used as a teaching aid.
- 4) Complete 6 of the 12 steps in the design process in preparation for the actual coding of a computer program which might be used as a teaching aid.

Designing Software

BY: DR. ROBERT WATTS

Designing software has two major components: design and software. The first part, design, includes the identification of needs or objectives (what one wants to do) and the detailed ways of reaching those objectives. This part uses the skills of the educational specialist regarding what is to be taught, how it can be effectively taught, and why it is being taught. The second part, software, is computer language coding, which tells the computer what to do and guides the student in the learning process. Coding in various computer languages such as BASIC, LISP, LOGO, PASCAL, or PROLOG, is done by programming specialists who understand data structure, logic, syntax, and efficiency. The two specialists do not necessarily understand each other.

Educational software has been criticized by teachers and students for a variety of reasons (readers are referred to unit C.4, B.5, & E.1.2.3.). Vocational teachers need to examine the underlying problems with early educational software, often written by individuals who knew little about curriculum and instruction or by educators who knew what they wanted to do, but lacked the skills of programming specialists.

The purpose of this section is to provide vocational instructors with skills and ideas for improving educational software. This unit will not prepare vocational teachers to be programming specialists, but it will focus on the tasks needed to help produce good educational software. This is 80% of the process, the area in which teachers are experts in the designing phase prior to coding software in a programming language. This unit will progress to the stage of computer programming. At that stage, instructors and their administrations can decide whether their professional time should be spent as educators or as programmers.

This unit describes design fundamentals and design specifics. Designing a computer program is a logical exercise in problem solving. Instructors might have something they want to do, like teach a skill, give insight into an understanding, or set up a drill-and-practice exercise. In each case, instructors are simply using the computer as an aid or tool to help reach educational objectives. Vocational teachers should consider these problems in a logical way, breaking them into subunits or smaller problems, and then reassembling them into workable systems.

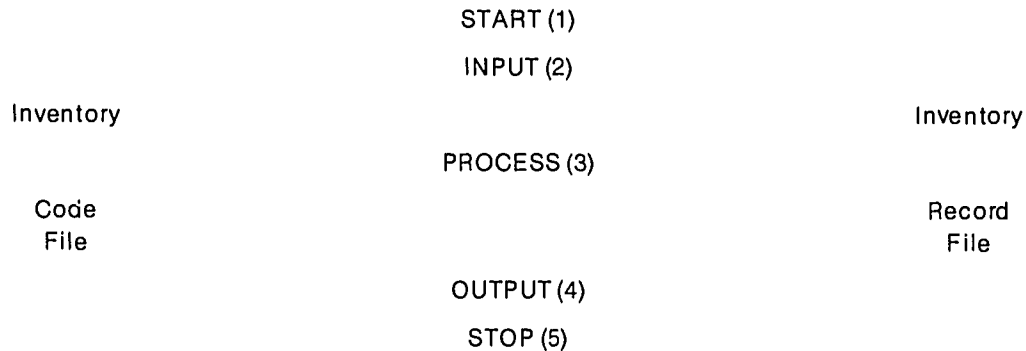
Twelve steps follow, eight of which guide readers through the logical development of an educational software program. A description of, or example for each step is given. Readers should examine the material quickly to get an overview of the process and then go through it again to design their own programs.

1. Completely understand the problem that is to be solved. What do you want to do? Complete an overall program design.

Sample Problem

You want students to learn how to use a simple parts inventory system. Your objective is to complete a computer program that will keep track of a number of different parts in several categories. Data will be entered at the microcomputer and a detailed report about the parts inventory will be produced upon request. The student will be able to add or delete parts from the inventory.

Sample Program Design



2. Determine and understand the exact output desired.

Often, the key to a good design is the ability to visualize the exact output, or what you would finally like to see on the computer screen or on a paper printout. Once the output, or final report, has been determined to be correct, the information or input and the processing needed to present the final output can be completed.

Sample Output

The output report, entitled "Parts Inventory," should appear as shown below.

Parts Inventory				
Part Number	Part Name	Part Category	No. on Hand	Original Cost
xxxxxx	xxxxxxxxx	xxxxxxxxx	xxxx	\$xxxx.xx
			Total Cost	\$xxxxx.xx

There should be a line containing all details, or a detail line, for each part. The detail line shall include part number, part name, part category, number on hand, and original cost. Total cost of all inventory on hand will be printed.

3. Identify the information sources (where does it come from and how will the student obtain the information) and the type of processing needed.

Sample Input

As each new part is obtained, the student will get the data from the original invoice (or a copy) and enter the data into the microcomputer. Parts that are used must be deleted from the inventory. Students will obtain this information from the requisition form (or a copy). Data will be saved as a file on a floppy diskette, one record for each part. The input data records will have the following field contents:

Part Number:

Part Name:

Part Category:

No. on Hand:

Original cost:

The student will be prompted for input, or asked for information, as follows:

Do you want to add or delete a part? (A = add; D = delete)

Sample Processing

Processing will include adding new parts, deleting parts, and keeping track of the total cost for all parts. The computer will perform processing as needed to produce the desired report (see section 2). The end of the input file will be signified by a part number of 999999. There will never be more than 50 input records for a given category.

4. Develop logical subdivisions for the overall problem.

These subdivisions describe in more detail the overall program design you developed in Step 1.

Sample Logical Subdivisions

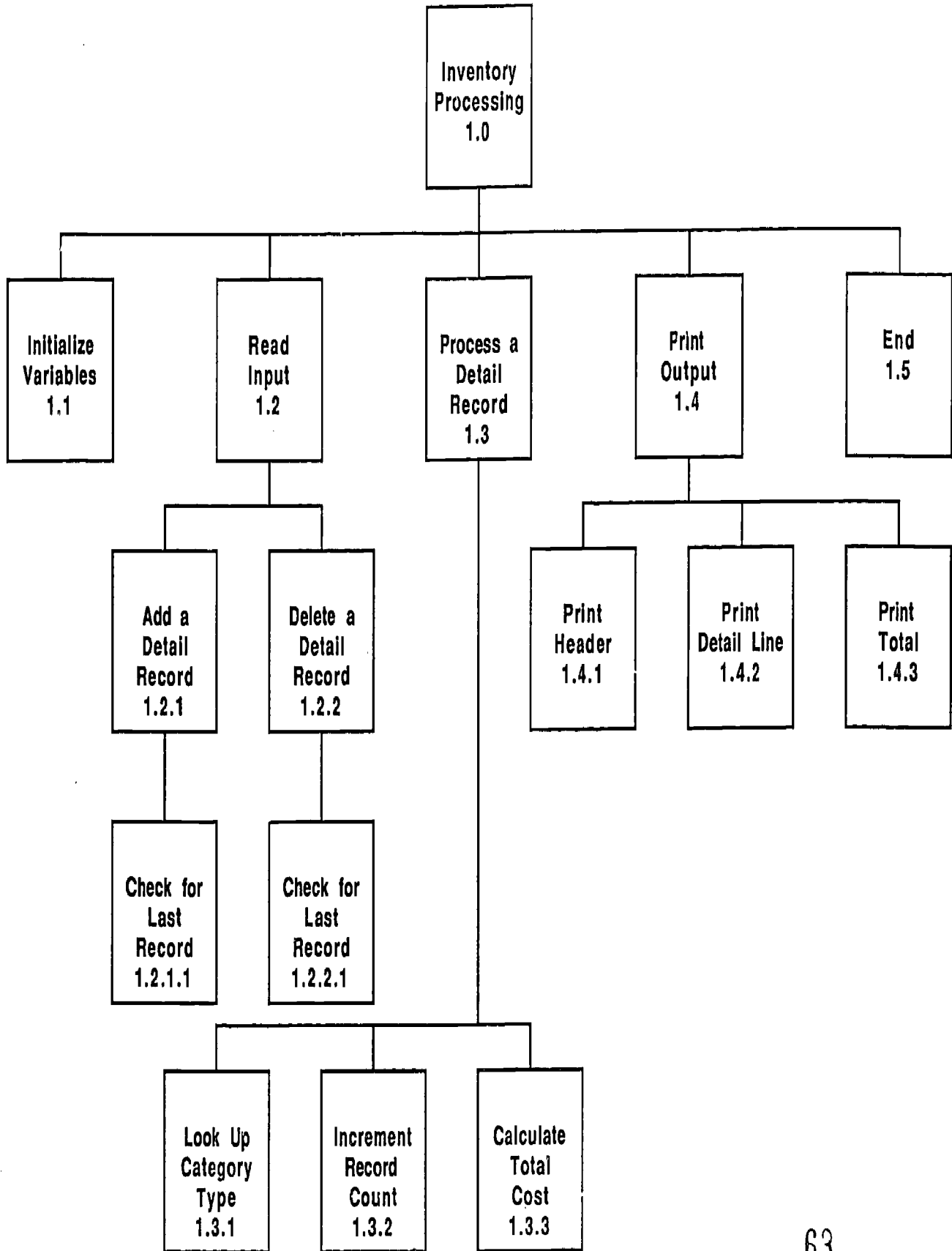
- initialize variables, or determine the starting point for each item to be used in the program
- enter the input data, or add/delete parts information, via the micro
- read input detail records until last record (999999)
- look up part category, or code, from diskette for each new input record
- print report heading
- print a detail output line for each input record
- after last input record print total cost of inventory on hand
- end

5. Draw a hierarchy chart.

A hierarchy chart is simply another way of integrating and describing what you have done in Steps 1 and 4.

Rules for construction of a hierarchy chart are:

1. Each module should be independent of the other modules, i.e., each module should be executed when control is passed to it by the module directly above it.
2. Once a module has been executed, control should be passed back directly to the module above.



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6. Develop a detailed program design.

The detailed program design places the modules you designed in Step 5 into a logical sequence which will eventually be executed by the computer. Remember, you are doing this to help describe to the computer specialists exactly what you want the computer to do for the student.

Sample Detailed Program Design

Inventory Processing Main Program	1.0
Initialize Variables	1.1
Read Input	1.2
Add a Detail Record	1.2.1
Delete a Detail Record	1.2.2
Check for Last Record	1.2.1.1 1.2.2.1
Process a Detail Record	1.3
Look Up Category Type	1.3.1
Increment Record Count	1.3.2
Calculate Total Cost	1.3.3
Print Output	1.4
Print Header	1.4.1
Print a Detail Line	1.4.2
Print Total	1.4.3
End	1.5

7. Write the pseudocode (or false code).

At this point, you are entering the realm of the programmer. But there is no reason why you cannot begin writing out the detailed steps the computer will need to execute or run your program. You are not writing the computer code. Pseudocode provides the opportunity to complete a detailed description of the program without having to worry about the syntax of writing in a computer language. It is a detailed high level cognitive process for planning what you want to do versus the rather mechanical process of coding. A programmer can take the pseudocode and write the actual code in almost any computer language available on the microcomputer.

8. Desk-check the logic in the pseudocode.

Desk-check means to check the pseudocode for logical errors in the logical structure of the program, errors that the educational specialist should be able to identify more often than the computer programmer. Go back through Steps 1 - 6 and be sure the program will do exactly what you want it to do.

You can desk-check your own code by going through the code very carefully, but like trying to proofread your own typing, it is better to have someone familiar with what you are trying to do desk-check your pseudocode.

9. Write the actual program code on paper.

This is often the point at which the layperson tries to begin writing a computer program. Up to this point, the choice of programming language or type of computer has not really been a factor. Through Step 8, enough thought and detail have gone into the planning so that changes are unlikely to occur during the coding process. The results of the working program should be of no surprise to anyone involved in the project.

A competent programmer should be able to complete this program in a few hours.

10. Key in the program.

This is the first time the computer is actually used. Once the program has been written, it must be keyed into the computer. This means simply copying exactly what the programmer has written in Step 9 and saving it on a diskette.

11. Debug the program.

It is not unusual for a program not to run properly the first time, even when the design and coding processes have been done meticulously. It may not run due to typing errors when entering the program, but hopefully not due to an error in program logic. You and the programmer can work together effectively in debugging the program so that it runs to your satisfaction.

12. Document the program.

Every good programmer knows that internal documentation, which is part of the program code, should be included as the program code is being written in Step 9. Once the program is running as anticipated, other types of program documentation should be developed.

External documentation, outside the program code—perhaps in a folder—is for the program user (teacher and/or student). The instructor who uses the program may differ from the one who developed the program. One should assume that this person or the student knows absolutely nothing about using the computer or this particular software.

System documentation should include all the documents that were developed during the design process (Steps 1 - 9) and should be kept in sequence along with the final source code (Steps 10 - 11), or computer language program code, and a successful sample program run that includes the use of addition and deletion of parts. All subsequent changes to the program should be added to the system documentation and all of this kept in a safe place away from students.

ACHIEVEMENT INDICATORS

- 1) Define the role of the teacher in the software design process.
- 2) Define the role of the computer programmer in the software design process.
- 3) Describe 12 steps which guide one in the software design process.
- 4) Complete 6 of the 12 steps in the design process in preparation for the actual coding of a computer program which might be used as a teaching aid.

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Unit 7

Prepare Instructional Materials to Accompany Software

UNIT OBJECTIVE

Upon completion of this unit, the learner will be able to prepare instructional materials to accompany microcomputer software. This knowledge will be demonstrated through completion of the unit achievement indicators.

SPECIFIC OBJECTIVES

Upon completion of this unit, the learner will be able to:

- 1) Explain the relationship between instructional materials and microcomputer software.
- 2) Describe the need for instructional materials in Computer-Based Instruction.
- 3) Explain considerations which should precede the preparation of instructional materials for Computer-Based Instruction.
- 4) Discuss characteristics of effective instructional materials.

Prepare Instructional Materials to Accompany Software

BY: DR. ROGER A. RANKIN

The inclusion of Computer-Based Instruction (CBI) into vocational curricula and instruction can achieve several outcomes:

- * enhance learning experiences for students based on their individual needs.
- * stimulate subject matter interest for each student.
- * motivate students to utilize capabilities of the microcomputer.
- * provide students information relevant to their occupational objectives.
- * achieve instructional objectives.

If vocational teachers are limited to teaching with educational objectives, lesson plans, and microcomputers, they will fall short of their instructional goals. Teachers are not perfect; they are not continually stimulating, motivating, relevant, and all things to all students (The Center for Vocational Education, 1977). Most instructors rely on additional help to aid in the teaching process in the form of instructional materials—materials for students to use, read, listen to, or view. Vocational teachers who have developed quality instructional materials can meet the

needs of students regardless of their abilities to perform (The Center for Vocational Education, 1977). The trials and tribulations of integrating CBI into vocational curricula and instruction can be considerably eased if instructors develop appropriate information sheets, handouts, and software documentation summaries and exercises.

Instructors will need more than a CBI plan and good intentions to successfully integrate computers into the vocational classroom. Instructional materials will help vocational teachers to reach program goals.

Although a wealth of software has been developed for the educational market, many software packages cannot be directly infused into vocational curricula and instruction. In addition, a majority of the educational software available does not meet the specific needs of vocational education. This lack of software for vocational education users, coupled with software accompanied by poor documentation, poses a definite problem for instructors teaching with microcomputers. To address this problem with the attitude, "Oh well, I'll just wait until the right software comes along," may be to wait a long time. Instructors must face up to the current status of software and then prepare instructional materials that will make up for the shortcomings in software and related documentation.

Another consideration stems from the laboratory setting in which students interact with microcomputers. This environment can render vocational instructors grossly ineffective if good instructional materials are not in place. Instructional materials are needed which will lead students through the software step by step, with examples and a system for evaluation. Frequently, especially in a microcomputer laboratory, vocational teachers will have to spend a lengthy period of time with a student. During this period of time, other students may need similar types of help. In this case, instructional materials can pay off the most. Good instructional materials can lead students through difficult segments of curricula. When necessary, teachers can refer to the specific materials to get students on the right track. The example "NOW, YOU'RE ON YOUR OWN!" (see Appendix) shows how a worksheet can be developed to assist students through a programming exercise. A teacher can have a large number of students writing this basic program and at the same time answering individual questions by referring students to a specific item on the handout. Without this type of handout, teachers would spend lengthy periods of time with each student as he or she encountered a problem. Frequently, students will encounter the same learning difficulties at different times in the class period according to their individual progress. There is no reason for instructors to repeat instruction or show students the same thing time after time when an appropriate handout will do the job. Handouts, information sheets, job sheets, examples, and worksheets will meet these needs as well as tutorial software, film strips, and other traditional instructional materials.

As instructors teach students via microcomputers, they must realize that the typical day is made up of blocks of time and that they must work within those time constraints. Therefore, instructional materials must be designed with the appropriate timeline in mind. For example, it would not be wise for the business education teacher to give students a word processing software package and a large book of documentation at the beginning of a 50 minute class period and say, "Have at it, we'll continue tomorrow where you leave off today." This "whole main course" approach to teaching implies that students must "inhale the meal" as opposed to eating it bite by bite. A logical alternative would be the development of information sheets designed to lead students to a specific point at the end of a 50 minute class period. These instructional materials should be available to students during each laboratory session.

The lengthy documentation that accompanies many software packages are difficult to understand and digest. This situation requires teachers to modify documentation and present it to students in a logical manner. An example of this process (*e.g., WordStar Handouts) is found in the Appendix at the end of the unit. This example shows what a business education teacher could provide students at the beginning of a unit which features WordStar word processing software on the IBM Personal Computer. A quick summary of the documentation, in information sheet form, can lead students through software step by step. This example, the first handout, "GETTING STARTED," is designed to lead students through the simple path of creating a document with WordStar, saving it, and printing it. This exercise which allows a brief introduction to the software, is designed to take approximately 45 minutes, leading the novice through a very elementary exercise that gives an overview of what the word processing package will do and how it works.

The second handout, "FREQUENTLY USED WORDSTAR COMMANDS," summarizes important commands students will use while learning the software package. This handout can serve as a ready reference for students. It can save students valuable time wasted in searching through documentation or repeatedly asking teachers for information.

The WordStar handout, "MENU MAP," depicts various menu options available to assist students. This handout allows students to gain assistance easily and individually.

Additional examples of instructional materials in the Appendix are titled "COMMANDS THE APPLE UNDERSTANDS" and "TRS-80 GRAPHICS." While the "COMMANDS" handout is not specific to any software

package, it is a summary of commands, statements, and thoughts that can be given to students to assist them in using specific hardware as well as programming on that hardware. Students will find that they will need these commands to interact with software programs as well. The "TRS-80 GRAPHICS" handout is an excellent example of one which introduces new information to students, gives examples, and assigns a work activity to be conducted with information on the handout.

Unit C.3 discusses lesson plans with regard to implementing CBI. It is this plan, when accurate, that helps instructors identify important considerations before they prepare instructional materials. The identification of subject matter content, goals, and objectives will help instructors determine what students must have in their hands to master assignments. The individual needs and learning styles of students are prime considerations for teachers in this process of developing instructional materials. Some students may perform well starting with an information sheet and software, while other students need an introduction from the teacher and step by step directions for the first few class periods. Often, students are able to work in small groups helping each other through spots and relying on the appropriate instructional materials.

A key consideration in the preparation of instructional materials is the reading level of students. A technically written explanation of how to perform a task will not help a student with a low reading level. However, alternative methods of explanations may permit that student to perform the task in a very capable manner (The Center for Vocational Education, 1977). Instructors must evaluate the variety of mechanisms available for determining reading level and work closely with counselors and other appropriate staff to ensure that instructional materials are effectively used by students.

The design of quality instructional materials requires instructors to implement a well-defined plan. Instructional materials should be designed to lead students through activities which accomplish the instructional objectives of the vocational program. Instructional materials should be "user friendly," not vague, not assume too much of students, and be at the correct reading level. Quality instructional materials can guide students through the difficult learning spots of Computer-Based Instruction.

SUMMARY

Instructors who implement CBI into vocational curricula should recognize that software development is at the beginning stage. Consequently, vocational teachers will need to prepare instructional materials to accompany software and its respective documentation.

Instructional materials should occur with grade levels, reading levels, needs of students, and instructional objectives. Daily lesson plans can help instructors identify the types of instructional materials needed for specific instructional activities.

Instructional materials should lead students a step at a time; they should not be constructed with the assumption that students will grasp the entire software program at one time. Students interact with microcomputers for specific time periods during the school day. Instructional materials should be constructed in accordance with student hours for microcomputer use.

Instructional materials can be in the form of film strips, cassettes, information sheets, handouts, and examples. Individual handouts and information sheets that guide students through software are very effective. These types of instructional materials summarize or emphasize specific portions of software documentation.

Vocational teachers cannot wait until publishers provide software and documentation to meet the needs of vocational education students. Instructors should recognize the shortcomings of software and prepare instructional materials that can guide students through difficulties they may encounter with Computer-Based instruction.

ACHIEVEMENT INDICATORS

- 1) Explain the relationship between instructional materials and microcomputer software.
- 2) Describe the need for instructional materials in Computer-Based Instruction.
- 3) Explain considerations which should precede the preparation of instructional materials for Computer-Based Instruction.
- 4) Discuss the characteristics of effective instructional material.

APPENDIX

NOW, YOU'RE ON YOUR OWN!

Objectives

Write a program that presents a story, asks four questions, grades the student's response, and gives the student a percentage score.

Some Hints and Help —

You will need to:

Statement

Needed

- 1) Make it friendly P
|
- 2) Give some directions P
- 3) Clear the screen after the directions P
|

Example NO 1

```
25 PRINT "HIT RETURN TO CONTINUE"  
30 INPUT B$  
35 HOME
```

- 4) Present the story P
- 5) Clear the screen after the story. Example NO 1 again P
|
- 6) Ask the first question, accept the student's answer, and grade it
P |

EXAMPLE NO 2

```
60 PRINT "GEORGE WASHINGTON WAS THE"  
65 PRINT "A. FOURTH PRESIDENT OF THE UNITED STATES"  
70 PRINT "B. THE SIXTH PRESIDENT OF THE UNITED STATES"  
75 PRINT "C. THE FIRST PRESIDENT OF THE UNITED STATES"  
80 PRINT "D. THE SECOND PRESIDENT OF THE UNITED STATES"  
85 INPUT C$  
90 IF C$ = "C" THEN X = 1
```

- 7) Clear the screen after each question—Example NO 1 again
- 8) Ask the second (and remaining) questions.
Same as Example NO 2 except: $X = X + 1$ for the IF statement
- 9) Figure students grade and report it.
- 10) Give students a good-bye message.

(Those individuals who care to, can have a student with a low score reread the story and take the test again—how would you do it??)

GETTING STARTED . . .

The steps below will guide you through the simple path of creating a document in WordStar, saving it, and printing it.

1. Entering WordStar

At the system prompt

TYPE:

WS [RETURN]

SEE:

OPENING MENU

2. Opening a Document

At the Opening Menu

TYPE:

D

filename [RETURN]

SEE:

D

Name of file to edit?

3. Entering Text and Saving Your Work

At the Main Menu

TYPE:

KD

SEE:

WAIT

saving file: a: filename

4. Printing Your Document

At The Opening Menu

TYPE:

P

SEE:

P not editing

name of file to print

filename [ESCape]

5. Leaving WordStar

At the Opening Menu

TYPE:

X

SEE:

A >

FREQUENTLY USED WORDSTAR COMMANDS

Moving Right and Left:

- ^D** Moves cursor right one character
- ^F** Moves cursor right one word
- ^QD** Moves cursor to right end of current line
- ^S** Moves cursor left one character
- ^L** Moves cursor left one character
- ^W** Moves cursor left one word
- ^BS** Moves cursor to beginning of current line

Moving Up and Down:

- ^E** Moves cursor up one line
- ^DE** Moves cursor up to top of screen
- ^W** Leaves cursor in same position; new line appears at top of screen and window on text moves down one line
- ^R** Leaves cursor in same position; previous screen reappears
- ^X** Moves cursor down one line
- ^QX** Moves cursor down to bottom of screen
- ^Z** Leaves cursor in same position; new line appears at bottom of screen, and window on text moves up one line

- ^C** Leaves cursor in same position; next screen appears
- ^QC** Moves cursor forward to end of file

Repeating Commands:

- ^QQ^** Repeats any cursor movement or scrolling command continuously until stopped

Deleting Text:

- ^G** Deletes character at cursor position
- ^T** Deletes word from cursor position to the right
- ^Y** Deletes entire line in which cursor is located
- ^QY** Deletes all characters from cursor position to the right end of the same line
- DELETE** Deletes character to the left of cursor position

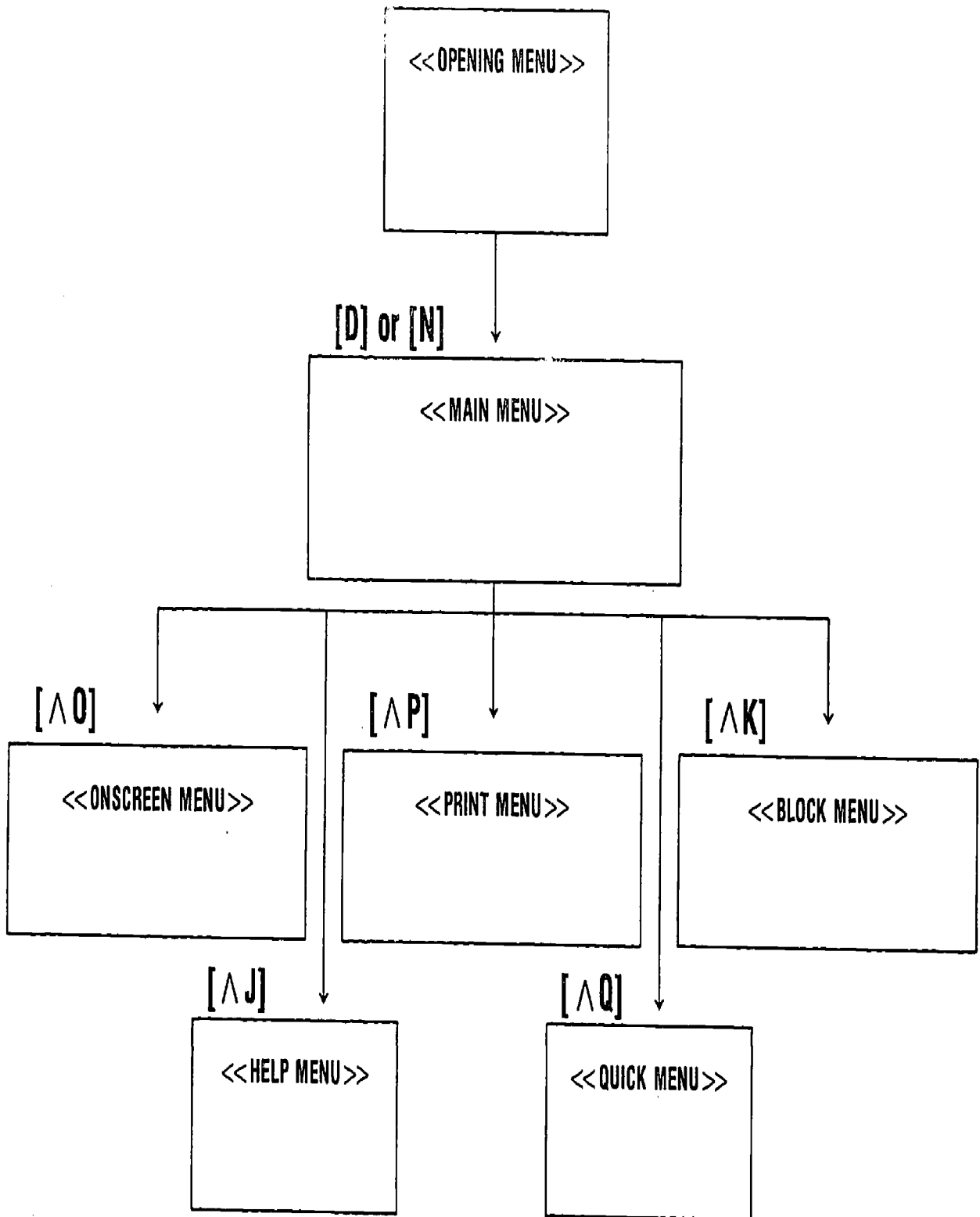
Inserting Text:

- RETURN** Inserts a hard carriage return, leaving cursor at beginning of previous line (insertion: on)
- ^N** Inserts a hard carriage return, leaving cursor at beginning of newly inserted blank line

Reforming paragraphs:

- ^B** Re-forms paragraphs between current margins

MENU MAP



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COMMANDS

THE APPLE UNDERSTANDS

- CATALOG — Will list on the monitor the program on the disk.
- HOME — Will clear the screen on the monitor.
- NEW — Will erase (or clear) the memory of the computer
- RUN — Will run the program currently in the memory of the computer.
- RUN (PROGRAM NAME) — Will tell the computer to go to the disk, load a program into the memory, and run it.
- INIT (PROGRAM NAME) — Will initialize the disk (get it ready to speak to the Apple) and save that specific program in the disk (Usually called the HELLO program).
- LOAD (PROGRAM NAME) — Will tell the computer to load a program from the disk into the memory of the computer, but will not put it on the monitor screen.
- LIST — Will list the program in the memory of the computer.
- SAVE — Will tell the computer to store what's in the memory in the disk in the disk drive.

STATEMENTS

TO BE USED IN BASIC PROGRAMMING

- PRINT — Will tell the computer to print everything inside the "quotation" marks.
- INPUT — Will tell the computer to stop and allow the user to input data.
- IN/THEN — Will tell the computer to compare data and then decide where to go in the program.
- GOTO — Will tell the computer to go to a different line number within the program.

THOUGHTS

ABOUT PROGRAMMING AND USING THE COMPUTER

You need to be able to play three roles: A programmer
A computer
A user

When writing programs, think like a programmer in order to get the correct program, think like the computer so you can visualize what the program is asking the computer to do, and think like the user so you'll know what the program wants the user to do.

TRS-80 GRAPHICS

Often, in software programs, you will see screen displays using borders and vertical and horizontal lines. There are a number of ways to do this in BASIC programming, but the command we are going to use is SET.

SET is a command which lights up a point on the screen.

The screen is divided into a matrix with 127 positions across the screen and 47 positions down the screen. The horizontal rows are designated by the letter X, while the vertical columns are designated by the letter Y.

Keeping this in mind, X can equal 0 - 127 and Y can equal 0 - 47.

0 1 2 3 * * *

0

1

2
3
*
*
*

To turn on a point, the syntax used is:

```
SET (X,Y)
```

SET can be used in the immediate mode or can be used in program lines.

Let's try a few examples.

Clear your screen.

Type in: SET (63,23)

This lights up a point at position 63 (X) and 23 (Y). Try a few more on your own.

A short program which randomly sets points is shown below. Type in the program to see what it does. (The RND command generates random numbers between) and 127 for X, and between) and 47 for Y)

```
10 CLS  
20 SET (RND (127), RND (47))  
30 GOTO 10
```

Experiment with turning on various points or creating a design using SET in a program.

Used in the programming mode with a few other BASIC statements, SET can be used to draw horizontal and vertical lines. The following simple programs demonstrate this.

Horizontal line:

```
10 CLS  
20 FOR X = 10 TO 100 — tells the computer to start at position 10 and stop  
    at position 100 on the X axis  
30 SET (X, 15) — sets X at position 10 to 100 (as defined in line 20),  
    and Y at position 15  
40 NEXT X — returns the program to line 20 and repeats until X = 100
```

Type in this program and see how it works. Now write your own program drawing a horizontal line (or several). Use your imagination.

Vertical line:

Vertical lines are programmed in the same manner, but with Y being used in the FOR NEXT statement instead of X. Here's an example:

```
10 CLS  
20 FOR Y = 15 TO 45  
30 SET (10,Y)  
40 NEXT Y
```

Experimenting with vertical lines.

Borders:

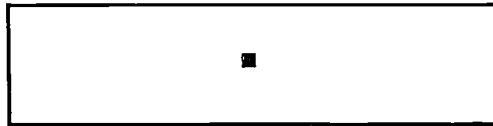
Borders are made by connecting a horizontal line with a vertical line. The sample program will draw a border by combining the two sample programs used to draw the horizontal and vertical lines above.

```
1-CLS  
20 FOR X = 10 TO 100  
30 SET (X, 15)  
40 SET (X, 45)
```


50 -NEXT X
60 FOR Y = 15 TO 45
70 SET (10,Y)
80 SET (100,Y)
90 NEXT Y
100 GOTO 100

Type in this program to see how it works.

Now it's your turn! Draw a rectangle made up of horizontal lines 20 units in length and a vertical line 5 units in length. And while we're at it, let's put a point in the center. Raise your hand if you need help.



ASSIGNMENT: Using the information we have provided, along with the graph paper provided, plan and develop a picture, design, etc., using SET and other BASIC commands. BE CREATIVE . . . (an idea would be to make a chart to visually display students' grades).

Make sure you draw out your figure and write out each statement **before** you begin.

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Unit 8

Modify Software Documentation For Specific Instructional Use

UNIT OBJECTIVE

Upon completion of this unit, the learner will be able to modify software documentation for specific instructional purposes. This knowledge will be demonstrated by completing the achievement indicators at the conclusion of this unit.

SPECIFIC OBJECTIVES

Upon completion of this unit, the learner will:

- 1) Explain the term "on-line documentation."
- 2) Describe two types of software documentation.
- 3) State four common problems associated with software documentation.
- 4) List four writing principles that should be used to improve documentation.
- 5) Discuss the importance of face validity for software documentation.
- 6) Develop a checklist of information to be included in modified documentation.
- 7) Describe the process of field testing modified documentation.

Retreading Misaligned Documentation

BY: MICHAEL T. DROTTER

Most of us have had to face this decision at least once in our lives. The old car is in pretty rough shape. The front end is so far out of alignment that it has prematurely worn the tires to a frazzle. It is cheaper to buy a set of retreaded tires than to get the front end aligned. However, with the bad front end those new tires won't last long. It is a dilemma; but one thing is for sure, as long as the front end is not performing right—neither will the tires.

This anecdote is comparable to the dilemma teachers encounter with documentation that inadequately serves instructional needs. Incomplete, misleading, and ambiguous software manuals can stifle the implementation stage of Computer-Based Instruction (CBI). Instructors may find themselves in the position of having to "retread" software documentation to meet teaching needs.

Trainers will encounter many software packages that are accompanied by learning guides of questionable quality (Huntington, 1983). Some program developers seem to be unaware of the significance of documentation. Often, software developers view the tasks associated with documentation as the drudgery end of the program development process (Johnson, 1983).

An increasing number of software publishers are sensing that computer programmers may not be the best writers for software manuals. Creating lines of code does not automatically translate into well written instructional materials. Writers with such diverse backgrounds as education and liberal arts are being sought to assist in the development of documentation (Fawcette, 1983).

The trend among progressive programming organizations is to provide as much on-line documentation as possible. On-line documentation is documentation which appears on the screen during program execution. It is implemented as a "help function" for the user in many software packages. This documentation may also include on-line prompts during the learning session. Quality software will allow the user to choose among several levels of assistance. The utopian goal for training curricula is to include software that is completely self-documenting. Memory capabilities and execution speeds of most microcomputers prohibit the complete internal documentation of software. What this fact means to instructors is that for the near future most software, no matter how sophisticated, is only as good as its printed documentation (Lobello, 1982).

WHICH DOCUMENTATION CAN BE DOCUMENTED?

Two types of documentation exist: Written manuals and internal program documentation. A starting point for instructors is to determine which internal documentation can be easily modified and which cannot be modified. Special purpose commercial software packages perform functions well, but most cannot be altered by the user. Many software packages reside on specially prepared diskettes that preclude anyone from modifying or copying the program code. Documentation changes for this type of software are limited to clarification of the documentation supplied with the software. For this reason, instructors will usually be limited to modifying written documentation.

If learners are having difficulty using software and its respective learning guide, a complete revision of the manufacturer's documentation may be necessary to create an educational computing document that will really serve learners' needs. Generally, it is easier to initially provide good documentation than to fix poor documentation. This fact makes CBI software that is derived from general software packages (such as spreadsheets or database management software) the easiest to tailor to specific educational purposes. Because specific CBI applications are created within the structure of the general software, documentation can also be tailored specifically to the learner's level of understanding. This documentation should include information necessary for the use of the software package integrated with information relevant to specific instructional applications. Approaching documentation in this manner should increase learner efficiency. Most users prefer to concentrate on the task at hand as opposed to reading several manuals on how to run software (Baldrige, 1983). This integrated method instructs the user about operating software without detracting from the objectives of CBI.

Common Problems With Documentation

What makes software documentation so difficult to use? Many times, documentation supplied with commercial software is filled with specialized vocabulary and acronyms. Additionally, documentation may require a higher level of understanding of general computing principles than most users possess, contain error messages that can stump a seasoned cryptographer, or omit information that is appropriate to educational computing. Many problems associated with documentation stem from poor technical writing; some forethought by educators will

prevent these problems. Four writing principles can be implemented by teachers as they work to improve documentation (Wiio, 1982):

1. use short, simply constructed sentences;
2. use vocabulary that consists of short familiar words;
3. structure the presentation using concrete ideas that can be perceived by the reader; and
4. present subject matter that is pertinent to the learning needs of the reader.

Teachers who improve documentation still risk the injustice that the manual will merely show the software as it is—no simpler and no friendlier. Good quality documentation cannot change poor quality software. To add to that injustice, every mistake that instructors make in the re-writing process can detract from the usability of the software. Documentation writers cannot make the software better, but they can certainly make it worse (Weiss, 1984).

Creating Usable Documentation

The first impressions that people form are often lasting impressions. Educators who develop documentation to meet specific training needs must strive for face validity with the manual. Face validity means that the documentation has a professionally prepared appearance. If the documentation is sloppily prepared and ugly in format, or if it looks like a work of technical drudgery, learners will hesitate to follow its intended use (Sohr, 1983). The appearance of the manual should enhance its credibility with the user.

An initial writing step for instructors is to state and define the audience for the documentation (Sohr, 1983; Weal, 1983). It is frustrating for readers to scan well written documentation that is too technical or too simple because the writer failed to define the audience in the preface of the manual.

Educators should organize the manual by task, not by command. For example, topics should be used that explain how to sort data, calculate new values, or print a report; not how to use isolated commands needed to execute a procedure within that procedure (Grimm, 1982). Sohr (1982) suggests moving the explanation from the overall general functions of the procedure through the specific steps of execution.

When instructors modify documentation, they should avoid the use of computer terms and computer acronyms (Grimm, 1982). Computer terms that are included in documentation should be defined within the text and in a glossary of terms at the end of the documentation manual. Documentation should contain complete explanations of error codes generated by the software. Teachers should use examples where possible to clarify and enhance the written text. Logic diagrams should be provided to aid advanced users. Instructors can integrate the text with the actual software to support and augment on-line documentation. Advanced users may resist reading the documentation in detail and average users may depend less upon the documentation as their familiarity with the software increases. A quick reference chart can be provided in each section of the manual to aid these users. This type of chart contains the name of a command or function, its syntax and options within the syntax, and a short remark defining the command (Huntington, 1983). Many experienced computer users can perform most operations within a specific software package through the exclusive use of a quick reference chart.

Educators planning to modify software documentation should develop a checklist to serve as a guide (Sohr, 1983). This checklist should contain a minimum amount of information for inclusion in documentation manuals:

1. a detailed table of contents;
2. a complete index;
3. an introduction and summary for each chapter and section;
4. a tutorial section to provide hands-on experience to the user in a controlled environment; and,
5. a quick reference section.

Software manuals which are written or modified should contain these elements to support procedures and user-friendly guides within documentation.

Field Testing and Implementing Documentation

Teachers should test the documentation guide with a sample of learners who represent the intended users of the guide. Instructors should not provide coaching to users during this testing phase. Documentation should be designed to provide users with ample information necessary for successful software execution. During this testing phase, teachers should note problem areas and revise the guide to eliminate unclear structure or unclear wording. The final result should be a documentation guide which enhances the educational computing experiences of learners.

After refining the documentation guide, instructors should conduct training sessions with students to familiarize them with the guide and CBI software. When the documentation guide is put to use in the educational program, minor problems may surface which affect either the guide or the software. Instructors should establish procedures for periodically updating documentation in order to correct its deficiencies or to solve new software problems encountered by learners.

The Future Looks Brighter

Educators can look to the future with a degree of certainty that commercially prepared software documentation is destined to improve. Most software vendors realize that their products will not maintain a market share if they don't live up to the labeling "user friendly." Additionally, these companies have the potential to utilize dramatic technical advances for creating multi-faceted documentation. Voice synthesis and recognition, interactive training with laser video discs, and infrared touch screens are technical advances that can make the documentation process an enlightening learning experience (Fawcette, 1983). However, for the time being instructors will need to think about rereading existing documentation. This process can prove to be time consuming, but it can be used to create software documentation that meets specific learner needs in a CBI program. Quality software should not be thrown in the scrap heap because of inadequate documentation.

SUMMARY

Instructors may need to modify software documentation to correct deficiencies with vendor supplied documentation or to create documentation for custom produced software. When developing documentation, teachers should use short sentences containing a vocabulary familiar to the intended audience. Instructors should develop concrete concepts that will aid students in software execution. The guide should be organized by tasks rather than by computer commands. This will provide a "big picture" overview to the students as well as teach common commands through repetition. A detailed index and listing of error codes in simple language should be provided to help students overcome problem areas in the software. A quick reference chart should be incorporated to serve more advanced users who do not need detailed explanations of procedures. Instructors should test, correct, and retest the guide until it can function on the merit of its content. A final recommendation for documentation is for teachers to periodically update the guide to correct minor deficiencies.

ACHIEVEMENT INDICATORS

- 1) Explain the term "on-line documentation."
- 2) Describe two types of software documentation.
- 3) State four common problems associated with software documentation.
- 4) List four writing principles that should be used to improve documentation.
- 5) Discuss the importance of face validity for software documentation.
- 6) Develop a checklist of information to be included in modified documentation.
- 7) Describe the process of field testing modified documentation.

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Unit 9

Sink or Swim: Orienting Students to Computer-Based Instruction

UNIT OBJECTIVE

Upon completion of this unit, the learner will be able to apply concepts for orienting students to Computer-Based Instruction. This knowledge will be demonstrated by completion of the achievement indicators at the conclusion of this unit.

SPECIFIC OBJECTIVES

Upon completion of this unit, the learner will:

- 1) Discuss how student characteristics and negative preconceptions can influence their initial attitudes and successes with microcomputers.
- 2) Describe three characteristics of microcomputers that can facilitate learning.
- 3) Explain the benefits of Computer-Based Instruction for students.
- 4) State a working definition of the term "program user."
- 5) Describe six steps for orienting students as program users.
- 6) Explain four supportive activities for orienting students to Computer-Based Instruction.

Sink or Swim: Orienting Students to Computer-Based Instruction

BY: DR. RICHARD A. McEWING
DR. GENE L. ROTH

Remember your first attempts at learning to swim? My memory recalls a fairly unpleasant learning experience. My swimming lessons were conducted on a piano stool in the basement, under the direction of my father. Dad hoisted me onto the piano stool and proceeded to teach me all of the movements associated with swimming. I waded my arms, kicked my feet, and did all of the things I was told that swimmers generally do to stay afloat. Through Dad's guidance I became quite adept at swimming on a piano stool. When the day came to test my swimming prowess under real conditions, my confidence began to wane as I waded into the water. The water creeping around my waist caused a release of very different feelings compared to my piano stool. As a final test, my father picked me up and threw me into the water; my perceptions of water have never been the same. As I came close to drowning, I learned that piano stool swimming was not a very good orientation to water swimming.

This anecdote parallels the situation many teachers experience as they begin to integrate educational computing into curricula and instruction. Orienting students to the realities of Computer-Based Instruction (CBI) is an important first step for both teachers and students. Early perceptions can produce lasting effects. This unit will present suggestions for easing student transition from traditional learning activities to the less familiar realm of educational computing. Whether students sink or swim with CBI may depend on how well the orienting experience prepares them for educational computing.

FIRST ENCOUNTERS WITH MICROCOMPUTERS

Some students have misconceptions regarding microcomputers. Sources of these misconceptions include parents, peers, and previous personal experiences. A common preconception of students is to overestimate the skill levels of math and science needed to effectively understand and operate microcomputers (Hannafin & Cole, 1983). This belief concerning hard science prerequisites is unfounded for most students. A more logical choice for a prerequisite to CBI is keyboarding skill (Kisner, 1984).

Instructors may also encounter students who possess a generalized fear of microcomputers. This deeper level learning block is more difficult to attack as it can be equally frustrating for students and teachers. Such fears normally abate within four microcomputer sessions as learners begin to gain confidence that they can control microcomputer sessions (Loftus, 1982). Instructor attitudes play a significant role in helping students to reduce initial anxieties toward microcomputers. The instructor serves as a reassuring influence in the learning process. This role is congruent with accepted professional approaches used to relieve anxiety in individuals who exhibit fears or phobias. Individuals fear the unknown, especially if peers and associates lead them to suspect their abilities to succeed in new endeavors. Students' fears of educational computing can be reduced through a few positive encounters under empathetic instructors who have been sensitized to the problem.

LEARNING STYLES AND COMPUTER-BASED INSTRUCTION

Personality and learning style affect the way people learn. Students' cognitive styles may require teachers to vary their orientation methods for CBI. Educational computing may come more easily and attract students who are considered to be introverts (Hopmeier, 1981). Additionally, field dependency may affect a student's success with computing (Stevens, 1983).

The concept of field dependency is based on the premise that individuals approach the world from one of two cognitive perspectives: (a) from a field dependent approach in which a person learns from a broad perspective and arrives at answers holistically, or (b) from a field independent approach in which learning is a step by step process and answers are logically derived. Computer technology would appear most compatible to the field independent student.

It would seem, then, that teachers should focus special attention on students who are perceived to be extroverted and/or field dependent during initial stages of CBI orientation. Students who exhibit these characteristics are possible candidates for early frustrations and, perhaps, are likely to resist CBI.

MICROCOMPUTERS AS LEARNING FACILITATORS

Seymour Papert (the creator of LOGO) claims that a scandalous outcome of education is that by **teaching** children things we deprive them of opportunities **to learn** (1984). This implies that learning involves active engagement on the part of the learner. Often, teachers control learning situations and prevent students from reaching optimum involvement. To learn, in the most real sense, students must experience control. Computer-Based Instruction, properly conceived and implemented, facilitates this type of learning. Educational computing can prevent the outcome feared by Papert if the orientation activities stress student control of the process.

Teachers should begin orientation activities by communicating to students that learning experiences with microcomputers can be positive emotional encounters. These successful encounters with microcomputers can be attributed to three characteristics which make these tools excellent facilitators of learning: (a) Microcomputers are nonjudgmental. They neither take offense at errors nor publicly ridicule students who make computing mistakes. (b) Microcomputers are consistent. Microcomputers react in consistent patterns to all people regardless of race, sex, ethnic background, religion, personality, age, or handicapping condition. (c) Microcomputers are patient. They search for the right answer, provide hints, and repeat information. They provide appropriate data to users as often as it is requested.

These three attributes of microcomputers parallel the suggested characteristics therapists might embody if they expect to enhance learning in their clients (Rogers, 1961). The preceding point neither advocated educational computing as a therapeutic tool nor does it imply that computers can replace the empathetic role of human beings. Rather, it suggests a theoretical base for the support of microcomputers as tools of learning facilitation. This belief (of the microcomputer as a learning facilitator) should be the first concept introduced to computing students. This concept should help to negate anxieties that students might harbor toward their initial experiences with CBI.

Teachers are cautioned against commenting, "Don't worry, it will be easy; everyone can operate microcomputers." The intent of the teacher may be positive, but the effect may be negative. Initial attempts to operate microcomputers may not be easy and this type of preface to instruction may serve to discourage students when mistakes occur. Teachers must be cognizant of conveying hidden messages during student orientations to CBI. These messages may be well intended; but can be counterproductive to combatting student anxieties toward microcomputers (Carey, 1984). The hidden message of the preceding is "If you can't do this, you're a real dummy."

BENEFITS FOR STUDENTS IN CBI

The next powerful orientation step is for students to be advised of the long-term benefits to be gained by educational computing. Notice that the orientation process inaugurates CBI with a consideration of what students bring to the experience and moves ahead to consideration of what they can take from it.

The most obvious benefit to be suggested is that CBI was selected for the class because it was expected that student learning would be enhanced. Teachers should share these expectations with students. Instructors should briefly indicate why CBI was considered and adopted for curricular and instructional purposes. Thus, the first long-term advantage of CBI is that students can expect to experience a greater mastery of course content.

A second benefit for students is that microcomputer applications learned in class are likely to parallel situations students will encounter in the world of work. For example, many students will eventually work at jobs in which they will use computers for information management. A conservative estimate is that by 1990 seventy-five percent of the nation's jobs will be directly related to information processing (Montana Task Force on Computer Education, 1983). Students who experience CBI will gain an understanding of how computers function as storage and retrieval units. This general understanding will be important in the operation of office computers and should help students develop skills and concepts that will aid them in their job searches.

A third benefit pertains to increasing student skills with computer languages. Although there are numerous computer languages, they share undergirding commonalities that allow users to accomplish tasks with computers. In some cases, educational computing can provide students with opportunities to learn the exact languages they will encounter in future work situations.

A final benefit of CBI for students is the array of simulations that can expand the classroom. Simulations permit students to experience decision making. Quality computing simulations provide students with situations in which they learn how alternative decisions create favorable or unfavorable consequences. Opportunities to rerun simulation programs permit students to analyze numerous cause and effect considerations. This ability of simulation software to reflect decision-making situations in the work world may help students gain confidence in their abilities prior to acquiring on-the-job experience. Furthermore, simulations permit students to make mistakes during a learning process without undue embarrassment to themselves or costs to employers.

Teachers should employ these four benefits as a core to the orientation process. **Localization** of this segment of the orientation process occurs through teachers building onto these additional advantages of educational computing which are relevant to their individual programs, students, and professional needs.

FAMILIARIZING STUDENTS WITH CBI

The orientation now moves back to the present with the microcomputer in front of the students. Teachers should refrain from providing too much information about computers during this orientation stage of CBI. Instructors will have gained extensive computer knowledge through developing a CBI course; they should not eagerly assume that students will need all the background information. Students will not want detailed computing information during the orientation stages of CBI. Premature in-depth presentations have counterproductive effects. In such lectures, learners are subjected to explanations which make little sense to them, which may not reach out to their needs, but which require them to reach out to the levels of the instructors, to adopt new vocabulary, and to make sense of processes about which they are totally unfamiliar (Loftus, 1982). The words "microcomputer overload" painfully depict computing initiations experienced by many people. Too many learners are told too much, too quickly. Orientation to educational computing may be crushed by a barrage of inappropriate technical jargon such as bits, bytes, RAMS, ROMS, modems, and chips.

The best way to begin is to familiarize students with basic concepts for operating software. Students are **program users** at this point in educational computing, not program writers. Depending upon instructional goals, students may not need to develop skills beyond this level of computer competency. A program user should be capable of turning the machine on and off, running a program, and being able to solve minor operational problems (Willis, 1981).

Teachers can help students move toward this level of computer competency by introducing them to operating microcomputer programs through the following six steps:

1. Introduce the brand of the microcomputer and the location of its manual. It should be stressed that brands of microcomputers feature varying operating procedures and a useful tool to consult when questions arise is a manufacturer's user's guide.
2. Introduce the key components of a microcomputer system—keyboard, monitor (t.v. screen), and storage device (tape recorder, disk drive). Discuss the care of these components and the software. This discussion should be non-threatening in that the objective is to encourage students to operate microcomputers properly so they can avoid technical failures. Teachers should limit concerns and fears. It would be useful to post guidelines for care of equipment in the front of the classroom.
3. Introduce procedures for turning on microcomputers and loading programs. An explanation of these procedures should be physically demonstrated by instructors and then students should be provided immediate practice.

Once students have been allowed to load computers and feel comfortable with this activity, they can then be introduced to the procedure of running a program.

4. Introduce students to procedures for running programs. Instructors should develop as many questions as possible for the initial explanation, demonstrate the activity, and circulate about the room as students practice. An example of such an interchange might be:

Teacher: "What do you see on the monitor?"

Student: "The question, 'What is your name?'"

Teacher: "Try typing your name. What do you see?"

Student: "My name appears as I type it. Why is it all capital letters?"

(Teacher explains) "Now what? Nothing is happening. What did I do wrong?"

Teacher: "You didn't do anything wrong, you need to tell the computer that you are finished with your response. To do so type (or press) 'RETURN' (or whatever the microcomputer in use requires)."

5. Introduce procedures used to terminate the program. Students should actually terminate their program to demonstrate that they have mastered this procedure.
6. Introduce procedures for turning off the microcomputer and leaving the area ready for the next user. Students should demonstrate their knowledge of these directions by performing the actual procedures.

Once these steps in microcomputer use have been presented in a class session, students should be permitted time to practice individually. Instructors should ask individuals to demonstrate their abilities to perform steps three through six. This orientation must pertain to the mechanics of operating microcomputers, not to the learning of course concepts.

What type of program should students use for introductory experiences? Teachers should avoid gaming programs which display impressive graphics. Such encounters may cause students to misinterpret the purpose of the orientation session and/or create a false impression that educational computing is comparable to playing arcade games. Conversely, instructors should avoid the extreme of demonstrating complex programs which will be featured at a later stage of the course. Complex programs will require students to have gained specific course content—a requirement which interferes with the goals of the beginning stages of educational computing.

Instructors should choose a simple introductory program written at the reading level of the students which uses procedures similar to what students must master for future educational computing activities. For example, if there will be simulations done on the microcomputer, then students should work through a simple simulation; if information will be presented which students must read and respond to, then students should work through this type of program. An ideal program will be one that also appeals to their interests.

A good possibility for an introductory program is one which instructs students regarding how to operate the particular brand of microcomputer they will be using. Many vendors have created these types of programs (usually referred to as tutorials) and certain manufacturers supply such programs with the purchase of their hardware. It is paramount for instructors to examine programs of this type to ensure that computing experiences are congruent with the educational goals of the course. The complexity of the program may extend beyond the skill levels of beginning students and thus be counterproductive to orientation exercises.

PROVIDING SUPPORT FOR COMPUTING STUDENTS

To support the introduction of CBI in classrooms, a number of activities can be undertaken to enhance students' perceptions of computer technology. Due to the individuality of students, instructors may find varying degrees of need for such activities. Additionally, instructors will find the time constraints and the availability of facilities will be limiting factors for the types of activities to be selected. The central concept for instructors to consider is that the selected activities should enhance the **believability** of CBI as a benefit to school work and in the working futures of the students. Suggested activities which serve this purpose include:

1. Students can practice utilizing computer printouts. Instructors can supply printouts of information which students will have interest because of the topic (e.g., sports statistics). Students can locate familiar facts in order to learn how computer printouts display information.
2. Field trips can be planned to regional businesses and industries which use microcomputers and mainframe computers. If possible, instructors should schedule sites which use the exact brands and models of computers that are available in their schools. This activity can be repeated at other times in the course to support lessons or to introduce students to other types of computers.

3. Instructors can develop games which provide practice and reinforce basic computer terminology. The nature of these games should match the maturity levels of students. Teachers can gain assistance in this type of activity by requesting students to develop games. Employing this student creation approach helps students to understand computer terms by developing games. Furthermore, this approach helps ensure that games will match maturity levels within the class.
4. Teachers can foster discussions in which students project their beliefs regarding the future of microcomputers in society. This is an excellent activity for discovering the attitudes of students toward microcomputers during their initial encounters with educational computing. Such discussions at the beginning of a course may identify students who need special attention in order to dispel misconceptions or high anxieties regarding microcomputers.

SUMMARY

This unit provides readers with very basic, yet very important concepts regarding orienting students to Computer-Based Instruction. Early student computing experience will have a major impact on whether these students sink or swim with CBI. Students should be advised during the orientation stages of CBI that they will control their own destinies with CBI, and that microcomputers are tools for them to use for their educational benefit, both now and in the future. Once they have the confidence to float, they can progress to the various strokes of swimming.

Instructors should try to alleviate the initial anxieties students might feel toward educational computing. Students should be encouraged to begin with simple computing exercises which build confidence before proceeding to more complex CBI activities. Instructors need to be aware of how the learning styles of students can impact progress in CBI.

Some students, after initial struggles, will easily stay afloat with CBI, whereas instructors will need to watch for other students who are going under for the second or third time. Educational computing can be exciting learning for students and teachers. However, instructors need to plan orientation stages of CBI carefully to ensure that students perceive educational computing as a rewarding learning experience.

ACHIEVEMENT INDICATORS

- 1) Discuss how student characteristics and negative preconceptions can influence their initial attitudes and successes with microcomputers.
- 2) Describe three characteristics of microcomputers that can facilitate learning.
- 3) Explain the benefits of Computer-Based Instruction for students.
- 4) State a working definition of the term "program user."
- 5) Describe six steps for orienting students as program users.
- 6) Explain four supportive activities for orienting students to Computer-Based Instruction.

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Unit 10

Execute Computer-Based Instruction

UNIT OBJECTIVE

Upon completion of this unit, the learner will be able to apply concepts for executing Computer-Based Instruction. This knowledge will be demonstrated by completing the achievement indicators at the conclusion of the unit.

SPECIFIC OBJECTIVES

Upon completion of this unit, the learner will:

- 1) Discuss how Computer-Based Instruction affects classroom communication and thought patterns.
- 2) Develop a list of rules for students pertinent to microcomputer usage.
- 3) Discuss considerations for the physical locations of microcomputers in classrooms.
- 4) Generate ways to maintain student motivation in Computer-Based Instruction.
- 5) Create a classroom specific **User's Guide** for a Computer-Based Instruction program.

Executing Computer-Based Instruction

BY: DR. RICHARD A. McEWING
AND DR. GENE ROTH

Historically, vocational teachers have faced the problem of keeping pace with the advancing technology of the work place. Preparing students for a changing world of work is a constant reminder to vocational teachers that they do not have the luxury of resting on previously learned work skills and knowledge. Vocational educators must keep abreast of contemporary developments within their vocational areas of expertise in order to guide students toward quality performances.

In addition to this concern for preparing students for a fluctuating world of work, vocational educators must contend with the application of new instructional technologies. Schools could be facing the most significant instructional technology challenge in the modern history of education—Computer-Based Instruction. The rapid influx of microcomputers into vocational classrooms has caught educators unprepared to effectively utilize this contemporary instructional technology. As school systems continue to acquire computer technology, numerous vocational instructors are talking, or at least thinking, about where to start with these machines (Roth & Tesolowski, in press). This unit provides vocational teachers with several key points to consider for integrating CBI into vocational education programs.

Reaching a Harmonic Chord Among CBI Students and Instruments

Computer-Based Instruction drastically affects communication patterns that occur in vocational classrooms. To gain success in vocational teaching, instructors must harmonize communication patterns with their instructional practices. Vocational teachers need to examine communication patterns among students, programs, and themselves to successfully integrate CBI with vocational curricula and instruction.

Communications of the First Kind: Student and Computer Program Interactions

CBI creates diverse communication patterns that are new to vocational learning environments. Consider the communication exchange that most likely will occur—the interaction of students and software. Students will expend considerable time and effort using microcomputers to communicate with software. What are the characteristics of these interactions? These exchanges are analogous to a conversation with a person who listens intently, never misses a point, but is inept with the subtleties of language. As a result, the person frames few suppositions about what is “meant” as opposed to what is “said.”

Vocational instructors can expect comparable communication dilemmas from students who periodically complain that the computer is not performing according to the students' expectations. These types of malfunctions (student fe/male functions) are frequent initial barriers for neophytes in educational computing. Common student errors consist of misusing computer commands, misspelling words, or making keyboarding mistakes. Vocational instructors can ease the pain of students who suffer from computer fe/male functions by properly orienting students to educational computing. Vocational students must discern that microcomputers, like mirrors, reflect user errors. Vocational students can be encouraged to develop analytical habits for exposing their computing errors as opposed to blaming mistakes on computers. Instructors should stress student attitudes which are less critical toward the eccentricities of computers and more demanding of themselves.

Vocational students who enjoy Computer-Based Instruction will strive to understand the underlying logical progressions of educational computing. Whereas humans are capable of formulating mental leaps to reach a desired solution, computers must track a problem solution by pursuing step-by-step process. Some students may identify with this required step-by-step process by recalling situations in math classes in which they were unable to solve problems. An understanding of these problems occurred when the teacher identified small steps that had originally been omitted because they were considered obvious (Howerton, 1982).

Communications of the Second Kind: Student to Student Interactions

An initial impression might be that educational computing in vocational classrooms decreases interaction among students. Each student is envisioned intently working at a microcomputer station. This vision is an unlikely reality and is not desirable from a number of points of view.

Purchases of microcomputers by school districts have been increasing at an approximate rate of fifty percent per year. Future Computing, Inc., a Texas based research firm, has predicted that the combined market for educational hardware and software will reach one billion dollars per year by 1987 (Watt, 1983). However, these numbers are relatively miniscule compared to the total numbers of students and classrooms to be served. If this fifty percent increase in microcomputers is sustained to 1986, there will still only be approximately three microcomputers per school or one for every eight classrooms (Becker, 1982).

For most vocational programs it is fiscally impractical for each student to have unlimited access to a microcomputer. However, unlimited access to a microcomputer is not required for successful educational computing. Research findings suggest that as few as ten minutes of computer use per day result in increased levels of motivation, rates of learning, and lengths of retention. Additionally, findings indicate that up to four students working at one machine gain comparable educational benefits to one per computer (Fisher, 1982). These research findings suggest that an educational computing approach which features students working at computer stations in team structures is a viable process for CBI in vocational programs. Team concepts will require vocational teachers to plan for various types of student interactions that can enhance CBI.

In examining the interdynamics of computer teams, several questions should be addressed by instructors: (a) Should teams be composed of students of similar backgrounds or should each team have at least one experienced user? (b) Should teams be grouped on the basis of career interests? (c) Should teams be formed according to academic abilities?

There are limited benchmarks to help vocational teachers answer these and similar questions. However, such problems can be minimized if team formation is not viewed as a one time occurrence which locks students into patterns for the entire school year. Curricular content and instructional methods may prompt the formation of various types of team compositions. Vocational instructors are encouraged to experiment with a number of team

structures to keep students from becoming either too dependent or too dominant in their groups. Communication should be allowed within teams and between teams to develop a healthy competitive spirit. Roles of instructors transform, to that of learning facilitators as teams work independently and collectively to perform educational computing tasks.

Communications of the Third Kind: Student and Teacher Interactions

Monitoring student to student interactions in CBI will be challenging for vocational instructors, but not more so than teacher and student interactions. Two communication pitfalls await vocational teachers in the implementation of CBI: (a) instructors may inadvertently rely on traditional teaching methods that had been employed prior to the advent of CBI, and (b) instructors may remove themselves from interactions with students by perceiving that software will manage instruction.

The first pitfall could occur if vocational teachers fail to recognize that students, through their use of microcomputers to interact with coursework, will have an increase in individual needs. Although vocational students may be pursuing common educational goals, their abilities and rates of comprehension vary. The teaching focus of CBI should be on the team or individual, not the entire class. Once the organizing directions are given to students, it will be unproductive to make whole class presentations on material unless it can be shown to be relevant to the entire group. Vocational teachers will be able to facilitate learning by circulating among microcomputer stations, monitoring student interactions, encouraging progress, checking on hardware, troubleshooting problems, and reviewing software usage.

Vocational students benefit from such personal interactions that keep them motivated and headed in the correct direction. Often students will need to discuss information and procedures in more detail than what is presented in the hardware and software documentation. It is through these individual conversations at microcomputer stations that learning will be enhanced. Effective interactions between instructors and students will be the keystone for successfully orchestrating CBI. Optimal student and teacher interactions in CBI will create the harmonic balance between "high tech/high touch" (Naisbett, 1983).

STUDENT RULES FOR COMPUTER-BASED INSTRUCTION

Several anecdotes have been used to convey the disapproval of rules. The continuum of anecdotes begins with an unspoken belief—"rules are made to be broken"—and ends with the golden rule—"whoever has the most gold"—rules. To avoid nurturing negative perceptions of rules, vocational teachers should not develop and present CBI rules to students as "necessary evils." Rules need to be constructed, but their existence should provide a positive contribution to class expectations. Clear rules, accompanied by a clear explanation of the rules, will enable students to avoid situations which could be damaging to themselves or equipment.

Rules for guiding student actions in educational computing may be grouped into three clusters: **access**, **safety**, and **ethics**. The first cluster, access rules, requires students to possess procedural skills and knowledge prior to operating computers. Access rules need to be established concerning (a) which students at what times will be permitted to work at microcomputer stations, (b) food and drink restrictions, and (c) game playing policies. These procedures should be written, distributed, explained, and posted in the classroom. Vocational teachers should solicit class discussion on each item. Student input should be valued by instructors and utilized in revising CBI access rules, as class experiences will foster rule revision and modification.

The safety rule cluster should be non-debatable. Safety rules include information related to power cord and plug-in locations, movement of equipment within the room, control of static electricity, alteration of hardware connections, reduction of glare and dust, and maintenance of an appropriate temperature for the microcomputer environment. Safety rules, like access rules, should be posted and clearly visible to vocational students at their microcomputer stations. The uniqueness of each vocational education laboratory or classroom may necessitate additional discipline related regulations.

The final cluster of rules pertains to the ethical application of microcomputers. Vocational teachers should not find themselves accused of giving students skills without giving them insight into ethical concerns regarding the use of those skills. For example, software pirating is a major problem for manufacturers (Harrison, 1983). Vocational students will quickly learn processes for duplicating programs for their personal use. Such duplication of software is a form of stealing if the program is not in the public domain. Vocational teachers must do more than talk about computer ethics. Instructional materials that support and supplement CBI must demonstrate an acceptance of computing ethics. No computer materials should be permitted in the classroom if they have been obtained by unauthorized procedures. Additionally, instructors should not permit the reproduction of copyrighted software by students or faculty using vocational education computer systems.

Enforcement of these three clusters of rules will require well defined consequences for rule violators. The most relevant consequence would be denial of access to school computers. Educational computing can be fun for teachers and students, but guidelines must be enacted to ensure that instructional activities are meaningful and purposeful for students.

SETTING THE STAGE: PLACEMENT OF MICROCOMPUTER WORKSTATIONS

Several considerations for locating microcomputer workstations pertain to environmental factors that may affect the performance of microcomputers and their users. Typically, microcomputers function best in locations that have good temperature control. Microprocessors transmit heat. As a result, a small room crowded with students and microcomputers could create a hot, stuffy, unfavorable learning environment.

Conditions that need to be controlled include static electricity, dust, and glare. These elements, unlike the problem of temperature control, should not require extensive modification of existing facilities. Many manufacturers offer recommendations for controlling these problems. For example, some manufacturers suggest that chairs without rollers be used in microcomputer laboratories to decrease levels of static electricity.

An equally important concern when planning the integration of CBI into vocational programs is achieving a balance between computer accessibility and security. While the placement of computer hardware to limit the potential for vandalism and misuse is necessary, there is a danger of protecting equipment to the extent that it is inaccessible to students and faculty.

Vocational instructors should direct their attention to several key questions regarding the locations of microcomputer workstations: (a) Will students use microcomputers only during class time? (b) Will students be expected to perform computer related assignments at times other than class periods? (c) Will students other than vocational students have access to microcomputers? (d) Will students be working in teams (requiring greater space allocation per computing station)? (e) Will hardware be bound to workstations?

Answers to the preceding questions will have continuing impact on the execution of CBI. Vocational instructors should avoid unnecessary precautions that tend to turn students away from microcomputers. Teachers should strive to achieve maximum flexibility for computer usage with minimal risk to facilities and equipment. The overriding intent is to maximize potential uses while minimizing potential abuses.

BOLSTERING STUDENT MOTIVATION

Aware of the inseparable connection between motivation and learning, vocational instructors rightly pursue relevant, challenging, and exciting vocational curricula and instruction programs. Several writers (Chandler, 1983; Jernstedt, 1983; Peelle, 1982; Stowbridge & Kugel, 1983) have portrayed CBI as a method for motivating learners. Nevertheless, CBI will not motivate students without sound educational objectives. Enhancement of motivational levels will be achieved through approaches employed by vocational instructors to orient students to CBI objectives.

The orientation process should feature a cycle of pre- and post-computer activities for building student motivation. For example, prior to each unit of instruction vocational teachers should set the stage for the educational objectives of the unit. This procedure is frequently called **set induction** (Kim & Kellough, 1983). Students should be introduced to a unit of instruction in a manner that stresses the importance and significance of the curriculum content. Students become aware of what will be learned in what fashion, and individually they become stimulated to explore the unit. After set induction, students begin to work while the instructor circulates and interacts with students in a facilitating role.

One motivating educational system, a method ideally suited for integrating CBI into vocational education curriculum and instruction, is competency-based education. This systematic approach to curriculum and instruction consists of three basic steps (Sullivan & Higgins, 1983). The first step involves the teacher establishing meaningful and worthwhile student objectives. During step two, the teacher develops appropriate instructional activities to mesh with learner objectives. In step three, the instructor monitors the progress of students toward achieving the educational objectives. This competency-based approach permits instructors to allocate more time and effort for working on an individual basis with students.

During this execution phase, it is useful to require students (as individuals or teams) to maintain and submit daily or weekly logs. This computer diary relates student experiences with specific computer software on given dates and times. From this information, vocational instructors may garner a sense of problematic software as well as rates of progression for individuals and teams. Information gained from student log books will provide evaluative feedback to instructors for modifying CBI.

Debriefing sessions should be used to conclude units of instruction. Students should receive feedback regarding how well they executed the unit. Sessions should include a sharing of information among students and

teams. Additionally, debriefing could include reviewing microcomputer skills or information outlined in previous instructional units. This cycle of briefing, executing, and debriefing ensures that goals of CBI are achieved and helps students recognize their progress and direction.

In addition to methods which focus on building intrinsic motivation of students, vocational instructors need to examine methods for extrinsic motivation. Extrinsic motivation should incorporate activities within the structure of the classroom that add fun to vocational education and create positive effects on work outputs.

Boss (1983) describes an innovative adaptation of CBI that increased the motivational levels of her students. She created the "Order of the Apple," which aroused student interest by fostering friendly classroom competition to attain six orders. Upon completing each level, students receive a different membership card. An interesting sidelight to this competition is the **bump command**, which permits students who are solving specific, teacher-directed problems to bump students off computers if they are merely playing games.

CREATING A USER'S GUIDE

A pivotal consideration for vocational instructors is the creation of a microcomputer user's guide. Initially, this idea might appear worthy of little consideration because manufacturers provide user's guides. Frequently, and unfortunately, the expression "user's guide" is a misnomer for such documentation. Computer documentation provides a disproportionate amount of information that can easily be misinterpreted by a person of limited computer vocabulary, i.e., the CBI novice. Readability tests for most hardware and software documentation would reveal a comprehension level beyond that of many students. It is therefore recommended that vocational instructors extrapolate information from documentation manuals and construct a user's guide that fulfills the computing needs of their vocational students.

A program specific user's guide should not be inclusive, but it should contain four components. In the first section, teachers should include diagrams of the microcomputer system and its components. Technical terms and brand names should be included. The second section should contain directions pertaining to basic computing skills such as loading, unloading, and turning on and off power sources. Third, an overview section of appropriate computer terminology should be provided to help students expand their computing vocabulary. Fourth, the guide should contain a trouble-shooting section to help students correct simple malfunctions and react to program error messages.

An example of a school/program specific user's guide is the *Apple II Do-It-Yourself Manual*, written by the Hopkins public schools of Hopkins, Minnesota. This type of manual can serve time-tested CBI needs for vocational students and instructors. The user's guide should be consumable and specific to the classroom or laboratory. Manufacturers' user guides will remain useful to students who seek additional familiarity with computing.

ENHANCING THE EXECUTION OF CBI

Vocational instructors can ease the transition of CBI into vocational curricula and instruction by employing educational computing activities which extend vocational concepts that are components of the program. Integration of computing into the vocational club may increase interest in CBI as well as vocational club activities. Students could be requested to help develop CBI materials for the management of club activities or for incorporation into the vocational program.

Another activity which will enhance CBI in vocational programs is discussion regarding computer ethics. One method for fostering such discussions is to create a computer news bulletin board for posting newspaper clippings and magazine articles related to computer controversies. Such controversies should include issues of software piracy, alteration of computer records, copyright restrictions, ramifications of computer technology to the world of work, and the impact of high technology jobs on personal life styles. Students should be encouraged to supply articles for discussion purposes. As controversial news items are considered, different formats for presentation should be used in vocational classes. Debate, role playing, guest presentations, media presentations, and group decision making are techniques that maximize student interactions on controversial computer topics.

One particularly effective method of exploring computer ethics is to present students with short dilemma stories about fictitious characters. A dilemma story depicts a situation in which the characters have at least two attractive courses of action. Through discussions of alternative solutions to these dilemmas, vocational students can clarify their values while developing reasoning and decision-making skills. Not only will students enjoy the computer ethics activities, but vocational instructors will gain insight regarding students' thought processes and value systems (Hannah & Matus, 1984). The central idea of all such enhancing activities is to help students reach an awareness of the complexity of computer ethics. Through such activities students are encouraged to examine alternative courses of action and to consider the consequences of those actions.

SUMMARY

Amid fanfare and high expectations from school administrators, school board members, parents, teachers, and students, Computer-Based Instruction is being implemented in vocational programs across the nation. Vocational teachers will play pivotal roles in the success of these programs. Teachers will carry the brunt of responsibilities for integrating CBI into vocational curricula and instruction. Instructors will face the challenges of synthesizing student talents with instructional materials, hardware, and software. Teacher/student/computer interactions, the educational computing environment, and the instructor's own perspective of educational computing must be considered during the implementation stages of Computer-Based Instruction.

ACHIEVEMENT INDICATORS

- 1) Discuss how Computer-Based Instruction affects the three classroom communication and thought patterns.
- 2) Develop a list of rules for students pertinent to microcomputer usage.
- 3) Discuss two considerations for the physical locations of microcomputers in classrooms.
- 4) Generate three ways to maintain student motivation in Computer-Based Instruction.
- 5) Create a classroom specific USER'S GUIDE for a Computer-Based Instruction program.

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Unit 11

Individualizing Instruction With Computer-Based Instruction

UNIT OBJECTIVE

Upon completion of this unit, the learner will be able to individualize instruction with Computer-Based Instruction. This knowledge will be demonstrated through completion of the unit achievement indicators.

SPECIFIC OBJECTIVES

Upon completion of this unit, the learner will be able to:

- 1) Explain how the learning concepts of attention and competence influence motivation and hence any program of individualized instruction.
- 2) Describe characteristics common to the tutor and the microcomputer program as they relate to individualized instructional goals and practice.
- 3) Define the term **user friendly software** and identify packages which embody this characteristic.
- 4) Distinguish reinforcing microcomputer programming practices from those which are not reinforcing to individualized instruction.
- 5) Create an individualized microcomputer program within a classroom setting with consideration given to scheduling, computer aides, and control.

Individualizing Instruction With Computer-Based Instruction

BY: DR. RICHARD A. McEWING
DR. GENE L. ROTH

THE BASIC NEEDS FOR ATTENTION AND COMPETENCE

In discussing ways that vocational teachers might structure classes to provide individualized instruction, it is worthwhile to consider a perspective regarding how students are motivated to learn. If the teacher keeps in mind some underlying idea pertinent to what motivates students to learn, then this guiding principle can suggest numerous ways to achieve the classroom environment necessary for learning to occur.

Studies by Page (1958) and Thistlethwaite (1959) suggest that students are positively influenced by attention. Page's work indicates that when students were provided written feedback on their papers, their subsequent performance improved. Thistlethwaite's study of high school graduates found that those who had received the most recognition for a similar achievement had the most favorable attitude toward intellectual activities.

These two studies confirm what most educators believe . . . if students are expected to improve their knowledge—if they are expected to learn—then they should be encouraged through the use of external reinforcement. Furthermore, the more extensive the positive feedback, the more positive feelings the students are likely to exhibit.

Is positive attention enough to motivate learning? Some theorists suggest not. While this external condition of positive attention is important, an internal condition is of even greater importance—the need for competence.

For one to be really involved in the learning process, the activity must be intrinsically motivating. It is suggested that "mastery motive" comes to influence learning behavior. It is the strongest and most dependable motivation for learning. This feeling of being able to deal with an important new area of knowledge and of self

satisfaction enables the student to manipulate the learning environment effectively and cope with problems which arise in the learning process. This perspective of learning development is based on the work of Jerome S. Bruner (1961).

Using these concepts of positive attention and competence as a base for motivating learning, the vocational teacher needs to select an instructional strategy which maximizes these two events for the student. One such strategy is individualized instruction.

INDIVIDUALIZING AND TUTORING

Attention giving and competence development appear to be maximized in situations where there is one teacher and one pupil. This conceptualization of individualized instruction is not new. Many affluent members of societies prefer that their children not be educated in common classrooms. Rather, they prefer that a tutor be hired to give their children "individual" attention. These parents expect their children to benefit by (a) having a carefully selected authority personally available (many tutors are skilled in an area—military, letters, statesmanship), (b) having this availability immediate (tutors often live on the estate), and (c) having immediate reward and punishment administered according to learning outcomes (many tutors were quite cruel to their charge, with the consent of parents).

Other citizens have extolled the values of the common public school. In these schools, it is argued, students learn the intricacies of society. They learn to respect the contributions of others in building society, they learn to be patriotic, and they learn a wider range of skills. Common schools are not limited to the knowledge of one teacher; thus, students have a larger world at their disposal. The drawback of the classroom as a place of instruction is that the individual may become lost in a lock-step approach among the rest of the students. The student may go for days, perhaps even weeks or months, without responding to the instructor's questions. Many students avoid asking questions that might draw attention to them, fearing a loss of self-esteem. The strategy of individualizing instruction is intended to deal with this problem associated with whole class instruction.

The idea at the center of individualized instruction is to return the focus of instruction to the individual. Rather than one teaching strategy, it is a group of strategies aimed at improving the individual's interaction, in terms of quality and quantity, with the subject matter. Typical ways to achieve this goal involve:

1. structuring time flow in the classroom,
2. structuring subject material, and
3. structuring teacher expectations.

COMPUTER AS MODERN DAY TUTOR

The Presentation Element

One of the biggest complaints voiced by students is that the teacher is unavailable when needed. Just when the student needs a problem to be clarified, the teacher is over in another part of the room. The student has no recourse except to wait. Jackson (1968) made observations in elementary school classrooms which suggest that waiting is the most common activity students perform at any given time.

Use of the microcomputer can alleviate this problem. A good microcomputer program has built within it a useful series of prompts and help statements. Vocational teachers should look for these two characteristics when purchasing classroom programs. Nevertheless, if the classroom terminal is connected to a mainframe computer, the students may experience some slow response time or some down time. These "attention lapses" are bothersome, but minimal compared to the attention lapses in a regular classroom. In addition, the students are not likely to take these down times personally. After all, it would be hard to believe that a machine is intentionally failing to acknowledge the requests of students because they are not liked. However, lapses from teachers are not so rationalized. Most computer centers plan their maintenance down time so that the user can work around these periods. Thus, like the tutor, the microcomputer offers increased availability of instruction to students.

"Prompts" and "Helps" relate to a second function that an individual tutor can perform. Not only is the student given the attention in terms of time commitment, but this attention can be programmed to be very positive. Some computer programs which seem to take into consideration the feelings of a novice operator are termed **user friendly**. This is another important characteristic that instructors should seek when selecting a program. If the student has a question and selects the wrong response, what should a good program do? The more helpful and interactive the program, the better. The following is an example of such a user friendly program in action:

Scene: Student is asked to read some text materials on the screen and then answer some questions.

Program: "Would you like to read the material again?" (yes/no)

Student: "Yes"

Program: Shows material, displays the question again.

Student: "No"

Program: Asks first question.

Student: Inputs answer (answer is wrong)

Program: "Sorry, your answer is incorrect. Would you like to try again?" (Yes/No)

Student: "Yes"

Program: Prints the question again.

Student: Inputs the correct answer.

Program: "Right, would you like to try another question?" (Yes/No)

Student: "Yes"

Program: Prints the second question.

Student: Inputs the wrong answer.

Program: "Sorry, the answer is incorrect. Would you like to try again?" (Yes/No)

Student: "Yes"

Program: Prints out the second question again.

Student: Inputs the wrong answer again.

Program: "Sorry, the answer is incorrect. Would you like to see the part of the text that pertains to this question?" (Yes/No)

The Knowledge Element

The provision for positive acceptance extends beyond being user friendly. This extended concept ties directly to the concept of individualization. In using microcomputers to facilitate individualized instruction, one should look closely at how the software program provides for **reinforcement** of the task at hand. Swenson and Anderson (1982) stated that reinforcement, by definition, must be individualized, since what is reinforcing to one student may not be reinforcing to another. They suggest that the four most important variables influencing the effectiveness of the reinforcer are timing, appropriateness, relevancy, and configuration.

1. Timing—To be effective, the reinforcer should occur immediately after the desired response (.5 seconds is ideal); it should then be "thinned out" over time (occur every other time, then every fifth time, etc.) and not linger on the screen more than a few seconds.
2. Appropriateness—To be effective, reinforcers must recognize the age level and maturity of the user. The best approach is to test reinforcers on intended audiences.
3. Relevancy—To be effective, reinforcers should add to the user's information on the subject.
4. Configuration—To be effective, reinforcers should be part of the program as a whole and not just additions. They should deal with student errors in a positive way without judgmental information which is not only unnecessary, but undesirable.

Another characteristic of the tutor situation is the limited knowledge available to the student. These limitations in subject area have been aptly pointed out by the advocates of the common school with its myriad of specialists and specialties. Unlike the tutor, the microcomputer is not fixed by what is there. A computer may teach one thing to one person and, by changing programs, teach another thing to someone else. The real advantage for the student lies in the ability for learning to take place through one conduit. The student does not have to worry about not getting along with teacher so-and-so, thereby being turned off to that subject area. If the student has an interest in an area and access to a microcomputer and computer program, the knowledge is available. The use of the microcomputer combines the best of the tutor and common education. The student has but one "authority" to learn through, yet has available the knowledge of a much wider world.

Ryba and Chapman (1983) conclude that many effective learning programs have characteristics which can easily be built into computer software. These characteristics include allowing the student to direct the program at several points with options such as "advance," "quit," "repeat," or "review." Good software programs provide for student goal setting and self-evaluation (e.g., "The last time you had 10 correct answers, how many correct responses do you want to attempt this time?"). Additionally, software programs may allow users to pick from a list of personally meaningful rewards and to verbalize one's findings in teams or small groups. Software packages which are particularly attention drawing are multi-sensory in nature. Programs which use graphics, sound, and color are more likely to keep students' interest longer than bland programs. Similarly, programs which provide a variety of reinforcers are likely to be more favored by students.

The Control Element

The last characteristic of the tutor, that of role model, would seem to be lost in the computer age. Surely, instructors do not wish and perhaps even fear, for students to identify with machines. Rather than despairing over this role model falling on the part of the computer, teachers should be encouraged. Vocational instructors need not be concerned about negative personality influences interfering with the presentation of material. A well written computer program neither ignores nor alienates students. The microcomputer does not attempt to make the student like it or approve of it, as a tutor/mentor is likely to attempt.

Some teachers believe that a human element can be returned to microcomputing through the use of more advanced students as computer aides. These students can help novices troubleshoot simple program and device problems. Special aides need to be used wisely, however, because their presence could have negative effects on the learning of the class (Glass, 1981). Student aides may create frustrations and resentments if they function from positions of power and privilege. Furthermore, aides may prevent students from gaining insights on their own, an experience which can be highly motivating. An alternate approach to increase interaction among students is to use group work situations for mutual support—discussions, cooperations, joint projects.

How do students perceive individualized instruction via microcomputers? Frizot (1980) found Computer-Based Instruction to be popular with students:

Conceived as an individualized instruction in the time-sharing format, the student rightly feels that he is spending his own time and applying himself to a project of which he controls some of the parameters and also that he can, in numerous cases, make moves and take alleys of learning on his own, without disrupting the rest of the class. Thus, the student's work is individualized but not solitary. (p. 107)

INDIVIDUALIZING THE CLASSROOM

The concept of individualizing control may be the key to successful individualization with Computer-Based Instruction. Vocational teachers can extend this control factor by individualizing to an extent that permits students to choose among software packages. Once students select software programs, there should be options within the software packages to accommodate learners at different levels. The sequence of presentation should allow advanced students to skip material, but the program should also provide avenue for return and review. Students should be free to choose the number of exercises of a particular type they wish to attempt.

For students who are skeptical about the ability of students to make appropriate self selections, there is a middle ground wherein one can use pretests to place students with scheduled mastery tests at specified check points. Programs can be organized into modules within a flowchart format involving specified objectives. Well written modules will allow for maximum student choice and self-pacing.

An individualized program approach will necessitate close attention to the scheduling of microcomputers. Blocks of time should be scheduled for class use and for free time use. Students should sign up for free time use in advance, but should be guaranteed regularly scheduled use. Since it is likely that more than one student will use each microcomputer, a log sheet should be maintained to indicate computer use and notations regarding problems with equipment or software. There should also be a provision regarding "wait time." If a student fails to show at the appointed free computing time, a provision should be established regarding how long another student should wait before taking over that time slot. These types of rules should be clearly posted in the microcomputer facility.

SUMMARY

Computer-Based Instruction is, in many ways, the best facilitator of individualized instruction next to the tutor; perhaps it is even superior. User friendly software programs that provide positive attention, build feelings of competence, and allow extensive student control are best suited for individualized instruction. Educators may choose to individualize within the software programs or they may choose to extend this individualization to the

structure of the classroom flow itself by providing increased flexibility in scheduling, program selection, and student control.

ACHIEVEMENT INDICATORS

- 1) Explain how the learning concepts of attention and competence influence motivation and hence any program of individualized instruction.
- 2) Describe the characteristics common to the tutor and the microcomputer program as they relate to individualized instructional goals and practice.
- 3) Define the term **user friendly software** and identify packages which embody this characteristic.
- 4) Distinguish reinforcing microcomputer programming practices from those which are not reinforcing to individualized instruction.
- 5) Create an individualized microcomputer program within a classroom setting with consideration given to scheduling, computer aides, and control.

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Unit 12

Assess Student Microcomputer Skills

UNIT OBJECTIVE

Upon completion of this unit, the learner will be able to develop an assessment instrument for evaluation of student microcomputer skills. This knowledge will be demonstrated through completion of the achievement indicators at the end of this unit.

SPECIFIC OBJECTIVES

Upon completion of this unit, the learner will be able to:

- 1) Define computer literacy in terms of vocational education requirements.
- 2) List at least five general microcomputer skills which students should possess in a computer-based vocational program.
- 3) List four steps required in a computer familiarization course to normalize students' microcomputer skills.

Assess Student Microcomputer Skills

BY: MICHAEL T. DROTTER

Introduction

Not too many years ago, vocational instructors could safely assume that incoming students had no previous microcomputer skills. Today, however, a group of students entering a vocational discipline may exhibit a complete spectrum of computer skills, from no experience to ten or more years of computer use. This wide range of computing skills requires vocational educators to change strategies for educational computing to ensure that all students possess a minimum set of microcomputer skills prior to starting a computer-based vocational program. This minimum set of microcomputer skills may be referred to as computer literacy.

Computer Literacy

Computer literacy, a highly overused buzz word in educational computing, has been given many different definitions by educational authors. Perhaps the most common definition of computer literacy is the ability of a person to use a microcomputer to perform routine tasks required in a job. This definition implies that knowledge and experience with microcomputers makes a person computer literate. Using this definition during the pre-assessment phase of determining students' microcomputer skills may create an inaccurate evaluation. Due to the non-standard nature of the computer industry, many individuals who are extremely proficient in the use of one microcomputer system will feel hopelessly illiterate when seated at another microcomputer's keyboard. The vocational educator must, therefore, redefine computer literacy for the purpose of assessing student microcomputer skills.

For the vocational educator, computer literacy is a general knowledge of microcomputers that aids the student in learning to use a particular microcomputer. This definition implies that the vocational educator must assess both the student's general knowledge of microcomputers and the student's specific knowledge of a particular microcomputer system. Inevitably, the microcomputer will be used directly in developing student mastery of minimum microcomputer skills. Manuals, textbooks, or video training series only provide the background information necessary to achieve a mastery of basic microcomputer skills. The logical result of this assessment will resemble a CBI program for basic microcomputer skills. Techniques illustrated in units C.9 (Orienting Students to CBI) and C.3 (Develop Lesson Plans Incorporating CBI) of this handbook provide detailed strategies for vocational educators which can be applied directly to normalizing student microcomputer skills prior to beginning a vocational CBI program.

Establishing Assessment Procedures

An initial step in devising a microcomputer skills assessment instrument is to determine the objectives students must meet to prove competence in basic microcomputer skills. The assessment instrument must address both general microcomputer knowledge and specific knowledge of the particular microcomputer systems in use. This assessment will help vocational teachers determine the levels of effort required for students to achieve minimum acceptable microcomputer skills. The students' general microcomputer knowledge is a good indicator of how quickly they can assimilate specific skills necessary to operate in a particular CBI environment. Assessment of general microcomputer knowledge will fall mostly in the cognitive domain. General knowledge of specific microcomputer components, such as disk drives, CPUs, and software, can easily be adapted to use on a specific microcomputer system. Knowledge of microcomputer terminology will aid students in the use of reference material associated with specific microcomputer systems.

Assessment of Specific Microcomputer Skills

When establishing objectives regarding minimum skills that students must possess to operate the CBI microcomputer system, care must be exercised to include only those skills required for the specific computing tasks which have been integrated into the vocational program. For example, if no computer programming will be performed by the student during CBI, then vocational instructors should not evaluate student's knowledge of programming languages. Likewise, instructors should not expect vocational students to acquire an extensive knowledge of the computer's operating system if students will be using "canned" commercial software in the vocational program. Appendix A provides a checklist of recommended microcomputer skills for the educational computing activities of a vocational program. This checklist should be used as a starting point to evaluate which skills are necessary for specific CBI applications.

The use of microcomputers involves psychomotor skills. Eye-hand coordination is an important consideration in the proper operation of a computer system. The only way for instructors to evaluate these skills is to place students in keyboard operating activities.

Method of Assessment

Vocational instructors should keep traditional test-type assessments to a minimum and maximize hands-on evaluations of microcomputer skills. A method to help vocational teachers determine how quickly a student will adapt to a new microcomputer system is to limit the amount of teaching during the assessment period. This will permit instructors to ascertain how quickly students learn required skills and also allow instructors to identify low frustration thresholds students may exhibit toward technology equipment. These two bits of data may be valuable indicators regarding whether students will be able to use the standard familiarization training for CBI or if it will be required to provide individualized instruction. Teachers should assess students' skills with all the equipment that will be necessary for specific computing activities within a vocational course or program. For example, instructors should not evaluate skills with basic microcomputers when job-specific computer applications will require equipment such as a barcode reader in a retail sales program, a digitizer in a drafting program, or a plotter in an advertising program.

Evaluate the Assessment Results

Evaluation of computer skills for CBI is really no different from standard methods of evaluation which have proven effective over the years. Pre-assessment, followed by a standardized or individualized teaching program, with built-in post-assessment and provisions to reteach certain skills, will prove to be an effective evaluation process. This process will assure vocational teachers that students who enter a computer-based vocational program will possess at least a minimum skill level in microcomputer use.

Whether computer familiarization training is implemented in a group or individual environment is best determined by follow-up CBI training. If the CBI program is one in which individualized instruction is utilized, the individualized computer familiarization is probably best. If a single class starting date is important to the overall CBI program, then group computer training is best. However, if group training is pursued, provisions must be made to provide constructive activities for students who meet objectives early, and also for students who possess prerequisite computer skills without familiarization training.

SUMMARY

Ensuring that all students entering a CBI vocational education program possess a minimum amount of skills on the CBI microcomputer system is a key element in the success of a computer-based vocational program. Requiring all students to complete a familiarization course may be a waste of time for select students. However some students will have little or no experience with microcomputers prior to commencing CBI. It is imperative that teachers who integrate educational computing with vocational curricula and instruction develop a method to assess the level of microcomputer skills of students. Teachers should be prepared to provide remedial training for students who lack the minimum-required skills. The assessment instrument should provide a hands-on evaluation of students' skills as well as built-in indicators to predict the adaptability of students to CBI.

APPENDIX A

BASIC MICROCOMPUTER SKILLS CHECKLIST GENERAL KNOWLEDGE

Definitions:

ASCII collating sequence

Database

Database Management System (DBMS)

Dot Matrix Printer

Fixed (or hard) Disk

Floppy Disk

Keyboard

Letter Quality Printer

Mouse

Plotter

Random Access File

Record
Sequential Access File
Spreadsheet
Word Processor

SPECIFIED MICROCOMPUTER SYSTEM KNOWLEDGE

How to initiate (boot) systems operation.
How to change the default disk drive.
How to load a program from disk.
How to save a program or data to disk.
How to make backup copies of programs or data.
How to halt program execution.
How to send program output to a printer or plotter.

ACHIEVEMENT INDICATORS

- 1) Define computer literacy in terms of vocational education requirements.
- 2) List at least five general microcomputer skills which students should possess in a computer-based vocational program.
- 3) List four steps required in a computer familiarization course to normalize students' microcomputer skills.

Unit 13

Evaluate and Modify Computer-Based Instruction Based on Student Achievement

UNIT OBJECTIVE

Upon completion of this unit, the learner will be able to implement the criterion referenced model of instruction for the purposes of evaluating and modifying CBI.

SPECIFIC OBJECTIVES

Upon completion of this unit, the learner will be able to:

- 1) Identify the steps in Glaser's model of criterion referenced instruction.
- 2) Write objectives for CBI units of instruction.
- 3) Develop pre- and post-assessment from CBI components of a unit of instruction.
- 4) Evaluate assessment outcomes and relate the assessment to the effectiveness of CBI in the vocational program.
- 5) Use task analysis to modify a unit of instruction prior to reteaching the computer-based instructional materials.

Evaluate and Modify CBI Based on Student Achievement

BY: DR. MOLLY WILSON-DROTTER

Computer-Based Instruction (CBI) is a relatively novel method of reaching students. It has seemingly met with a great deal of success because computers motivate students and increase their time on task. Yet, CBI has not been thoroughly evaluated as a teaching method in terms of legibility of material displayed on a CRT for poor readers, value of gaming in teaching basic skills, and need for repetition of simple level skills in teaching overall skill concepts.

As accountability becomes more and more prevalent in school districts, it is imperative that teachers are able to prove that CBI—or any chosen method of instruction—is effective. The need to evaluate CBI and to modify it as needed is an essential part of effective educational computing. To date, the instructional measurement model that allows the most flexibility is Criterion Referenced Instruction. Criterion Referenced Instruction lends itself to CBI because its basic concepts can be applied to many different types of computer-based learning activities. It is a flexible measurement and evaluation system.

Criterion Referenced Instruction provides vocational teachers with a method of assessing student learning as it occurs in classrooms and laboratories. Teachers are given the freedom to decide what they want to teach and to assess what they have taught. Thus instruction is geared to learners. Vocational instructors can present material they believe should be covered for specific students while employing instructional methods which they perceive to be appropriate.

Criterion Referenced Instruction, which follows a test-teach-retest format, is designed to be a practical guide to instruction. Two keywords in this type of instruction are **PLANNING** and **TEACHER DECISION MAKING**. This unit, based on Glaser's model of classroom management, shows how to effectively implement both ideas.

GLASER'S MODEL OF CRITERION—REFERENCED INSTRUCTION

One method of Criterion Referenced Instruction that provides a simple and straightforward approach to classroom evaluation is Glaser's model for teaching (1962).

Glaser's model for classroom instruction provides great flexibility and freedom for the teacher (Tillman, Bersoff, & Dolly, 1976). This model can be used in individualized, group, or whole-class work to meet teacher and student needs in a computer-based vocational program. It includes four steps:

1. Pre-Assessment
2. Behavioral or Instructional Objectives
3. Teaching or Instruction
4. Testing

1. **PRE-ASSESSMENT:** This step assesses what students know before they begin a particular unit of work or a daily CBI lesson. Pre-assessment can take several forms: (1) A *written pre-test* which determines if students already have the skills to be taught. This step can permit students to skip upcoming work. Additionally, it may determine that a student needs remedial work. (2) An *informal assessment* helps vocational instructors identify certain skills which students need prior to beginning a lesson. It is important for instructors to recognize if students have these skills. If students do not possess prerequisite skills, then instructors should prioritize these skills as the first to be taught. If students have previously mastered these prerequisite skills, this step permits teachers to avoid repetitive learning for students.

These skills can cover both basic computer literacy skills (presented in Unit C.12) and the vocational skills and knowledge highlighted in this unit of instruction. In CBI, as in other soundly-based forms of instruction, pre-assessment avoids both needless repetition and teaching above the learners' competency levels.

2. **BEHAVIORAL or INSTRUCTIONAL OBJECTIVES:** Objectives are student goals. They describe what students are expected to learn in particular units or daily lessons. They provide a way for vocational teachers to identify what is to be accomplished prior to the start of the instructional period. Objectives for educational computing should be flexible and capable of being modified. Objectives are starting points for effective computer-based learning.

In CBI, knowing when to use the computer for assistance with appropriate tasks and how to select students to be trained is facilitated by having goals in mind before instruction begins. Particularly in CBI, clear cut instructional objectives quell the fear of the computer being a play toy for avoiding "real work" in the classroom.

3. **TEACHING or INSTRUCTION:** This step involves writing lesson plans for CBI. Building on the foundation of objectives, daily planning provides for good teaching. Having lesson plans does not reduce teacher flexibility. Vocational teachers can change lesson plans as the need arises, but having plans provides instructors with starting points.

Planning is a necessity in CBI, particularly in classrooms where students must share terminals, software, and printers. Lesson planning facilitates classroom management and provides a structure for students.

4. **TESTING:** The testing step evaluates what students have learned as a result of CBI. This process can be performed daily, at the completion of units of instruction, or as the vocational teacher sees fit. Objectives set forth in Step 2 of the model are converted into test questions. Since this is the material that has been taught in the vocational program, it is the material on which students must be tested. After the test is given, the teacher can evaluate the effectiveness of the instructional unit.

In cases of failure and in individualized instruction, students falling below the "pass" percentile may redo the unit with modifications to the practice exercises and test questions, and with a variation of instructional methods by which they were taught. CBI is very useful in the recycled instruction phase because it provides individual student practice. Furthermore, it is a handy bookkeeping system for student progress.

The four steps of Glaser's model of Criterion Referenced Instruction lend themselves to the easy and effective evaluation of CBI. Each step of the Glaser model will be discussed in more detail in the following sections of this unit.

Pre-Assessments:

There should be two phases of pre-assessment for students in a computer-based vocational program: a) establishing overall goals and b) pre-test.

- A. **Overall Goals:** This phase requires vocational instructors to determine what skills students should be able to perform upon completion of the unit of instruction. Skills, knowledge, and attitudes pertinent to job-specific applications of microcomputers in vocational education should be established. Overall goals are stated in terms of what students will be able to do at the end of the unit of instruction rather than what the teacher will do during the unit. Overall goals are not as clear cut as behavioral objectives, but serve to focus the teacher on the overall crux of the instructional unit. The unit could be one in which CBI is being used as a delivery system or it could be one in which computer skills are being taught.
- B. **Pre-Test:** This is a very important, but simple idea. Vocational teachers must analyze what students will be asked to do in the unit. Then, instructors need to determine which skills students are expected to possess prior to starting the lesson. What are the prerequisites? For example, should they be able to read at a certain level? Should students have certain background knowledge? Will vocational students need certain tools or equipment? What level of computer skills are expected? These background competencies must be present before the student can proceed with the lesson. If they are not, the vocational teacher must provide the backup skills prior to executing the lesson.

Pre-assessment can simplify a great deal because no one begins a unit until all the prerequisite skills are mastered. The teacher has focused goals for each unit and knows beforehand the specific use the computer will have in instruction. Therefore, CBI is a meaningful part of structured instruction, not a gaming device to fill empty instructional hours.

Instructional Objectives

Instructional objectives are specific student goals—the foundation of good planning. They tell what students will be able to do upon completing a computer-based unit of instruction. Mager (1962) identifies three parts to an objective: a) student behavior, b) testing conditions, and c) performance standards.

- A. **Student Behavior:** Instructional objectives identify what pupils will be able to do when lessons are completed. What students will do must always be something that teachers can observe. For example, assume that an instructor is teaching students how to replace a clutch drive belt. How will the instructor know if students have mastered this skill? Students will be able to list different types of drive belts; identify parts of the pulley assembly; perform other types of observable learning activities; and as a concluding activity, demonstrate the ability to replace a clutch drive belt. Often, there are many ways to assess the same skill. The key is that the pupil behavior in the objective has to be an observable action.
- B. **Testing Conditions:** What will students be provided when they are tested on material? If students are tested on tuning an automobile, the conditions of the testing will be very important because they can vary from using an engine analyzer to a feeler gauge. Instructors must decide what types of tasks students should be able to

perform. Then, instructors must indicate which tools, equipment, manuals, specifications, or other materials should be used by students to correctly perform the task.

- C. **Performance Standards:** The vocational teacher determines how many answers the student must correctly answer on a post-test to reach mastery. However, advisory committees and industrial standards are often used to establish criterion levels. By establishing standards before the work is done, teachers will know what to expect. This expectation of performance will apply to each student undertaking the unit. Students who fall below the performance standard may repeat a modified unit of instruction which reteaches the subject matter.

The following is an example of an instructional objective in a computer-based vocational program:

Given a microcomputer and software package titled *Micrometer Readings I*, the student will choose micrometer measurements graphically displayed on the CRT by inputting ten correct micrometer readings.

Student Behavior: Choose micrometer measurements graphically displayed on the CRT

Testing Conditions: Given a microcomputer and software package *Micrometer Readings I*

Performance Standards: Inputting ten correct micrometer readings

Teaching With Lesson Plans

This section of Unit C.13.14 focuses on planning lessons for CBI. Readers are referred to Unit C.3 for a more in-depth look at this topic.

There are many ways to write lesson plans for CBI. This section features a lesson plan format which permits vocational teachers to generate more approaches to teach any one lesson. Teachers can use alternative ideas in case a lesson flops, computers or software malfunction, printers do not print, or some other type of normal catastrophe occurs. Being overly prepared permits vocational teachers to use the best computer activities as opposed to the quickest or most convenient. A sample lesson planning format entails seven components.

I. Title of the Lesson

II. Student Performance Objective(s)

Teachers should list expected performances for students upon completion of the lesson. These can be computer-based objectives which have been taught for several days or can be objectives for new instructional material.

III. Entering Behaviors of Students

What expectations will vocational teachers have for students as they begin a CBI lesson? Instructors need to provide a quick check to determine if students are ready for certain computing activities. If a student does not perform well in a given lesson, this pre-instruction check can help teachers determine if the student needs more practice at the computing activity or if the student did not have the prerequisite skills at the onset of the lesson.

IV. Methods to Accompany CBI

Vocational teachers should list several alternative methods for teaching a CBI lesson. Instructors should try to list a range of ideas from the most practical to the most outlandish. This exercise in flexibility serves to provide teachers leeway in ways to teach a lesson. Units C.9, C.10, and C.11 provide expanded views of this topic.

V. Selecting CBI Methods

Instructors will find some methods more suitable than others for integrating computer technology into vocational instruction. Instructional methods used with a lesson should be evaluated according to cost; ease of execution; time parameters; availability of hardware; software and other materials; and student reaction to the lesson. Unit C.1 focuses on education applications of microcomputers and provides readers with additional insight for selecting CBI methods.

VI. Delivering the CBI Lesson

Vocational instructors should focus on three components of a CBI lesson.

- A. **The Warm Up:** This should be a quick attention-getting technique that will highlight the significance of computer technology in the lesson. This technique prepares students with a "thought set" for the lesson and gets them ready for the upcoming instruction.
- B. **Teaching the Skill:** This phase involves the teacher in using one or several instructional methods for teaching a vocational skill, knowledge, and/or attitude to students. Once again, Unit C.1 provides examples of educational applications of microcomputers in vocational instruction and curricula.

C. Reinforcement: Vocational instructors should create fun or unique activities to help students grasp the content of a lesson. Educational drill and practice or gaming software can be used in this reinforcement phase. Microcomputers can be used extensively in the reinforcement phase of a lesson because of their high motivational value with students.

VII. Testing

Vocational instructors should note on lesson plans whether tests will be given at the end of the lesson or at a later date. Software packages may include testing activities or students may have to demonstrate a proficiency with hardware or software. The student instructional objectives provide teachers with the performances and criteria levels for test questions.

Evaluation

Evaluation is an essential component of an effective computer-based vocational program. Teachers must assess whether students have sufficiently mastered vocational curriculum content in order for them to progress to the other units. Vocational instructors can rely on four considerations for determining a student's mastery of vocational education materials:

- A. Asking diverse questions
 - B. Covering the objectives
 - C. Using the correct types of test questions
 - D. Grading
- A. Questioning Techniques in Educational Computing: As with traditional modes of instruction, vocational instructors need to request different levels of skill from students engaged in CBI. There is a place for memory work in educational computing, but higher thinking skills must be made a part of CBI to reflect the demands of using computer technology in the work world. Teachers should seek out educational computing materials and software which force students to engage in higher order thinking skills.

The word **taxonomy** means that each learning level builds on the one which precedes it. Vocational instructors can use Bloom's Taxonomy (as an example) for forming questions at a desired level for an educational computing skill, knowledge, or attitude (Bloom, Hastings, & Madaus, 1971).

The levels of Bloom's Taxonomy are:

Recall This entails the recognition or memory of specific facts, rules, or principles. Students are asked to recall facts or figures from memory.

Comprehension This is the lowest level of understanding. Students are requested to summarize, paraphrase, or make extensions of knowledge.

Application Students select a process or rule and correctly apply it to a new situation.

Analysis Students take a whole idea and break it down into parts, emphasizing its organization and functions.

Synthesis Students create a new pattern or structure. This entails new, creative applications of computer technology to a vocational discipline.

Evaluation Students examine their own work or others' and make judgments regarding strengths and weaknesses.

The purpose of a taxonomy in a computer-based vocational program is to encourage students to do more than merely recall answers. Students need opportunities to apply what they learn to create original applications of computer technology in vocational education. These types of creative, analytical skills will pay off for students in the job market.

- B. Covering the Objectives: Vocational instructors should make it a practice to test students on all of the performance objectives. If objectives for educational computing are included in lesson plans and units of instruction, then tests should be prepared to assess students' mastery of those objectives.

Objectives and test items should test students at the same level of the taxonomy as a skill was taught. In other words, an objective should not be written at the recall level and a corresponding test item constructed at the analysis level. Vocational instructors can use a table of specifications to graphically display the levels of the taxonomy at which the objectives and test items are written, and to see how well they mesh with the instructional goals of the computer-based instructional program.

TABLE OF SPECIFICATIONS
SPECIFIC OBJECTIVES OF COMPUTER-BASED VOCATIONAL PROGRAM

CBI Instructional Evaluation Goals	Recall	Comprehension	Application	Analysis
Instructional Goal A		Objective No. 1	Objective No. 2	
Instructional Goal B	Objective No. 4			Objective No. 3
Instructional Goal C		Objective No. 5	Objective No. 6	

C. Using the Correct Types of Test Questions: Vocational instructors realize that different types of test questions test different levels of knowledge (Gay, 1980; Gronlund, 1976; Payne, 1974). Certain test items mesh well with select educational applications of microcomputers. Other types of test items may lend themselves to the strengths of computer managed instruction (See Unit E.6.7.8).

True-false questions permit the use of a greater number of questions, but they are used predominantly at the recall and comprehension levels. Multiple choice and matching questions eliminate much guessing of answers by students. These types of questions are difficult to write because they require teachers to formulate four or five alternative answers. However, well written multiple choice and matching questions test above the recall level of Bloom's Taxonomy.

True-false, multiple choice, and matching test items permit computer scoring and evaluating, as discussed in Unit E.6.7.8. Short answer test items require students to recall information and formulate a response. Vocational instructors have the responsibility of judging the correctness of the response. Essay items provide students opportunities to organize information and present it in their own words. Students learn to collect their thoughts and express themselves. However, essay tests are time consuming to grade and they penalize students who are not good writers. Additionally, essay tests restrict the number of questions which can be asked in an allotted time period.

D. Grading: Vocational instructors will encounter dilemmas with grading in CBI similar to those they have encountered with traditional instructional approaches. Teachers who apply the techniques of mastery learning eventually face the decision of what letter grade to assign to mastery. Vocational schools and programs which feature competency-based education have taken various approaches to this issue. Students can be graded pass/fail, letter grades can be assigned to varying competency levels for each task, or students can all receive A's once they meet mastery levels. Some programs and schools do not use letter grades. Instead, progress charts present numerical values for competency levels for all of the tasks which make up the instructional program.

Teachers must decide upon a grading practice for the vocational program, set standards, and inform students of what is expected of them to reach mastery level. It is imperative that students be informed of these standards prior to the beginning of instruction.

Those who do not meet the criterion level are retaught the materials, with modifications in practice exercises and test questions. Computer-Based Instruction is especially useful in remediating the skills of students independently while other students engage in other units of instruction.

Recycling Students

For students who do not reach competency, the vocational teacher must make decisions about reteaching material to criterion. These decisions are based on selecting objectives that were not mastered, analyzing why they were not mastered, and modifying instruction to reteach necessary concepts.

If a teacher has worked through the criterion referenced model of test construction, each test question should clearly fit an objective for the unit. Teachers can easily examine student papers, projects, or software responses to assess which objectives were not met. Objectives on which the student mastered fewer concepts than the teacher designated in the performance standard should be retaught.

For most test items, teachers can examine the incorrect answers chosen and reconstruct the misinformation the student was using in giving answers. The misinformation must be the focus of the reteaching of material. At times, the best way to comprehend wrong answers is to simply ask the students why they chose a particular answer. Clear-cut fallacies can be remediated rather simply. Guessing answers randomly will require reteaching the entire concept.

If the objective involves a complex, sequential task, a task analysis is in order for deciding what skills to remediate. Task analysis involves the teacher working through a particular task and noting the subskills involved. Then, in order to assess what the student needs to have remediated, the teacher observes the student work through the task, checking off each mastered subskill in the sequence. Only unmastered steps are remediated until they are mastered.

After the teacher decides on the objectives to be remediated and the particular skills to be retaught, instructional strategies must be modified to reteach material. Computer-Based Instruction is an extremely useful tool for reteaching because it allows the teacher to give individualized remediation to those who need it while concentrating his or her efforts on instructing the other students who are ready to move ahead.

In the reteaching phase, the teacher must construct new practice exercises and, later, new test questions—all matching the objective and concentrating on the misconceptions that were identified from examining the test. A data bank of practice exercises and test items will facilitate the remediation process for a teacher using the Criterion Referenced Instruction model. Again, the use of a computer memory bank is an efficient way to store data. Programs can be written to randomize practice items and to call up items that relate to specific objectives. Students can receive feedback on correct and incorrect responses, and that data can be stored for the teacher, so that he or she will know when to retest the student on concepts being remediated.

When the student is ready for the retest, the teacher may choose to readminister the entire test again, or to only retest the objectives that were not passed initially. Test items on the retest should be keyed to specific objectives, but should present new information to the student so that he or she is not merely retaking the original test. A computer terminal may be used to administer the test so that the student is working individually and quietly. The computer can score the student's retest and let the student and teacher know if the objectives and material have been mastered.

SUMMARY

Practicing vocational instructors have already realized that teaching involves much work. Planning is the key to success for CBI just as it has been for traditional modes of instruction. Computer-Based Instruction is based on a teach-test-reteach model. An advantage of CBI compared to other forms of instruction is that it provides students with a motivating method to practice new skills. Computing activities can be good ways to remediate students who have not mastered vocational materials. These features, in addition to computer managed instruction features (Unit E.6.7.8), make CBI a welcome component of vocational curricula and instruction.

ACHIEVEMENT INDICATORS

- 1) Identify the steps in Glaser's model of criterion referenced instruction.
- 2) Write objectives for CBI units of instruction.
- 3) Develop pre- and post-assessments for CBI components of a unit of instruction.
- 4) Evaluate assessment outcomes and relate the assessment to the effectiveness of CBI in the vocational program.
- 5) Use task analysis to modify a unit of instruction prior to reteaching the computer-based instructional materials.

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A GUIDE TO HEALTH OCCUPATIONS

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A GUIDE TO HEALTH OCCUPATIONS

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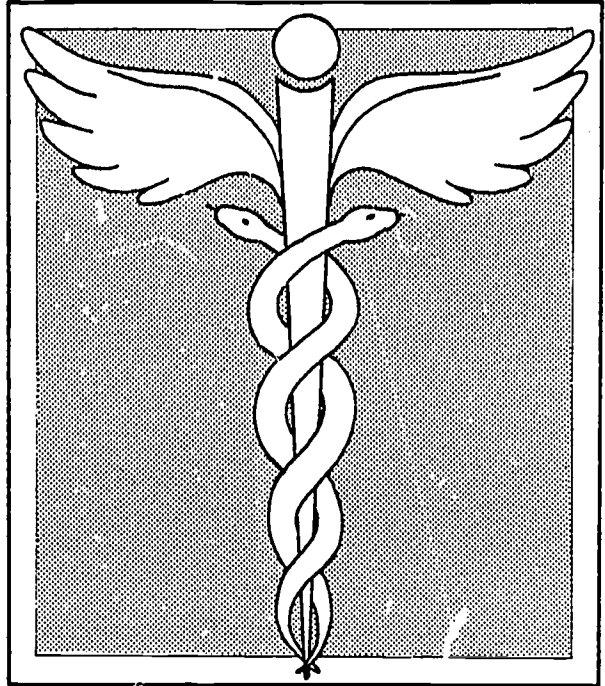
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I. Introduction

A. Thinking About a Career

Choosing a career is perhaps one of the more difficult and exciting decisions that a person encounters. Given so many choices, one wonders where to begin! Surveying the possibilities is a first beginning. Equally important is learning more about yourself: What do you truly like doing? What excites your curiosity? What are your strengths and weaknesses? What type of life-style appeals to you? Then comes the tasks of matching your personality, skills and interests with possible career choices.

This handbook is designed to help you think about the variety and range of career possibilities in the health field. Intelligent and wise choosing is knowing "what's out there!" Although you may not have even considered a health related career, you may discover something new about the health care field and do more exploring. From this you may gain some different ideas about the world of work and start to narrow down the choices.



My Likes and Dislikes

Because a career is often a life-long pursuit, understanding what you like and dislike is very important. In many cases, knowing one's likes and dislikes comes only after one has tried them. However, when you can begin to identify some preferences, the sorting out process becomes easier.

A good way to start is to think about the things that you do. Ask yourself some of the questions below:

- . What are my hobbies?
Why did I select them?
- . What types of activities give me the greatest enjoyment?
What are the most boring?
- . What skills have I developed from my hobbies, extracurricular activities and sports? Are there some skills that I might want to apply in the work world?

- . Do I like to try many different things or stick to a few things? Should I seek a career where I constantly encounter new challenges, or am I more comfortable with a more stable routine?
- . What courses have I found to be most interesting? Easy? Difficult?
- . Do I like working under pressure and making fast decisions, or do I prefer a calm environment?

Following your interests and developing your skills are important in considering a career, because being satisfied in your work has much effect on your personal happiness as well as that of your family's. It can be very disappointing after long years of training to suddenly discover that you do not enjoy that work. Yet, a wrong career choice is not the end of the world. If you know how one type of career might relate to another or how similar skills and knowledge can be utilized in another area, new opportunities can suddenly emerge and you will have more options. Making a change may not be all that difficult. It is a matter of knowing the opportunities.

Different Workplaces

In many instances, it is not the work that one does not like but the type of workplace. When you explore the various careers, examine also the many types of work settings which employ those workers. You may be surprised to find that a particular occupation becomes quite appealing in another setting. For example, working as a physical therapist in a hospital or clinic might not thrill one person, but that very same person might enjoy being a physical therapist at a fitness center or with a football team. So, do not disregard an occupation based on the workplace that you typically associate with that job. With the changing approach and attitudes towards health care, there are many new and different work settings for health care workers.

Another consideration is where you like to live. What type of area do you enjoy? Large metropolitan? Suburban? Rural? Would you be willing to move for a particular type of job? Different areas offer different opportunities. This is especially critical in the health field. If you are interested in a very specialized occupation, working with highly sophisticated equipment, do not expect to find work in a rural area. Rural areas for the most part do not have the population to support the more specialized services. However, health care personnel are in great demand in rural areas. Jobs there require people with more general training who can perform a wider range of functions than people who are more specialized. If you happen to prefer a rural environment, look for occupations with higher job opportunities in those areas.

In deciding between a rural or metropolitan area, the question of salary may be important. As a rule, salaries in rural areas tend to be lower (but the cost of living also may be lower). Making a decision involves making "trade-offs". It is asking yourself what is more important: A higher

salary? A less hectic pace and the outdoors? What are you willing to trade?

Think about the various types of workplaces and how you might view yourself working in those settings. What type of organization appeals to you? Small group or larger group? Would you prefer to be your own boss? If so, is it possible in that occupation, and how might it be accomplished? Some people enjoy work where there is a great deal of interaction with other people, while others prefer to work alone or with a few co-workers. Awareness of the setting you prefer is another factor in selecting a career. The setting makes a difference in the pleasure you will derive from the work.

Future Goals

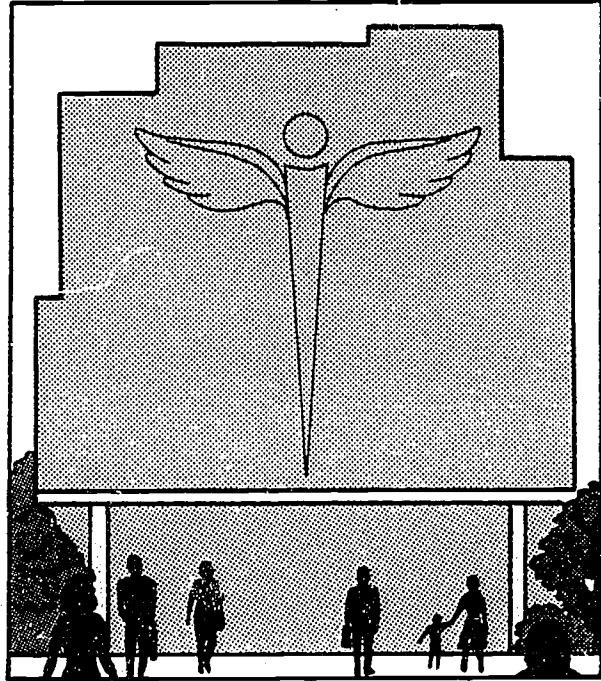
Choosing a career is very much like an exercise in forecasting the future. Unfortunately, no one has an accurate crystal ball that tells you that today's decision is what you will want 10 years from now. Nonetheless, it is useful to set future goals to guide you in planning carefully and wisely. Leave room for making changes in case your interest changes or job opportunities change.

In setting some future goals, talking to other people is most useful. Talk to people in a variety of areas and of different ages. Most people are willing to share their experience so do not be afraid to ask or think that your question is foolish. No question is foolish if you sincerely want to know. Find out what people like about their jobs, what gives them the greatest satisfaction, as well as what they do not like. Remember that people are giving opinions. As you obtain more opinions, you will construct a better picture of a particular job. Then ask yourself, "Is this where I would like to be 10 years from now, 20 years from now?" Recognize that jobs are not always as glamorous or exciting as they are portrayed on television. Most all jobs include the routine and mundane. Even famous scientists spend years performing tedious, repetitious experiments before making that one great discovery!

Goal setting also involves adjusting the ideal with realities. Setting lofty goals that one cannot attain can lead to much disappointment and frustration. On the other hand, in setting one's vision too low, one soon lacks challenges and loses interest in the job. Many health careers require special abilities as well as long, extended training. Various tests given through your school counseling service can offer insight into your interests and abilities. They are useful in helping you learn more about yourself, but of course, are only general guides. Some factors such as motivation and ability to overcome obstacles are more difficult to measure. It is up to you to decide if you want to devote the time, effort and money for the future rewards of doing what you think will be interesting, challenging and fulfilling.

B. An Overview of Careers in the Health Field

What comes to mind when you hear the words "health care"? Doctors and nurses? Dentists? While they are the more commonly known health professionals, they represent but a small percent of the personnel in the field of health care and allied health services. Over 5 million people in the United States are employed in health care. Physicians, dentists, pharmacists, and registered nurses make up about 33 percent of the total while the larger majority include therapists, technologists, technicians, scientists, engineers, counselors, and administrators. They represent over 300 kinds of health occupations. Health care extends beyond the traditional hospital setting. Today, large numbers of health care workers are found in settings such as: community health centers, fitness centers, long term care facilities, rehabilitation centers, mental health facilities, home health agencies, clinical and research laboratories, schools and industry, to name a few of the health care employers.



Health care occupations are so varied that a person with nearly any type of training, ability and interest might be able to find a suitable career in the health care field. The jobs range from serving people directly to those which involve manual and mechanical activity. However, they are all, in some way, related to helping others and contributing to the betterment of health.

This handbook is intended to present a sampling of the many opportunities in the health care field and the variety of ways in which a person might enter the health profession. Because health services and the way we think about health have changed in recent years, the role of health care workers has also changed. When you learn more about this rapidly expanding field and what people do on the job, you may discover an area that intrigues you. From there your career planning will start to take form.

What Are the Prospects?

The demand for health care workers has been steadily increasing and the number of jobs in the health field is expected to grow faster than the average of all other occupations. There are a number of reasons for this. Since Congress enacted Medicaid and Medicare laws, health services have been made available to many people who previously received little medical attention. Developments in science and medicine offer new techniques and instruments for treatment, requiring people with more specialized training. Injuries and diseases that once had no treatment can now be treated. As more people are covered by private health insurance, they have begun to utilize services that they were reluctant to use. That is, people no longer wait to visit doctors when they are seriously ill. They are taking advantage of preventive health care services such as annual checkups, nutritional planning, and physical fitness programs. More medical facilities have been built in the past two decades, making it easier to obtain medical treatment. Also, our increased population of senior citizenry has resulted in the need for workers to provide for their care, because the elderly are more susceptible to disease and require longer time to recover.

These factors and our attention to providing better health care have greatly expanded the number of health care positions and the types of services available.

Moreover, the duties and responsibilities of health care workers, in many cases, have markedly changed. Since the cost of medical care is high, it is inefficient, for example, to have physicians perform routine functions. Skilled technicians now assist physicians in many patient care activities. Registered nurses, especially those with additional training, are involved in more administrative and supervisory roles while practical nurses, aides, and technicians take on many of the direct patient care duties.

With the high cost of medical services, the prevention of illness has taken on new importance. Also, people in general are more interested in physical fitness. The area of preventive medicine is expanding. Personnel needed to inform the public about the maintenance of good health or dealing with their illness include: health educators, social service workers, counselors, therapists and nutritionists. Health and patient education programs have become an integral part of health services.

The Question of Training

In today's world of high technology, workers need specialized training. The degree of specialization will most probably increase in the future. Advances in technology also change the types of skills needed. For example, with computers, secretaries are doing less filing and typing and are assuming more functions in organizing and coordinating. Skills such as evaluating and decision-making become more important. Additional training is needed to use the new electronic equipment, training that continues beyond high school. As in other fields, the health care field has also been greatly affected by technological advances. Technicians must be specially trained to operate and service modern equipment and electronic instruments. Specialized knowledge means more training and perhaps a longer training period.

It is therefore important to know what preparation is required in order to be qualified to receive training in a particular area. As you explore the various careers, take a careful look at the prerequisites so that you can efficiently plan your course work in school. Become aware of where training is available. Training for some specialties is offered at only a few places in the country so you may have to think in terms of travel. New technologies also mean new specialties. Some specialties are just emerging so schools are now starting to offer the programs. Check with teachers and counselors who have the up-to-date program information.

While the prospects look favorable for growth in health occupations, some specialties may have a great surplus of personnel while others have a shortage. In developing your career plans, you should keep in mind the personnel demands in that specialty and the locales where there may be a shortage. Up-to-date information is available through school guidance departments and state employment agencies. This handbook will only highlight the existing job market trends so it is necessary to keep up with new developments in your planning.

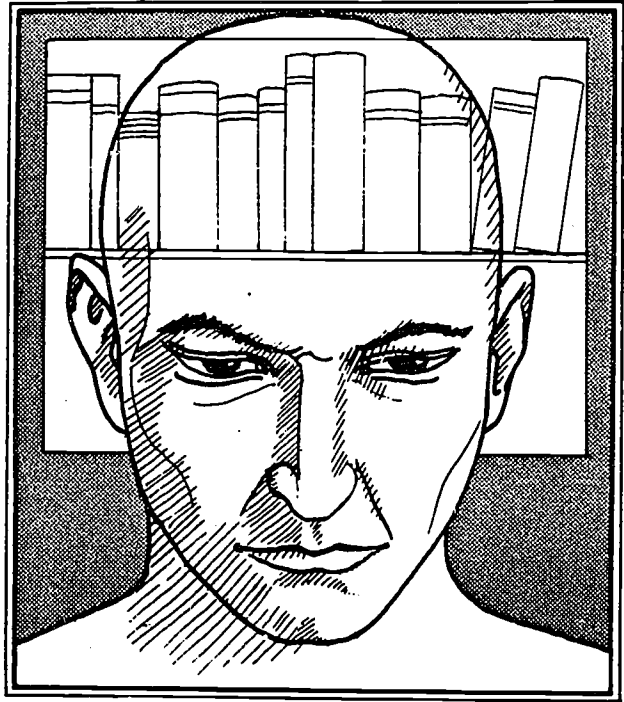
In the past, many people received their training for certain positions by learning on the job. Currently, vocational schools and community colleges offer courses and programs in some of these specialties, such as dental laboratory technology. Although prior formal training may not be a prerequisite for a given occupation, the person who has more training or more highly developed skills has the greater advantage. This is especially true when the job market is tight. Find out as much as you can about school programs and training opportunities when you explore the occupations. Here again your teacher, counselor and people in the profession are excellent resources.

C. Using the Handbook...

Discovering What is Out There

The first section of this handbook is intended to introduce you to places which employ health care personnel. The second section goes into greater detail about each occupation and what people do. It is divided into the different service areas, such as nursing, dental, etc. Similar skills and training are usually characteristic of a given service area. However, for the various occupations within a service area, the amount of training varies according to the level of responsibilities and duties performed.

Be adventurous when you scan through these first sections. Read about some occupations that you may have never even considered! You may be surprised to discover that a particular occupation is very different from what you envisioned. Very often people end up in careers far from their wildest imagination when they were your age, so be an explorer and keep an open mind!



The last sections describe some strategies for planning a health career and contain information about additional resources that you might explore in depth. The following terms are used frequently and are defined as follows:

Explanation of Some Terms

LICENSE - is granted by a state or other government agency after a candidate has demonstrated his/her qualification in that area and passes an examination. A license is the permission given to a person to perform a particular type of service or use a certain title. The licensing process is a method to protect the public from unqualified practitioners. Licenses must be renewed periodically according to state regulations.

ACCREDITED PROGRAMS - are educational or training programs that have met the minimum standards established or recommended by a government board or professional organization. In many cases, jobs are opened only to persons trained in accredited programs.

CERTIFICATION - is awarded by non-government agencies or professional associations and is acknowledgement that the person has attained a level of competency in the profession. A candidate receives certification by passing an examination and/or presenting documentation of education and training. In a profession where there is no licensing process, certification is often the requirement for the job. Even when a certificate is not required, employers tend to favor hiring the certified professional. Certification is a process employed by a professional group to maintain the standards of that profession.

REGISTRATION - is the listing of qualified professionals on an official government or professional organizational roster. Registration and certification are often used interchangeably by professional associations.

ACCREDITATION - is granted to schools or colleges by a government agency or professional association. An accredited school has met the minimum standards established by the accrediting body. The standards cover all aspects of the school's operation to insure that it will provide adequate education and training for its students. In some states, only professionals trained at accredited institutions are allowed to practice. Therefore, education received from non-accredited institutions may limit employment opportunities.

Medical Terms

Do not be discouraged by some of the long names or titles in this handbook. Most words are combined terms. Deciphering them requires simply taking them apart and knowing what each part means. The definition becomes quite obvious once you understand the basic roots. Most roots are from Greek or Latin words.

FOR EXAMPLE: electroencephalographic

 electro/encephalo/graphic

electro - refers to the use of electricity or measurement of electrical changes

encephalo - refers to the brain

graphic - refers to a picture or an illustration

Therefore, electroencephalographic simply means recording a picture of brain activity. Our brain works through electrical changes. So the brain wave that is recorded indicates electrical changes or electrical activity.

SOME COMMON ROOTS

ROOTS	REFERS TO
<u>audio</u> -	hearing, sound
<u>bio</u> -	life or living process
<u>anesthesio</u> -	the loss of sensation or consciousness
<u>cardio</u> -	the heart
<u>cephal</u> or <u>cephalo</u> -	the head
<u>cyto</u> -	cells from body tissue
<u>derma</u> -	skin
<u>encephal</u> or <u>encephalo</u> -	brain
<u>endo</u> -	the inside or inner layer
<u>graph</u> or <u>graphic</u> -	picture, chart or illustration
<u>gyneco</u> -	women
<u>hema</u> or <u>hemo</u> -	blood
<u>histo</u> -	the structure of living tissue
<u>neuro</u> -	the nervous system--brain, nerves
<u>ologist</u> -	specialist
<u>optic</u> -	eye or vision
<u>orth</u> or <u>ortho</u> -	serum, straight, corrective
<u>path</u> or <u>patho</u> -	disease
<u>ped</u> or <u>pede</u> -	foot
<u>sero</u> -	serum

Using the preceding table, try to determine what people with the following job titles do:

ORTHOPIST

AUDIOLOGIST

ORTHOPEDIST

Check your definition with that in the dictionary. Were you surprisingly accurate?

Occupational Titles and Numbers

You will notice a nine-digit number by every occupation in this handbook. These numbers are codes used for each occupation listed in the Dictionary of Occupational Titles (D.O.T.) which is put out by the U.S. Department of Labor. The code identifies each occupation from all others. The coding provides: 1) a system for listing occupations, and 2) a standardized usage so that people can more effectively compare employment information. This coding is also a shorthand method for describing the nature of the occupation and work requirements.

At some point in your career search, you may wish to consult a reference such as the D.O.T. which describes all jobs in the United States. The Occupational Outlook Handbook, another reference by the U.S. Department of Labor, also uses the D.O.T. numbers. This reference offers more detailed information about occupations. We will briefly describe the coding system here so that the numbers will become more meaningful to you.

The first three digits describe the occupation. The second three digits describe the functions of the workers. The last three digits are used to distinguish between occupational titles that share the same first six digits. For example, 070.101 is the six digit code for physicians who diagnose medical problems and prescribe treatment. Their specialty--whether it be anesthesiology, cardiology, or dermatology, etc.-- is then given three other digits to distinguish one specialty from another. A pediatrician, for example, is identified by the code 070.101-066.

All jobs are classified within one of nine broad occupational categories:

- 0/1 Professional, Technical and Managerial
- 2 Clerical and Sales
- 3 Service
- 4 Agricultural, Fishery, Forestry, and related occupations
- 5 Processing
- 6 Machine Trades
- 7 Bench Work
- 8 Structural Work
- 9 Maintenance

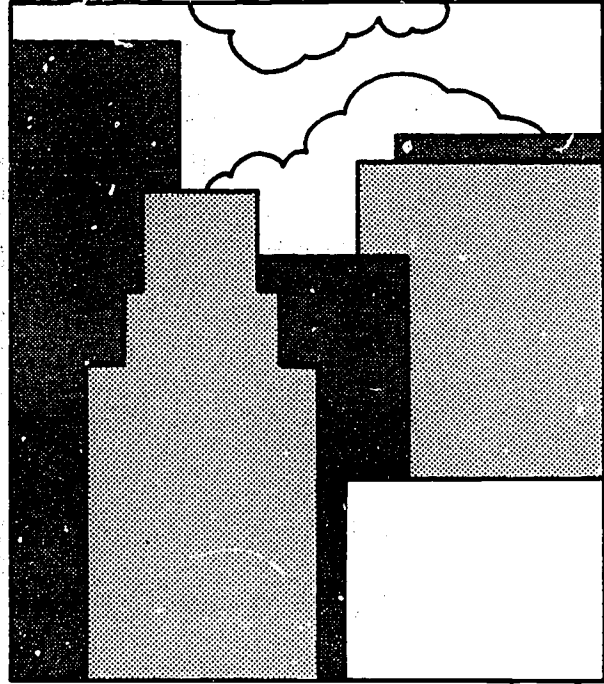
These categories are further subdivided into divisions and then groups which contain closely related jobs.

The middle three digits which are the worker trait codes describe how a worker deals with data, people and things. It is also the way in which the D.C.T. has rated the complexity of the job. More complex tasks have lower numbers while the least complex tasks are numbered six, seven or eight. By comparing the middle digits of various occupation codes you can learn much about what those jobs entail. For a detailed explanation of the worker trait code see the Appendix entitled, Explanation of Data, People and Things.

II. Working in the Health Field

A. Where Do Health Care People Work—

Our typical image of the health care worker is one who works in a hospital or in a physician's office. These are, indeed, places where we are most frequently treated for illness or injury. However, health care workers are employed in many different types of settings, some of which we do not normally associate with the practice of medicine. One of the reasons is that health care today has expanded into a complex system of services and specialties requiring the support of a variety of health practitioners as well as allied health professionals. Also, the greater emphasis on preventive health care has led to the development of new approaches to serve the health needs of the public more effectively and economically. Moreover, advances in medicine and technology have resulted in new forms of treatment that are not necessarily administered at a hospital or a doctor's office. Hence, health care workers may be found in nearly every place where people work.



If you have dismissed the notion of a career in health care because you have not cared for hospitals, think again. You may find an interesting non-hospital setting where you can fulfill your desire to help others and apply your talents! Hospitals employ the largest group of workers, but with changing approaches to health care, non-hospital settings are experiencing rapid growth. For example, a person trained as a nurse may find work in areas other than in bedside patient care. The skills and training of a nurse may be applied in teaching at a medical school, developing a community health program, managing a health club, editing a nursing journal or conducting research. Within each occupation there are a variety of diverse opportunities, many of which do not seem to fit the traditional mold. Yet, these new opportunities in different types of settings need people with a particular type of health care training. Since we will be referring to different workplaces in the section describing the health occupations, we will briefly list and define some of the more typical health care employers.

AMBULANCE SERVICES - provide transportation for the sick or injured to and from hospitals. The majority are operated by fire departments; a number of these are served by volunteers. A smaller number are operated by private companies. Some communities, especially large cities, have advanced life support ambulances employing highly trained paramedics.

BLOOD BANKS - obtain, process, store and distribute blood and blood products. Among the largest are regional blood centers operated by the American National Red Cross. Others are community blood centers that provide blood to hospitals within the community. Some hospitals operate their own blood banks. A smaller number are privately operated as a profit-making business. Blood banks are staffed by managers who administer the program, technologists and technicians who perform lab tests and process blood products, nurses, and drivers for the mobile units.

CLINICAL MEDICAL LABORATORIES - are located in different settings, although most are in physicians' offices and hospitals. Independent clinical laboratories are, for the most part, privately owned and perform diagnostic tests for physicians. Some of the larger labs are operated by government public health agencies. Drug manufacturing companies and other industries also operate clinical laboratories to test and evaluate their products. Directors of clinical labs are physicians or medical scientists who supervise the activities of laboratory technologists, technicians and assistants.

COMMUNITY MENTAL HEALTH CENTERS - provide comprehensive care to the mentally disabled of the community. Funded by the federal government, they operate hospital facilities as well as provide outpatient care and services. They offer the range of therapies and educational programs important in the treatment and rehabilitation of the mentally disabled. Their staff includes psychiatrists, other physicians, nurses, mental health workers, therapists, psychologists and social workers.

COMMUNITY HEALTH CENTERS (NEIGHBORHOOD HEALTH CENTERS) - are sponsored by local communities, hospitals, volunteer agencies, municipal health departments, or several of these groups to serve the non-hospital needs of the poor. They emphasize preventive health care and early diagnosis of disease. Their services include medical and dental diagnosis and treatment, dispensing of pharmaceuticals, X-ray and laboratory facilities, and health education programs. Given the wide array of health services offered, the staff consists of personnel from nearly all the health care occupations.

DENTAL LABORATORIES - for the most part, are operated commercially and produce bridges, crowns, and dentures for dentists. Most dental laboratories are small and serve the general needs of dentists within the local community. Some laboratories specialize in one or more areas. Work that requires very specialized equipment is performed by "processing" laboratories which serve other dental labs. Personnel are dental laboratory technicians.

HOME HEALTH AGENCIES - are operated by local, state or federal government or by private or voluntary organizations such as the Visiting Nurses Association. They provide health services to the sick or disabled who are cared for at home. Services offered include medical treatment, nursing care, therapy, counseling, and medical equipment and supplies. Physicians, nurses, therapists, social workers, home health aides and administrative personnel are employed by these agencies.

HOSPITALS - employ the largest proportion of health care workers. They vary in size from six beds to those having over 1,000 beds. Hospitals are classified as general hospitals or specialty hospitals. Surgical hospitals constitute the largest group of specialty hospitals. Others specialize in psychiatry, chronic diseases, tuberculosis, eye, ear and throat, epilepsy, alcoholism, narcotic addiction, maternity, orthopedics, or physical rehabilitation. Among the general hospitals, most are nonprofit facilities, others are government operated, while a small number are privately owned and managed. Nearly all general hospitals care for patients on a short-term basis. The type of personnel employed will vary with the services offered and the needs of the community. Some of the larger general hospitals which offer diverse services can be compared to a small city with facilities to meet most every imaginable health care need, as well as shops, restaurants, gyms and schools.

LONG-TERM CARE FACILITIES (EXTENDED CARE FACILITIES) - include nursing homes (although some nursing homes are classified as resident care facilities) and long-term care hospitals such as psychiatric, chronic disease, and tuberculosis hospitals. They serve patients who require highly skilled and specialized nursing care on a daily basis. Patients in these facilities may also need a variety of therapy and rehabilitative services. Such facilities employ, in addition to physicians, nurses, technicians, and therapists, aides trained in the various rehabilitation therapies.

OTHER IN-PATIENT HEALTH FACILITIES - include those serving patients who are not necessarily ill or elderly. Patients in these facilities may not need skilled nursing attention daily, but need rehabilitation services. Over half of these facilities are for the mentally retarded which offer special education programs in addition to medical and therapeutic services. Another large group are homes for the mentally disturbed. Also in this in-patient category are homes for dependent children, orphans, and, unwed mothers, schools for the physically handicapped and the deaf and blind, and treatment centers for alcoholic and drug abusers. Many of these facilities focus on special educational programs. Medical and nursing staffing may be minimal, while rehabilitation, personal care, and education personnel are in the majority.

PHARMACEUTICAL FIRMS - although they do not deal directly with patients, are a critical link in the total health care system. Moreover, they employ a number of health care professionals, such as physicians, pharmacists, biological scientists, biomedical engineers, biochemists, medical illustrators and photographers, laboratory technicians, and so on. Areas of work include research and development, production, marketing and sales, and information services.

RESEARCH CENTERS - are the source and testing ground of new ideas and products for the improvement of health and health care. Most are associated with medical schools, universities and government agencies. Much of our medical science research efforts are funded by the federal government. Some research centers are supported by private agencies, nonprofit organizations or industry. Many of the researchers come from the basic sciences, biological, chemical and physical, while others come from the health care specialties such as medicine, pharmacy, nutrition, rehabilitation, environmental health and so on. Technologists, technicians, laboratory aides, administrators, and clerical staff also are part of the research team.

GOVERNMENT AGENCIES - The government is the largest single health care employer operating clinics and hospitals, such as the Veterans Administration hospitals, supporting medical care for the aged and poor (Medicaid and Medicare programs) and funding hundreds of training and service programs. At state and local levels, the government also supports a variety of programs and provides health care services. Many of them focus on controlling communicable disease, insuring food, water, air and soil quality and providing health education.

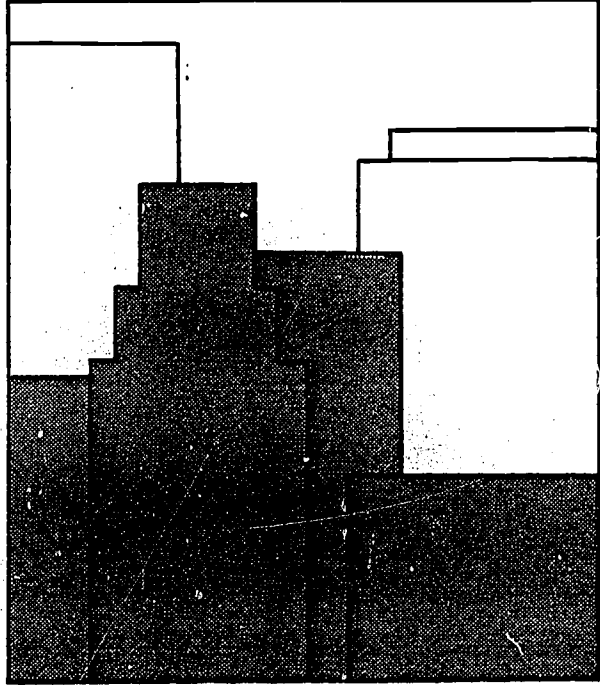
The major federal health organization is the Public Health Service whose agencies are involved in programs that span the entire range of health care services. Some of these include:

- The Alcohol, Drug Abuse and Mental Health Administration (ADAMHA) is concerned with the prevention and treatment of mental illness and the misuse of alcohol and drugs. Among the activities are treatment programs, research, programs to train personnel, and programs to educate the public.
- The Center for Disease Control (CDC) prevents and halts the spread of disease transmitted by humans, animals and insects or through water and air.
- The Food and Drug Administration (FDA) insures that drugs and food sold to the public have been processed safely and do not contain harmful or dangerous ingredients. It also checks medical products to insure that they confer the benefits as claimed.

- The Health Resources Administration (HRA) has the responsibility of encouraging the education of sufficient health personnel to meet the country's needs. It assists schools in the development of new programs or revision of existing programs.
- The Health Services Administration (HSA) helps to make health care available to all Americans by providing care in areas with a shortage of medical personnel, helping states and local communities develop emergency medical services, and training health care personnel to work in underserved areas.
- The National Institute of Health (NIH) funds as well as conducts medical research. Training of medical researchers is one of the uses of funds awarded to universities and medical research centers.

B. Some Health Care Settings

The following are some health care settings described in greater detail. A few of these reflect some changing or different approaches to health care delivery. Several of these have become established in recent years because of changing health care needs, while others have developed in response to the high costs of health care services. Although our basic medical and dental needs will not change, how those services are provided may experience dramatic changes in the future. By the time you enter the work world, there may be a greater variety of settings where you may apply your training, or the current places where some health care personnel work may be organized quite differently. The health care field, like many other fields, is expanding in many different directions. Some settings may play a more dominant role in the future.



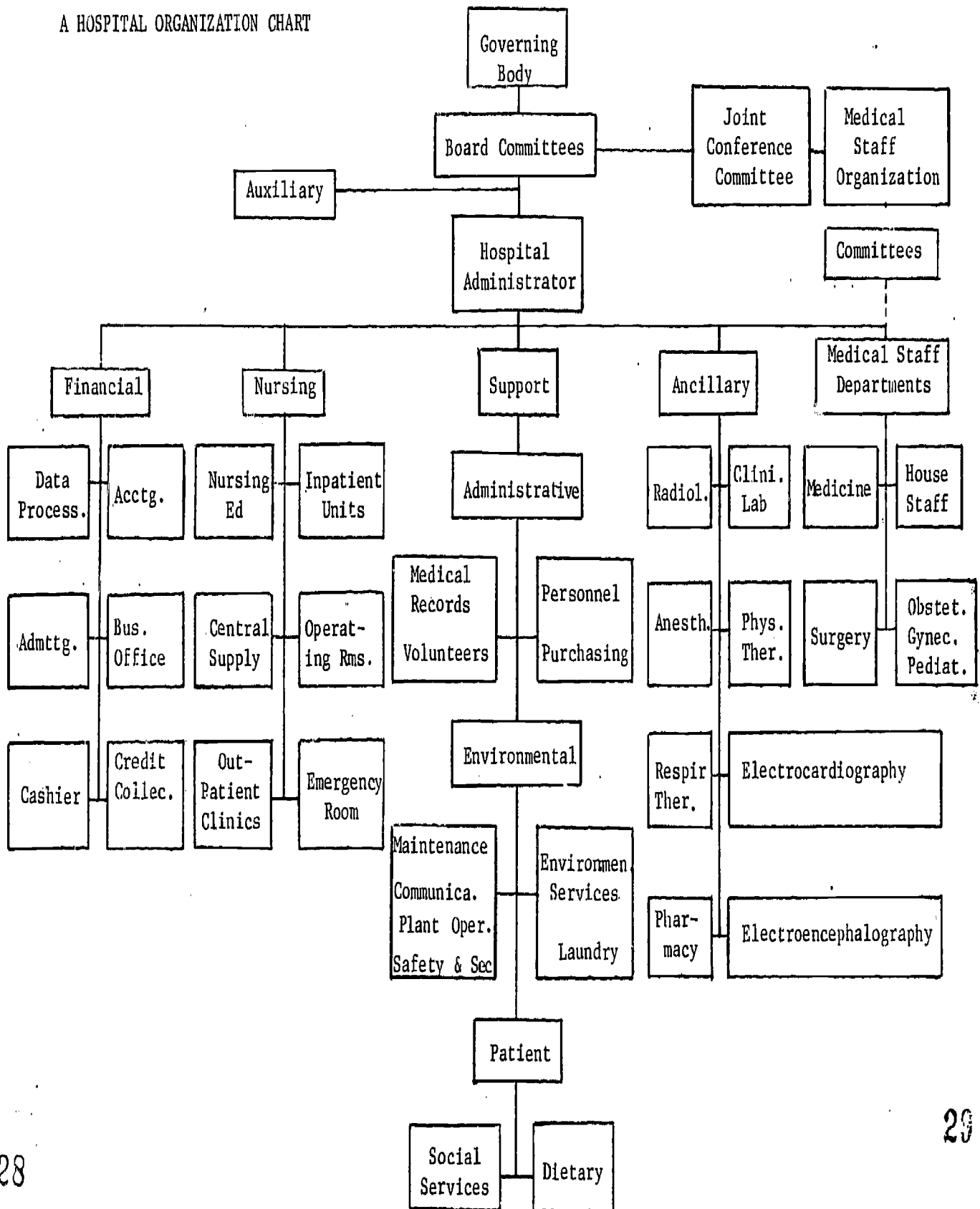
A General Hospital and Some of Its Departments

While we are familiar with hospitals as places where people go for a variety of medical treatments or life threatening emergencies, we are perhaps less familiar with the multitude of activities involved in running a hospital. Patient care depends upon the services of many different types of health care personnel, a large number who have no direct contact with patients. The many "behind-the-scene" hospital staff range from the administration and clerical to equipment maintenance to food preparation.

To provide some insight into the complex of activities necessary to run today's hospitals, some of the lesser known departments and units will be described. As you read through these, you will see that hospitals rely on people who represent a wide range of skills and training.

On the following page is a chart which shows the organization of a typical community hospital. One can easily see that it is, truly, a complex of components that provide services in very different ways.

A HOSPITAL ORGANIZATION CHART



Environmental Services Department

Behind the scenes of every hospital is the environmental services department. This less visible department, formerly known as housekeeping, provides vitally necessary services. Maintaining high standards of cleanliness, and in some areas a sterile, germ-free environment, is essential to the health of patients and employees alike. For this reason it would be misleading to call this department just "housekeeping." The services extend beyond mere cleaning to maintaining highly controlled environments found in few other institutions.

The responsibilities of this large and carefully trained staff range from choosing and testing cleaning chemicals to helping design new facilities and room decorating. The staff is also called upon to move equipment or help in emergency clean-ups such as breakage, flooding, etc.

This department works closely with other departments--laundry, maintenance, infection control and the medical personnel. General and specialized cleaning chores must be carefully scheduled so as not to interrupt medical treatment or patient care.

You may wonder how cleaning in a hospital differs from cleaning anywhere else. Some of it is not too different, such as in offices, lobbies and reception areas. The important differences are in patient areas.

Some areas must be kept completely sterile and germ-free--operating rooms, delivery rooms, nurseries, and isolation rooms (rooms where patients with contagious diseases stay). These very special areas place a unique responsibility on the environmental services department of hospitals. Let's take a closer look at the special needs of these important places.

Newborns are easily susceptible to germs, and exposure to any possible contamination must be avoided. All persons coming into contact with newborns must wear a sterile hospital gown. Nurseries are cleaned thoroughly from top to bottom--ceiling lights to floors, walls to glass, counters to air vents.

The labor and delivery rooms must be attended to after each use. Again, the cleaning is so thorough that even the beds are washed down, including mattress and springs!

Probably the most highly controlled environment is that of the operating room. To prevent contamination of any sort, even the environmental service staff must be completely gowned, from hair to shoes, in order to work here. The staff is on-call to clean after each operation. All parts of this room are cleaned with special germicidal solutions to assure sterility.

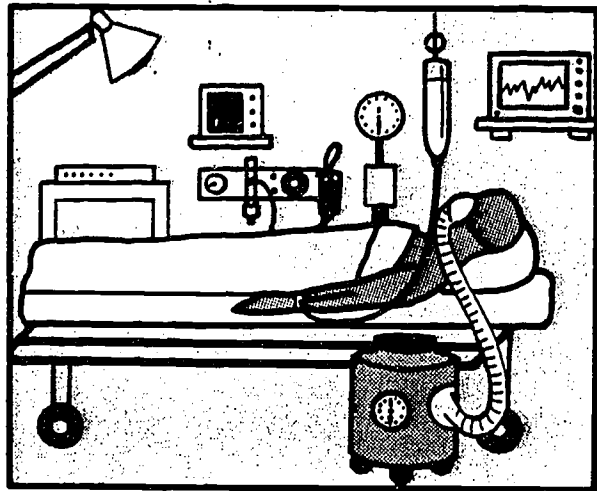
Isolation, as the word implies, means that everything must be kept separate. Equipment used here cannot be used anywhere else. This is to prevent contaminants from leaving or entering the room. For protection against infectious materials, workers must be covered with a cap, mask, gloves and gown. Since all items in the room are considered contaminated,

everything must be disposed of in a special way. For example, even drapes and soiled linen are handled separately from other hospital laundry. Great care is taken to assure the protection of patient and staff alike.

The value of this department cannot be underestimated. The effectiveness of environmental services assures a quality hospital.

Intensive Care Unit

The Intensive Care Unit (ICU) of a hospital utilizes some of today's most advanced and sophisticated biomedical equipment. Also, some of the most sophisticated treatment procedures are performed here. This is the specialized unit which cares for patients in serious conditions following surgery, a heart attack, accident or other life threatening condition. Some larger hospitals and medical centers have separate intensive care units--surgical intensive care, burn intensive care, shock intensive care, neurological intensive care and pediatric intensive care. They are designed to provide the attention and special equipment necessary to respond to the patient's critical situation. Most ICUs are separate, self-sufficient facilities where diagnostic, monitoring, and treatment equipment and supplies are immediately available. Patients may require special life support systems such as respirators to help them breathe. Others may require a continuous intravenous so that medication, if suddenly needed, can be administered quickly and efficiently. Still others may require continual renal dialysis.



Patients who are seriously ill or injured need continuous and specialized care as well as constant assessment of their condition. Much of the monitoring today is accomplished using sophisticated electronic equipment. Heart rate and rhythm of a coronary patient, for example, are monitored by an EKG (electrocardiograph) equipment system. The heart activity pattern is shown on the screen by the patient as well as at the nursing station (where nurses can observe the EKGs of several patients simultaneously). The machine will signal the nursing staff if there is a sudden change in the patient's condition. The information is stored in its computer memory bank which can be retrieved and printed out for review

and study at a later time. More complex machines will monitor several vital functions such as respiration rate, body temperature, brain activity, blood pressure and so on.

Perhaps the most important characteristic of an ICU is the specially trained team of physicians and nurses who can respond to the critical patients' needs. All personnel on this unit have had advanced training. A sudden change in a patient's condition requires decisions and treatment action that may mean the difference between life and death. Therefore, the combination of alertness, knowledge, and problem solving skills provide the basic ingredients of the ICU. Advances in equipment technology and therapy techniques have significantly revolutionized the care that these specialists can provide.

Medical Records Department

The medical records department is the patient information library of the hospital. Here all information of a medical nature is stored. It is essential to keep complete records of all patients and services provided them from admission to discharge. Since a medical record is a permanent document, it is not discarded upon a patient's discharge. When not in current use, a medical record is stored usually in a computer file or on microfiche.

A medical record serves as a major source of information. It describes details of a person's state of health--illnesses, injuries, operations, hospitalization. It includes diagnoses, treatments, complications, tests, and any other medical reports or health information. This medical history is an accumulation of information from many sources. Not only does the patient contribute to the report, but also physicians, nurses, lab technicians, and other health team members. Therefore, medical records are the vital statistics of hospital activity.

Although much work in a medical records department is of a clerical nature, it also consists of gathering and analyzing information, organizing and reviewing reports and records. This work is essential for reasons other than storing information for doctors' use. The information is used for health statistics and hospital needs assessment and so must be accurately classified in different categories. Data are kept on many types of things. From these data, statistical reports are written and analyzed. Hospitals need to keep track of the number of patients admitted, types of diseases treated, operations performed, and other health care information. Reports prepared by this department help the hospital identify needs on a day-to-day basis as well as to study trends and plan for the future. This information may indicate the need for a larger or additional hospital or clinic to service the needs of a community. Assessing internal needs such as staffing or the utilization of equipment depend on reports prepared by medical records. The information can also help the administration to evaluate how well the hospital services its patients.

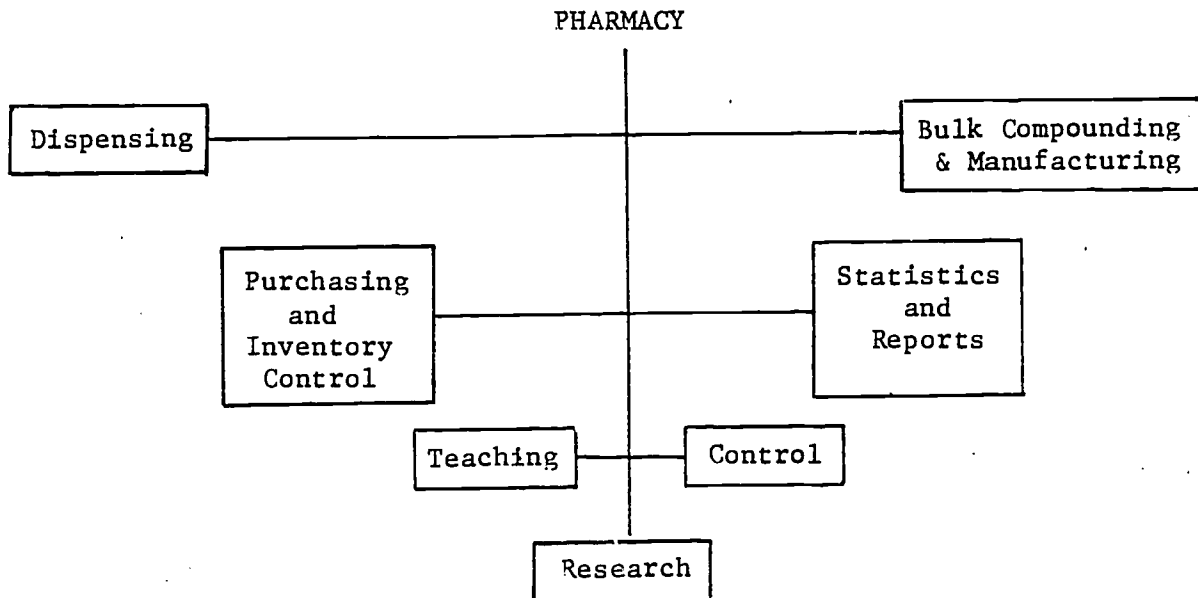
Medical record information is also used by medical personnel and health agencies outside of the hospital. It is employed for insurance purposes--to verify and complete insurance claims. Medical information is often important in court cases, providing evidence to settle disputes. Public health officials seek information to study health trends. Frequent occurrence of a disease may be a sign of an epidemic. Finally, medical record information is used in research.

A relatively new position in the medical records department is the tumor registrar. This person has the responsibility of keeping track of all information pertaining to cancer patients. The accumulated information can provide data for future diagnosis, treatment, research, and planning of hospital facilities.

More and more of these activities are being computerized. Therefore, all this information must be put into computer language. Everything from name, age and sex, to diagnoses and doctors' written directions, is coded and entered into the computer.

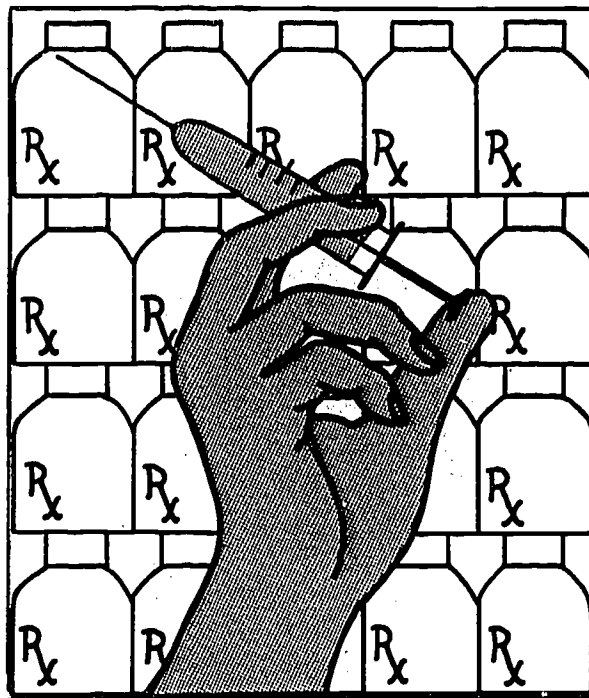
The medical records department may be viewed as an information gathering system which in turn organizes and extracts information for the health care community to make informed decisions.

Hospital Pharmacy



Hospital patients usually require some type of medication in their treatment. As such, the pharmacy department is an integral part of every hospital. As the chart on the preceding page indicates, this department does more than simply fill prescriptions. Let's take a look at some of the different functions of a hospital pharmacy department.

It is important that patients receive the appropriate medication in the correct form and dosage at the proper time. The hospital pharmacy participates in the patient's entire therapy. It follows and monitors the patient's treatment, keeping detailed records on the patient's progress and response to the drugs. Physicians seek its advice and knowledge when planning patient treatment.



Most medications needed for filling prescriptions are available from the manufacturing company. Occasionally, however, if the proper dosage is not available, it must be repackaged according to the need. Injectable medication is put in solution and sterilized in the hospital. Drugs must be properly packaged, labeled, and dated before delivery to the nursing staff.

The pharmacy department has the responsibility for keeping track of drug needs for every area of the hospital. Proper inventory and control procedures must be followed, especially with narcotics. Some drugs are very sensitive to light and temperature and must be properly stored to insure their effectiveness. Extensive records are kept by this department on all pharmacy operations--prescriptions filled, controlled drugs dispensed, drug purchases, inspections, and so on. Reports sent to the administration are used to evaluate pharmacy services and for budgetary purposes.

Providing drug information is increasingly important among the duties of this department. The role of pharmacists as drug information specialists has expanded as the field of pharmacology has become more complex. To prescribe and administer medication properly, the health care team must be knowledgeable about how drugs interact and their possible side effects. Education programs are conducted frequently for the hospital staff. New personnel must be taught the proper procedures for using and handling drugs. In teaching hospitals, pharmacists are involved in training, lecturing, or teaching courses in pharmacology. Some pharmacy departments publish regular drug information bulletins to keep the medical and nursing staffs informed and up-to-date.

Hospital pharmacy departments also provide vital emergency services. They must be ready to provide emergency medication or antidotes to treat drug-overdose or to counteract a poison. Hence, they must be knowledgeable about rare and unusual poisons as well as the more common.

Last but not least, drug-related research is often conducted in a hospital pharmacy department. Research activities are conducted to improve the usefulness of drugs, to determine effective dosages, and to develop new drugs, as well as ways of administering those drugs.

As you can see, this department participates actively in patient care.

Radiology Department

The radiology department uses X-rays and radioactive materials to aid in diagnosis and to treat disease. Highly sophisticated equipment is used in this department and must be operated by specially trained physicians and technicians.

X-rays enable a physician to "see" inside the body. While we commonly associate X-rays with broken bones, X-rays are also used to detect disease in other parts of the body. Sometimes, surgeons depend on X-ray pictures for specific information before operating. X-ray pictures must be carefully taken and developed in order for doctors to make accurate readings. Having to retake an X-ray would expose patients to unnecessary amounts of radiation.

Some patients go to the radiology department for treatment purposes. In this case, the X-rays themselves are used to treat diseases, such as cancer. The radiologist, with the assistance of technologists, determines the radiation dosage and treatment site. X-ray beams must be precisely directed to the diseased tissue; otherwise, healthy tissue may be needlessly injured.

A more recent and increasingly important section of the radiology department is nuclear medicine. Nuclear medicine technology uses radioactive substances to diagnose and treat disease. These substances may be injected into the bloodstream. The technologist then uses scanning and counting equipment to trace these substances. Based on where these substances are then distributed in the body, the radiologist determines the patient's condition. In other instances, tissue or blood samples may be taken from the patient and mixed with radioactive materials. How the cells react with the radioactive substance provides information for diagnosis.

A hospital radiology department might also include an ultrasound specialist. An ultrasound technician operates equipment which takes pictures of internal organs using ultrasonic waves. Ultrasound offers another method to observe internal organs and study organ malfunction. This new technology has enabled doctors to examine disorders of the unborn baby and even treat it while still in the womb.

A Rehabilitation Center

Imagine having to relearn all the common everyday tasks we take for granted--speaking, driving a car, getting dressed, or eating. The person who is disabled or handicapped, either by illness, injury, or birth defect, often has to face such a challenge. A rehabilitation hospital/center is a specialized facility which assists disabled persons to regain or develop the skills needed to live a more independent life. Some patients require constant care or more extensive medical services and are hospitalized. Many more persons require only certain types of therapies and can be cared for at home. These patients use rehabilitation facilities as outpatients and come for therapy daily or on a periodic basis.



A wide variety of services and therapies are offered at a rehabilitation center, ranging from instruction in daily living tasks such as shaving or getting into a car, to speech lessons, to fitting artificial limbs, to job placement services. The personnel who provide the services are trained specialists in their field. Each deals with a different aspect of the rehabilitation process.

Let's look at a person disabled by a stroke. Results of a stroke may leave one unable to speak and parts of the body paralyzed. This person may find him/herself unable to walk, dress or eat without help. Suddenly dependent on others, this person must gradually learn to do simple things all over again.

Perhaps one of the more difficult of tasks is regaining one's speech. The speech and hearing department of a rehabilitation center first determines the degree to which speech has been impaired. In addition to speaking, the patient's other communication skills--reading, writing, and hearing--may be evaluated. The speech therapist then designs a therapy plan and conducts the training.

To regain the use of paralyzed muscles, our stroke victim goes to the physical therapy department. Paralysis occurs when areas of the brain controlling muscle movements are damaged. Through physical therapy the stroke patient learns to use those muscles again, often by retraining other

parts of the brain to perform the function. Not all patients regain full use of their body and must learn to get about using braces or wheelchairs. Depending on the disability, therapy sessions may include exercise activities: using the whirlpool, in a wheelchair using bars and other equipment. Relearning basic mobility skills may also involve exercises in walking or climbing stairs.

Imagine the stress when an active, independent person becomes disabled. The stress can be reduced when one begins to do more for oneself. The occupational therapy department teaches disabled persons practical, everyday skills to restore muscle function and increase mobility. This is where our stroke victim may learn to dress or eat without help. Sometimes a person loses his/her ability to work in his/her former occupation. In this case, part of the occupational therapy program may involve training for a new vocation. The goal is to help the disabled gain new skills and self-confidence in order to achieve greater independence.

In preparing disabled persons for the world of work, the vocational rehabilitation department aids patients in adjusting to their disability and setting realistic goals. Depending on their needs, patients may receive vocational testing, evaluation, job placement services, job-seeking skills, counseling and other support services.

Learning to live at home again requires a variety of adjustments--some physical, some emotional. Keeping house from a wheelchair requires some different techniques. In addition, sections of the house may need to be modified, such as lowering the work counters in the kitchen. The rehabilitation center can recommend structural changes needed in the home to help ensure safety while permitting maximum mobility.

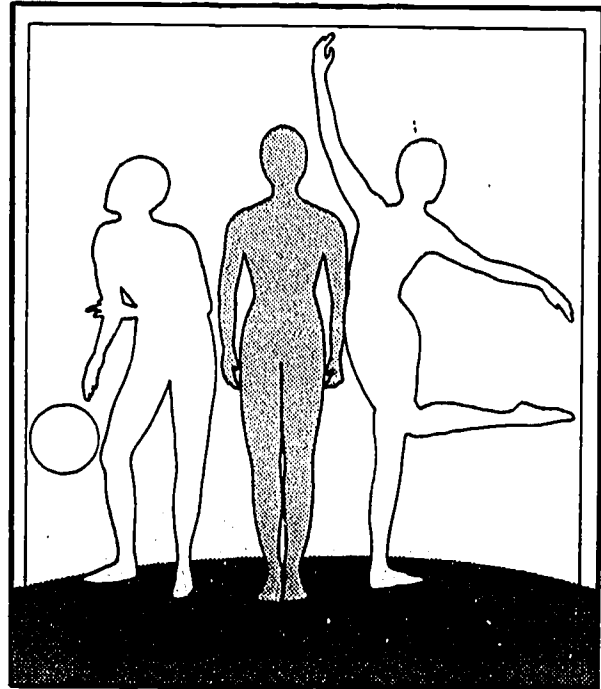
Everyone knows how important it is to have shoes that fit well. It is no different to a person suffering the loss of a limb to have the new arm or leg fit well. Some larger rehabilitation hospitals may have a prosthetics and orthotics department on their premises. Here artificial limbs are designed, made and fitted, along with braces and other support devices.

A rehabilitation center serves many different types of patients. In addition to the stroke victim, a teenage athlete may need to strengthen injured leg muscles. A child born disabled may be taught how to walk. An accident victim may need therapy to relieve pain. A person who has suffered loss of a limb may need to learn how to use the replacement limb. Someone suffering from severe spinal injury may need counseling to adjust to life in a wheelchair.

The services and therapies available at a rehabilitation facility are as varied as the needs of each individual.

A Stay Well Center

Americans are growing more aware that good health is not merely the absence of illness. We now realize that keeping our body fit will lead to a happier, longer life. Health clubs, health clinics, fitness/wellness centers, and so on are sprouting up throughout the country at a rapid pace. Also, companies are finding that healthy employees work more effectively and have fewer sick days. In the long run, both employer and employee benefit. Larger companies are now developing wellness programs that often include gym and exercise facilities at the workplace.



Wellness programs are based on the idea that keeping the body healthy includes balanced foods, exercise, adequate rest and learning to control stress. Because each person is different and has different needs, programs need to be tailored for the individual client. The staff first determines an individual's overall health, personal habits and family history before creating an exercise and health program best suited for that person. Participants then learn from fitness instructors appropriate exercises and the proper use of exercise equipment. In addition, the centers offer lectures and courses that deal with nutrition, weight control, ways of coping with stress, ending the smoking habit, and home safety.

As fitness/wellness centers grow in popularity, preventive health care professionals will find an increasing need for their services at commercial centers, YMCAs, hospitals, universities and in larger corporations. Staffing will vary with the types of programs offered, but a center may typically include the following staff:

MEDICAL DOCTORS

PHYSICAL THERAPISTS

or

PHYSICAL EDUCATION INSTRUCTORS

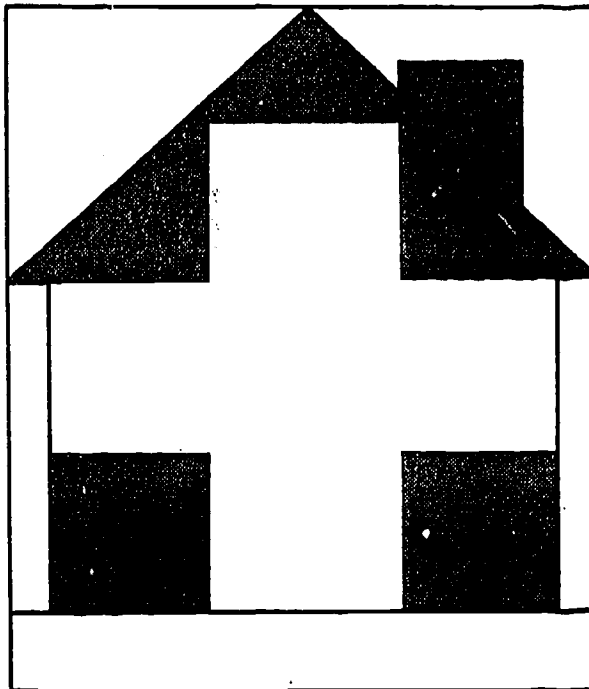
PSYCHOLOGISTS

NUTRITIONISTS

An Extended Care Facility

During the past few decades, the age of the population and the structure of the American family has undergone many changes. People are now living longer. The extended family (parents, children and other relatives all living under one roof) was common not so long ago. Today family units are smaller and may live great distances from their close relatives.

Where once family members took care of each other, particularly their elderly, this is not always possible any more. In families where both husband and wife work, it becomes especially difficult to care for sick or convalescing elders. While many older people are very active and are able to live independently (e.g., maintaining their own home and working beyond the retirement age of 65), many are less able to do so because of illness or disabilities brought about by the aging process.



Aging often brings on its own set of problems. Many elderly struggle financially, suffer failing health, or face the loss of a spouse. These things often happen together, increasing the elderly's dependence on others. With the growing number of elderly persons, there is an increasing need for physicians, health care personnel, and social service workers who can meet the special needs of this group. There is also an increased demand for medical and nursing care outside of hospitals. Nursing homes serve an important function in the care of the aged and have rapidly grown in number.

Nursing homes vary in their facilities and the services they provide. Many operate much as a hospital, with physicians and other medical personnel on staff. In such facilities, nursing care is the primary function. Medical services on a 24-hour basis are available to those who are chronically ill or who require constant attention.

Other nursing homes are geared more to personal care of the elderly who are not critically ill or severely incapacitated. Personal care services may range from help in bathing, dressing, eating and walking, to help in correspondence and shopping. Medical needs may be minimal, occasional medications or treatment of minor ailments according to doctor's orders.

Whatever the scope of activities of a particular nursing home, it must be kept in mind that basic human needs do not change just because one ages. People continue to seek companionship and the warmth and love of others. The desire for independence--the need to do things for oneself--does not lessen with age. What does change is one's ability to fulfill those needs.

Companionship becomes more difficult as many elderly are left widowed or unable to get around. The ability to be independent may change with the onset of disease. A fall may disable a person, making walking difficult or impossible. A stroke may take away the use of certain muscles, perhaps affecting one's ability to move as well as to speak. Hearing loss is also very common in the aging process.

Nursing homes attend to the psychological needs behind the physical limitations of the elderly. They strive to provide services and programs designed to encourage independence and enjoyment of life.

The therapeutic services available in a nursing home vary with the institution and patient needs. More commonly offered are physical and occupational therapy, and speech and hearing therapy. Physical therapy helps the elderly patient regain the use of muscles weakened by illness or injury. Occupational therapy helps persons regain independence in dressing, eating, or doing other things for themselves. Speech and hearing therapy is of prime importance in enabling patients to communicate, given their disabilities.

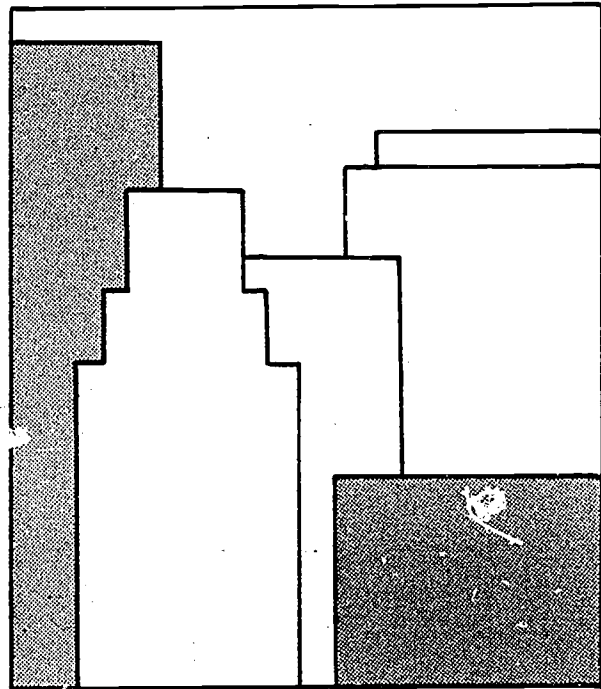
Nursing homes frequently employ the services of a music or art therapist. Music and art activities have been found to be important forms of therapy for social or emotional problems in addition to providing interesting recreation. Recreational programs are planned with the special needs of the residents in mind. Programs include movies, music or art events, exercise classes, and arts and crafts classes. Social events in nursing homes bring the residents together, providing both therapeutic benefits and opportunities to socialize.

Many elderly have a reputation for being quarrelsome or ill-natured. Very often, poor diet or reaction to medication is the reason. Nursing homes need also to address the special dietary needs of the elderly. Dietitians play an important role in these matters.

With an expanding elderly population, facilities to meet the needs of this group are increasing. Facilities such as nursing homes require the services of a diverse staff of trained personnel. As indicated, geriatrics is a rapidly growing specialty, since serving the elderly depends on knowledge about the unique problems of aging. Personnel required to serve the geriatric population in nursing homes range from doctors, nurses, the primary care team, to therapists, dietitians, and geriatric aides as well as the support staff that includes cooks, housekeepers and administrative and clerical personnel.

A Dental Center

Dentists have typically practiced as solo practitioners or as a small group with two or three other dentists. More recently larger dental centers and dental groups have appeared on the dental care scene. Dental centers offer full dental services that can meet the needs of the entire family. Dentists trained in general dentistry or in the different specialties--orthodontics, pedodontics, prosthodontics, etc.--provide services under one roof. By practicing as a larger group, such as 20 or more, the dentists share many of the resources, equipment and office personnel and can offer dental care at lower costs. Dental laboratory facilities are also on the premises so certain types of work can be completed during the same visit.



For many dentists, this type of group practice has several advantages. Dentists do not have to assume the entire burden of purchasing the equipment, an important consideration since sophisticated dental instruments are so very expensive. Hours can be more regular when dentists can take turns in covering emergency cases. The responsibility of responding to emergencies is not left to one dentist. When dentists practice alone they are more involved in managing the office. Whereas, in a large group, a professional manager is employed to supervise the office activities. Dentists can therefore devote more time to the actual practice of dentistry and less to office details. They also have more specialized assistants and technicians to perform different functions and are freed from some of the more routine activities.

For the patient, this type of center can save time and travel. One need not go first to a general dentist who makes a diagnosis and then travel to a specialist who then performs the work, such as oral surgery. With one stop at the dental center, all dental needs can be covered. Families find this particularly efficient, since all members can be treated at once. Moreover, because several dentists are on staff, the center can offer office hours in the evenings or even weekends.

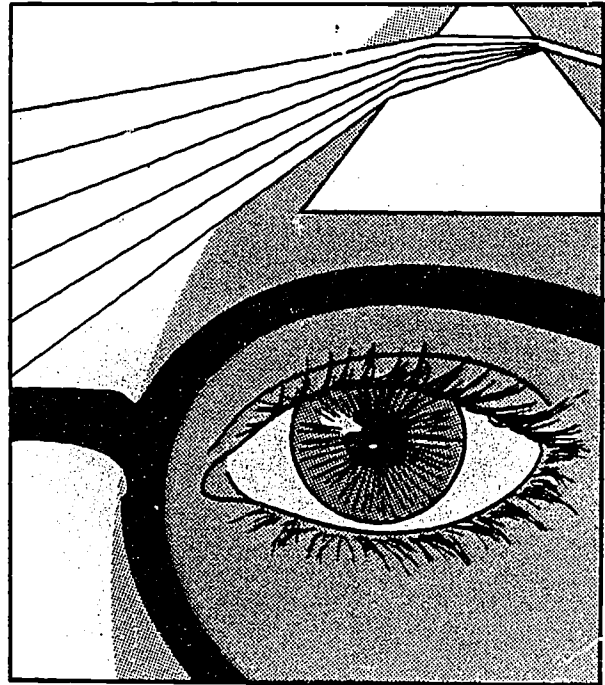
When patients first come to the center they are seen by the diagnosing dentists who perform the initial examination and determine the treatment needs. Patients are then assigned a dentist who specializes in a particular

area; a teenager needing braces will see the orthodontist; a person who has lost a tooth will see the prosthodontist.

Where a typical solo practice dentist may employ only a dental assistant and a dental hygienist, dental centers will employ a larger number of different allied dental workers and administrative personnel. Among the administrative personnel are office managers, appointment secretaries, insurance processors, receptionists, financial coordinators, bookkeepers and computer specialists. The duties of dental assistants are more specialized. Some may work only with new patients, explaining the procedures, establishing the records, and taking the X-rays. Other dental assistants may only assist dentists as they work. Dental hygienists, sterilization technicians, and dental laboratory technicians are other personnel employed at these centers.

A Vision Center

In more highly populated areas we are seeing a trend towards large centers that offer specialized health care services under one roof. This is also the case with eye care. Typically, when we need corrective lenses we visit the optometrist who tests our vision, writes and orders the prescriptions, and fits us with eyeglasses or contact lenses. Or, we visit the ophthalmologist who conducts the examination and writes the prescription which we then take to the optician. Optometry and opticianry establishments are, for the most part, operated by one or two persons who order the lenses from an optical laboratory. More recently, large scale, department store type eyewear establishments have appeared on the scene.



A vision center or eyewear department store houses the full complement of eyecare services (except that of an ophthalmologist). Like a department store, with one stop and a short wait, our eyes are tested and lenses are immediately made. These vision centers differ from the more common optical dispensing establishments in that they have their own optical laboratory with complete lens making facilities. Lenses are made right in the same building. This reduces the time between ordering the prescription and when we receive the finished products. Because of their size, vision centers are able to offer a much wider selection of frames, a special attraction to fashion conscious eyeglass wearers. Establishments of this type are responding to segments of the American public who desire more choices, faster service, and greater economy.

Providing the services at these vision centers are a staff of optometrists, opticians, optical laboratory technicians, and sales clerks. Like personnel in larger organizations, their activities are more compartmentalized. Here optometrists will do only the eye examinations, while the dispensing opticians will make the measurements for the eyeglasses and do the fitting. Some opticians may even specialize in helping children select frames and assist them in adjusting to wearing eyeglasses. Others may specialize in fitting contact lenses.

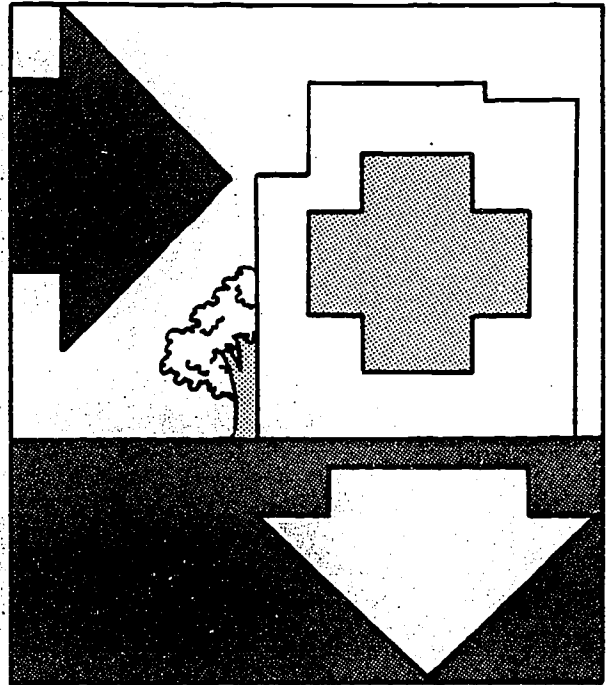
A Health Maintenance Organization

Health Maintenance Organizations (HMOs) are based on the concept of health care paid in advance (up until the 1970's, the term "prepaid group practice" was used). While the federal government has long applied this concept in providing health services to seamen and members of the armed services, HMOs have gained wider acceptance and grown rapidly only the past decade.

One of the earliest and largest HMO is the Kaiser-Permanente system, established in the 1930's for employees of the Kaiser Company. It enabled workers to obtain health care at affordable costs during difficult economic times. Later, during the war years, when health care professionals were scarce, it proved to be an efficient system for health care delivery. Its membership has now exceeded 3.5 million, and it has health facilities in six states. This HMO is one of the several types of HMO organizations that have since emerged.

HMOs differ from health insurance plans in that they directly provide health services--from medical treatment to hospitalization care. That is, HMOs can offer their members complete health care facilities and all the special services associated with recovery from illness or injury. Insurance plans, on the other hand, only pay for the services received but do not provide these services. For a fixed fee (usually paid on a monthly basis), subscribers are eligible to use the HMO facilities for routine checkups, treatment of illness, or hospitalization if needed. Since they deliver complete health services, HMOs facilities will include physicians' offices, ambulance units, outpatient clinics, hospitals, pharmacies, clinical laboratories, emergency departments and rehabilitation centers. Some HMOs also offer eyewear facilities and dental services.

Health care personnel who work in an HMO hospital or clinic will find their work no different from any other similar health care facility. What differs is in how the system is managed and funded. Different HMOs are also organized along different models. In some HMOs, the physicians are paid employees of the organization. In other HMOs, the organization arranges with a group of physicians and health professionals to provide the medical services. A third type contracts for services from different sources. In this type, physicians practice in their own private office serving their own



patients as well as HMO subscribers. HMOs are sponsored by various groups--physicians, hospitals, clinics, insurance companies, labor unions, consumer groups, medical schools, medical societies, government groups, and so on.

HMOs have offered the public another system to meet its health care needs and are expected to grow in popularity and numbers. Because they agree to provide their subscribers with comprehensive health care and since major hospitalization is expensive, greater emphasis is placed on preventive medicine and health education. Consequently, they pay prompt attention to patients' symptoms and try to diagnose and treat illnesses early to prevent more serious complications. HMOs are influencing and bringing about new methods for servicing the public. They will play a major role in improving the quality of health care while keeping the costs lower. As the HMO trend grows, it is expected that we will see more health care personnel working in centers where many services and specialties are housed together. Personnel will work more closely as part of a total health care team. Stressing the preventive aspect of health care, HMOs will no doubt employ more people trained in the allied health professions such as health education, counseling, nutrition and so on.

III. Occupations and Occupation Descriptions:

.type of work .work opportunities
.special skills/interest .education

1. Clinical Laboratory Services

Cytotechnologist

Histologic Technician

Medical Laboratory Assistant

Medical Laboratory Technician

Medical Technologist
(Clinical Laboratory Scientist)

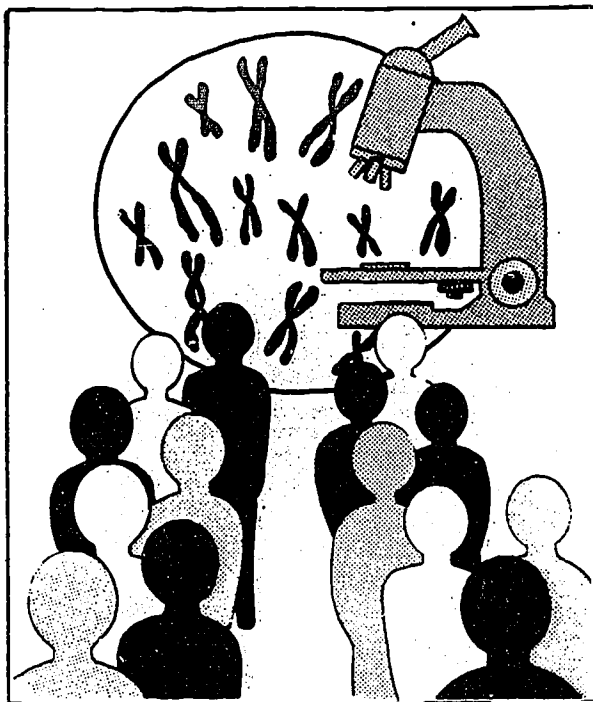
Nuclear Medical Technologist

1. Clinical Laboratory Services

Cytotechnologist

078.281-010

Cells from each type of organ tissue have a characteristic size, shape, color and structure. When cells deviate from the normal pattern, the disease of cancer is often suspected. Cytotechnologists examine tissue, looking for possible cancer producing cells. They prepare and stain slides of body cells with dyes and examine the preparation under a microscope. Cytotechnologists do the initial screening of the cells. Those cells showing abnormalities are then examined by the pathologist who interprets the findings. Frequently, to confirm the diagnosis, the cells must be tested using other procedures which are also performed by the cytotechnologist. Examination of cells in these ways has made it possible to detect disease before symptoms are evident. When treatment is started early, the disease can be more easily arrested.



Personal Qualifications and Training

The exacting work of a cytotechnologist requires concentration, patience, and care to details. One should have good spatial perception and color vision. High school preparation should include courses in biology and chemistry. Persons may enter a cytotechnology program after two years of college. Courses in college should have a strong biological science emphasis. The cytotechnology training program is one year in length and is given at hospital or medical schools. Formal classroom courses are conducted during the first six months while practical laboratory training is given during the remaining months. Cytotechnologists who pass the certification exam are certified by the American Society of Clinical Pathologists.

Outlook

The public's awareness of the value of screening tests to detect early signs of cancer will continue to expand job opportunities in the field. While the Pap test for cervical cancer is one of the main screening tests performed by cytotechnologists, new screening tests for other types of cancers using other tissue cells will increase the demand for trained personnel.

Areas of Employment

- . hospitals
- . commercial medical laboratories
- . cancer research institutes
- . pharmaceutical companies

Schools in New Jersey

Muhlenberg Hospital
Plainfield, New Jersey 07061

UMDNJ - School of Allied Health
Professions
Newark, New Jersey 07103

For Additional Information

American Society for Clinical
Pathologists
P.O. Box 4872
Chicago, Illinois 60614

American Society of Cytology
130 South 9th Street
Philadelphia, Pennsylvania 19107

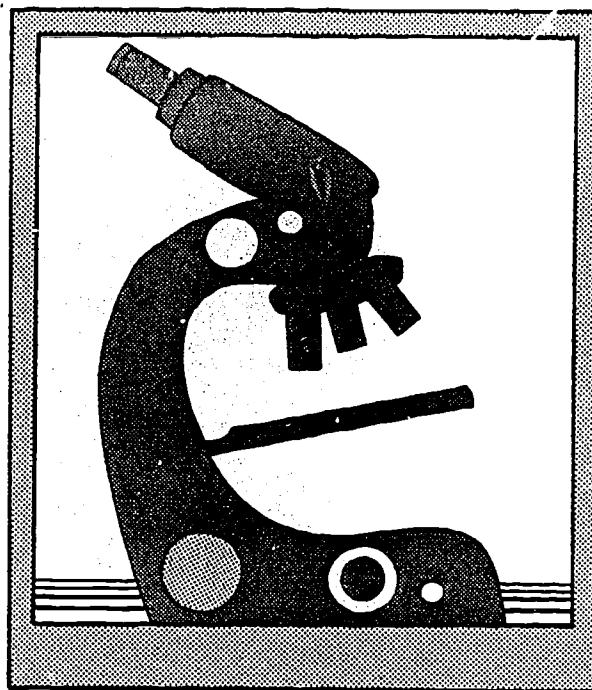
1. Clinical Laboratory Services

Histologic Technician

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In order to examine body cells microscopically, tissue from the organ must be cut very thinly and stained so that different parts of the cell are highlighted. Histologic technicians prepare the tissue samples for the pathologist to study. The appearances of the cell and its structure offers information for the diagnosis of disease.

Very frequently the cutting, mounting, and staining of a specimen is performed while a patient is still on the operating table. In such situations, the histologic technician must work quickly and accurately so that the pathologist can provide an immediate report to the waiting surgeons.



Personal Qualifications and Training

Since histologic technicians work with delicate, minute amounts of materials, they must possess good manual dexterity, keen spatial and color vision and patience. Attention to detail, neatness and accuracy are also important traits. High school courses should include biology, chemistry and algebra. Most training programs are one year in length and are offered by hospital schools. In the near future, some of the formal course work may be given at community colleges. Graduates from accredited programs may take the certification examination given by the American Association of Clinical Pathologists.

Outlook

There is a good demand for skilled technicians in this area. Although this is not a large profession, the numbers will increase as more people use medical services and need lab tests that rely on tissue specimens.

Areas of Employment

- . hospitals
- . commercial medical laboratories
- . clinics
- . research laboratories

Schools in New Jersey

Mountainside Hospital
Montclair, New Jersey 07042

Muhlenberg Hospital
Plainfield, New Jersey 07601

Newcomb Hospital
Vineland, New Jersey 08360

For Additional Information

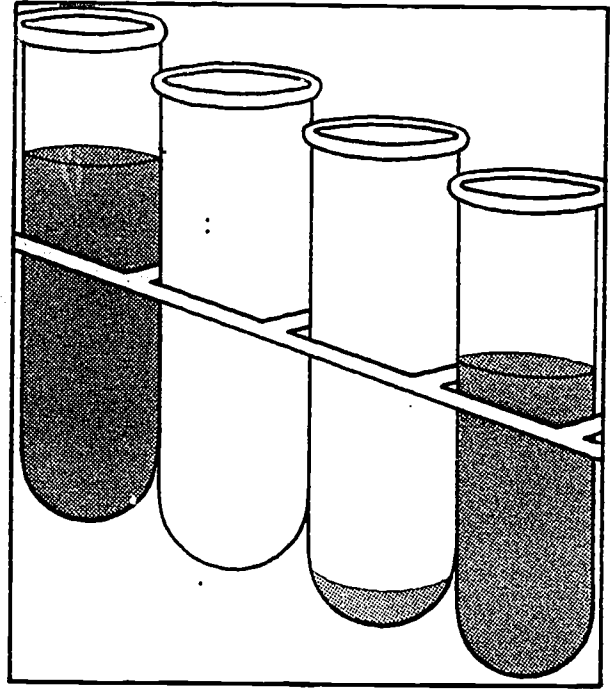
American Society of Clinical
Pathologists
P.O. Box 4872
Chicago, Illinois 60612

1. Clinical Laboratory Services

Medical Laboratory Assistant

078.381-010

Medical laboratory assistants are trained to perform a variety of routine laboratory procedures. They conduct tests such as urinalysis, blood typing, blood serum chemistry, tissue staining, etc. Other work includes setting up equipment, preparing solutions, sterilizing materials, keeping records and organizing the work area. They are supervised by a medical technologist or physician. Although the work requires specialized skills, an in-depth understanding of the scientific principles is not necessary.



Personal Qualifications and Training

Similar to other clinical laboratory personnel, one must be able to perform delicate precision work that requires good eye and hand coordination. Neatness, careful attention to detail, and accuracy are also important qualities. Science and math courses in high school are recommended preparation. A high school diploma (and sometimes biology, chemistry and algebra) is prerequisite for entry into a formal training program. Most are approximately a year in length and are usually offered by hospital schools. It is preferable to obtain one's training from a certified laboratory assistant's school. Training is also available through the Armed Forces. Graduates from accredited programs who pass the certifying exam are certified by the American Society of Clinical Pathologists.

Outlook

The demand for laboratory workers remains high. Since many tests are based on straightforward procedures, they can be performed by trained assistants and technicians. Although clinical laboratories require a medical technologist to supervise the work and check the consistency of test results, it is expected that laboratories will hire a larger proportion of assistants and technicians to conduct the routine testing.

With additional experience and formal college coursework, a medical laboratory assistant may advance to the next level position--medical laboratory technician.

Schools in New Jersey

Camden County Area Vocational
Technical School
Sicklerville, New Jersey 08081

Community Memorial Hospital
Toms River, New Jersey 08753

Newcomb Hospital
Vineland, New Jersey 08360

Riverside Hospital
Boonton, New Jersey 07065

Warren Hospital
Phillipsburg, New Jersey 08865

For Areas of Employment and Additional Information,
see MEDICAL LABORATORY TECHNICIAN

1. Clinical Laboratory Services

Medical Laboratory Technician

078.381-014

Medical Laboratory Technicians (MLTs) work under the supervision of medical technologists, performing the variety of laboratory tests necessary in the diagnosis of diseases. The duties vary with the size of the laboratory. In

smaller labs MLTs may run a wide range of tests--chemical, bacteriologic, blood typing, microscopic and so on. In larger labs MLTs may specialize in a particular section. They use precision instruments in performing many of the tests, including microscopes, centrifuges, incubators, electronic counters, spectrophotometers, etc. In hospitals, MLTs may also have contact with patients when they obtain the necessary specimens for testing, such as blood, urine, and cultures.

Personal Qualifications and Training

Work in this area requires a high level of precision and accuracy. One should be alert to details, have good eyesight, and work well with one's hands. A good high school background in biology, chemistry and mathematics is highly desirable. Formal training is offered by community colleges and technical schools which confer an associate degree or certificate. Graduates from accredited programs may take a certification exam given by the American Society of Clinical Pathologists. Training is also available through the Armed Forces.

Outlook

There is a growing trend to employ MLTs to perform the bulk of the testing, allowing medical technologists to attend to supervisory, research, and managerial duties. Also, the increased use of automated equipment and advanced instrumentation have reduced the requirement of higher level technological knowledge to perform many of the tests and analyses. The job opportunities in this field continue to be favorable as lab tests play a dominant role in diagnosis and treatment.

Areas of Employment

- . hospitals
- . commercial medical laboratories
- . public health agencies
- . clinics
- . pharmaceutical firms
- . research laboratories

Bergen Community College
Paramus, New Jersey 07652

Brookdale Community College
Lincroft, New Jersey 07738

Burlington County College
Pemberton, New Jersey 08068

Camden County College
Blackwood, New Jersey 08012

Schools in New Jersey

Atlantic Community College
Mays Landing, New Jersey 08330

County College of Morris
Dover, New Jersey 07801

Felician College
Lodi, New Jersey 07644

Greater Paterson General Hospital
Wayne, New Jersey 07470

Institute for the Advancement of
Medical Science
Cherry Hill Medical Center
Cherry Hill, New Jersey 08034

Lyons Institute
Cherry Hill, New Jersey 08034

Mercer County Community College
Trenton, New Jersey 08690

Middlesex County College
Edison, New Jersey 08817

St. Barnabas Medical Center
Livingston, New Jersey 07039

St. Francis Medical Center
Trenton, New Jersey 07302

Union County Technical Institute
Scotch Plains, New Jersey 07076

For Additional Information

American Society of Clinical
Pathologists
P.O. Box 4872
Chicago, Illinois 60612

1. Clinical Laboratory Services

Medical Technologist
(Clinical Laboratory Scientist)
078.361-014

Diagnosis of disease and following the effects of the treatment depend to a large extent on laboratory tests. Sometimes different diseases may have similar symptoms but require totally different treatments. Or outward symptoms of a disease are so vague that the physician cannot determine its cause. Laboratory tests help to confirm diagnosis or provide clues to guide further investigation. Frequently a large battery of tests is necessary because various information must be pieced together in order to pinpoint the nature of the disease. Making a diagnosis is similar to putting together a puzzle, and lab tests are some of the pieces that help create the total picture. Results from lab tests help physicians select the proper treatment, answering such questions as: "Will the organism causing the infection be affected by the drug?" "What is the necessary dosage?"

Many different types of tests are performed in the clinical laboratory. Tissue may be examined microscopically to detect abnormal growth of cells such as in cancers.

Personal Qualifications and Training

As applied scientists, MTs should have an aptitude for the sciences and mathematics as well as possess an inquisitive mind. Good perception and manual dexterity are required because delicate, precision instruments are used and tests must be performed with great accuracy. (Errors can result in misdiagnosis and endanger the patient.) High school preparation should include biology, chemistry, and mathematics. MTs are usually trained in four-year MT programs that include three years of prerequisite college courses and one year of clinical training, leading to a BS degree. Or, a

Chemical tests may be performed on blood or spinal fluid to check for unnatural amounts of a substance. Samples of materials from patients may be cultured to isolate and identify the bacteria causing the disease. Some tests require the use of complex and sophisticated detection equipment, while others require the keen observational skills of the trained personnel.

A medical technologist (MT), working under the supervision of a clinical pathologist, is trained to perform the wide range of activities of a clinical laboratory. Large hospital laboratories may have several distinct departments: immunology, biochemistry, hematology, histology, microbiology. Medical technologists may specialize in one of these areas, supervising other technical personnel and performing duties that require their experienced judgment. MTs with work experience in specialized areas may gain an additional certification as: Technologist in Chemistry; Technologist in Hematology; Technologist in Immunology; Technologist in Microbiology, or Technologist in Nuclear Medicine.

Specialists perform more complex procedures, conduct research, supervise other laboratory personnel and teach. They often hold masters' or doctorate degrees in their specialty.

person may enter a clinical training program after completing a bachelor's degree in one of the related science areas. Certification examinations are given by the American Society of Clinical Pathologists and the International Society for Clinical Laboratory Technology.

Outlook

As more people utilize health care services, the number of laboratory tests performed also increases. Hence, job opportunities for medical technologists are good. Nonetheless, there may be a number of factors that could create a greater competition in the job market: 1) the large number of programs graduating medical technologists; 2) the use of automated and electronic equipment to perform tests; 3) the high cost of medical services may induce doctors to be more selective in the tests they order; and 4) the increased employment of technicians to perform the more routine tests.

Areas of Employment

- . hospitals
- . commercial medical laboratories
- . public health agencies
- . clinics
- . pharmaceutical firms
- . research laboratories
- . medical schools

Rutgers - The State University
of New Jersey

College of Arts and Sciences
Newark, New Jersey 07102 and
Camden, New Jersey 08102

Douglass College,
New Brunswick, New Jersey 08903

Livingston College
New Brunswick, New Jersey 08903

Schools in New Jersey

Caldwell College
Caldwell, New Jersey 07006

Centenary College for Women
Hackettstown, New Jersey 07840

Fairleigh Dickinson University
Rutherford, New Jersey 07070 and
Teaneck, New Jersey 07666

Kean College
Union, New Jersey 07083

Monmouth College
West Long Branch,
New Jersey 07764

For Additional Information

American Society for Medical
Technologists
330 Meadow Fern Drive
Houston, Texas 77067

American Society for Clinical
Pathologists
P.O. Box 4872
Chicago, Illinois 60612

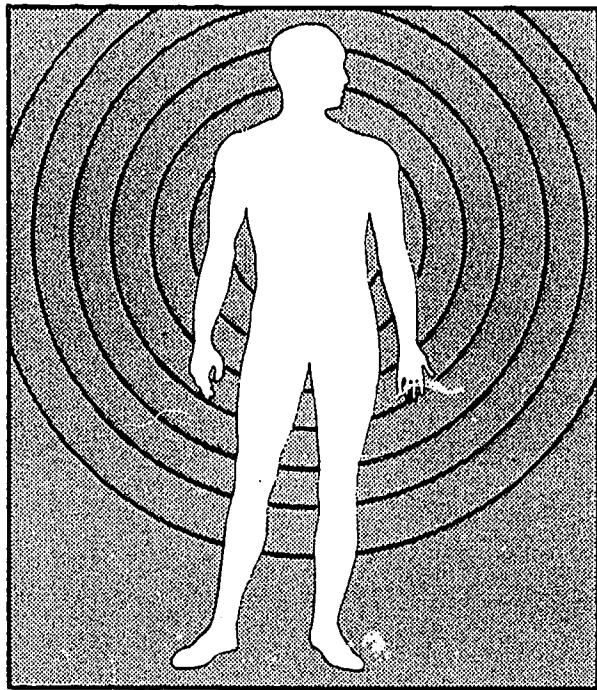
International Society for Clinical
Laboratory Technology
818 Olive Street
St. Louis, Missouri 63101

1. Clinical Laboratory Services

Nuclear Medical Technologist

078.361-018

Nuclear medicine is among one of the newest, fastest growing areas in the medical technology field. This is a specialized science which uses nuclear materials in diagnosing and treating disease. For the purpose of diagnosis, radioactive materials are injected into patients or mixed with cells in a test tube. How these materials react with body organs, tissues, or cells provides information about the patient's condition. Information is obtained using advanced radioactive detecting equipment such as Geiger counters, scintillation and positron scanners, electrosopes and cameras, as well as computers.



Nuclear medical technologists perform a variety of tests using radioactive materials under the supervision of a physician. They prepare the materials, administer them to patients, operate the equipment, analyze the data and write the reports. Since the materials are potentially hazardous, nuclear medical technologists must be extremely diligent in calculating correct dosages and properly administering them to patients. The regulations for handling and disposing of the materials must be followed carefully to protect personnel and patients from unnecessary exposure to radioactivity. Work in this area involves both laboratory activities and directly servicing patients.

As nuclear medicine technology is a rapidly developing diagnostic tool, technologists must constantly keep up-to-date on new tests and procedures. To understand and apply the technology one must be knowledgeable in biology, chemistry, and physics, as well as statistics and nuclear and electronic instrumentation.

Personal Qualifications and Training

An interest and ability in science and mathematics are important, as are skills in problem solving and manual dexterity. Training is a one or two year program. To be eligible for training one must have at least two years of college, but preferably a BS degree in the sciences, or be qualified as a registered nurse, medical technologist or radiologic technologist. Training programs are offered by hospitals, community colleges, colleges, universities and medical schools.

Outlook

As this is a relatively new and rapidly expanding field, there is currently a lack of trained technologists to fill the available positions. With more training programs being established, the demand may gradually ease. Currently, many nuclear medical technologists are not trained under formal programs. However, as licensing requirements are established, these technologists may need to return to school for further education.

Areas of Employment

- . hospitals
- . research institutes
- . physician's offices

Schools in New Jersey

John F. Kennedy Medical Center
Edison, New Jersey 08818

Rutgers - The State University
Livingston College
New Brunswick, New Jersey 08903

For Additional Information

Society of Nuclear Medicine
475 Park Avenue, South
New York, New York 10016

Society of Nuclear Medicine
Technologists
1201 Waukegan Road
Glenview, Illinois 60025

2. Dental Services

Dentist

Oral Pathologist

Endodontist

Oral Surgeon

Orthodontist

Pedodontist

Periodontist

Prosthodontist

Public Health Dentist

Dental Assistant

Dental Hygienist

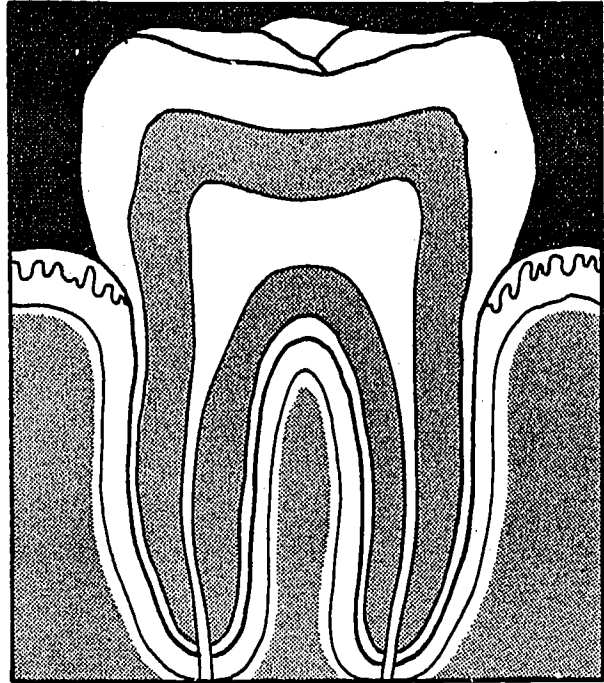
Dental Laboratory Technician

2. Dental Services

072.101-010 Dentist
 072.061-010 Oral Pathologist
 072.101-014 Endodontist
 072.101-018 Oral Surgeon
 072.101-022 Orthodontist
 072.101-026 Pedodontist
 072.101-030 Periodontist
 072.101-034 Prosthodontist
 072.101-038 Public Health Dentist

When we speak of dentistry, what probably first comes to mind is the general practice dentist whom we see for our regular checkups, cleanings, and fillings. While the treatment of oral diseases and disorders, providing artificial replacements, and preventive care continues to be primary activities of dentists, we are seeing new trends in the delivery of dental services. In order to provide dental care to more people, dentists are joining group practices and health maintenance organizations or practice community dentistry. Also, they are relying to a greater extent on allied dental personnel (dental assistants, dental hygienists and dental technicians) to perform a number of tasks.

Research efforts have brought about new scientific advances which enable dentists to offer more effective (and perhaps less stressful) treatment. New knowledge has brought about greater understanding of and techniques for dental disease prevention. There is a growing emphasis on viewing dental care as part of a person's entire well being. That is, a stronger relationship is developing between dentistry and other branches of medicine.



New areas of specialization have emerged. The following descriptions of dental specialties indicate the level of sophistication in this field, as well as the diverse career opportunities in different settings. Nonetheless, the great majority, nearly 90% of dentists, are in general practice.

Endodontists treat dental problems that arise from diseases or defects of the gum tissue. A root canal is one of the more common surgical techniques associated with this specialty. Other activities may include surgical removal of disease tissue, treating gum injuries, realigning displaced teeth, or reinserting lost teeth.

Oral Pathologists are concerned with the causes and processes of diseases of the mouth area. They perform chemical, microscopic, and radiographic tests on tissue samples to provide diagnostic information. This information is used by the patient's dentist or physician for treating disease or correcting teeth, gum, or jaw abnormalities.

Oral Surgeons perform operations in the mouth area as needed in the treatment of disease, injuries, and defects. Dentists send patients to oral surgeons for more complicated tooth extractions or multiple extractions. Other types of surgery include removal of tumors, correcting jaw alignment problems, and preparing the mouth for dentures.

Orthodontists diagnose and correct mouth and teeth irregularities that require movement of teeth and restoring a proper balance of the mouth structures. Braces are, of course, most commonly associated with the work of orthodontists. They also fabricate other types of appliances required in the repositioning of teeth. Orthodontics is the largest of the specialties.

Pedodontists specialize in treating children. Since children's teeth are in the continuous process of change and growth, their dental problems and needs are somewhat different than those of adults. For example, when special appliances are required, the pedodontist must take into account the rate of jaw and teeth changes.

Periodontists diagnose and treat diseases of tissues surrounding the teeth and underlying bone. A variety of treatment procedures that include minor surgery are employed to restore and maintain the healthy function of these tissues.

Prosthodontists restore natural teeth or replace missing teeth with artificial substitutes. When replacement parts are made, the prosthodontist must carefully take into account the patient's total jaw and facial characteristics. Patients' improved speech, chewing, and appearance are the outcomes of the work.

Public Health Dentists work for public health agencies and are concerned with the overall dental health of the community. They plan, organize, and maintain dental health programs. Programs may include dental clinic services; dental hygiene instruction to school and adult groups; analysis of dental needs of the community; and prevention and control of dental disease.

Personal Qualifications and Training

Dentistry is both an art and a science, requiring high levels of both intellectual abilities and visual abilities. Skill in use of one's hands, judging space and shape, and good visual memory are needed in restoring and replacing teeth. Proper diagnoses depend on applying technical knowledge in problem solving. Interest in people and in helping others is also important.

Since competition is keen for the available places in dental schools, good preparation is important. High school courses should include biology, chemistry, mathematics and health. Two or four years of college is a prerequisite for entrance into dental school. The majority of dental students have their bachelor's degree. Dental programs are four years in length and award DDS or DMD degrees. Graduates must pass a licensing exam in order to practice. To practice in one of the eight specialty areas, an additional two to three years of education and clinical training is required.

Outlook

Population growth, an older population, federal health care programs, dental insurance plans, and a public better informed about dental health all contribute to a high demand for dental services. There is a shortage of dentists to service the needs of the public, especially in lower income areas. Most dentists starting out open their own offices, purchase an established practice, or work with a practicing dentist. The high cost of equipping an office is one of the hurdles facing dentists entering private practice. However, private practice dentists have the independence of being their own employer, and the financial rewards of a well-established practice are high.

The increase in public health programs have created new opportunities for work in health agencies and clinics where dentists administer programs or practice dentistry.

Teaching at dental schools and research are other opportunities for dentists.

Areas of Employment

- . private practice
- . group practice
- . health maintenance organizations
- . hospitals
- . clinics
- . community health agencies
- . dental schools
- . Armed Forces

Schools in New Jersey

Fairleigh Dickinson University
Hackensack, New Jersey 07601

UMDNJ - New Jersey Dental School
Newark, New Jersey 07103

For Additional Information

American Dental Association
211 East Chicago Avenue
Chicago, Illinois 60611

2. Dental Services

Dental Assistant

079.371-010

Dental assistants, as the title implies, assist dentists during the treatment of patients. They prepare the patient for examination and subsequent dental procedures. As the dentist works, they select and pass the necessary instruments and materials. They help keep the mouth area cleared and dry, so that the dentist can put in the fillings or perform

other dental work. Dental assistants also prepare solutions and mix materials for fillings and cement. Other activities may include helping the dentist take and develop X-rays, sterilizing instruments, and keeping the treatment area stocked and organized. Their assistance enables the dentist to work more effectively and efficiently. They are, in essence, the dentist's extra "hands" and "eyes."

In smaller dental practices, dental assistants may also perform secretarial duties such as making appointments, keeping records, and billing patients.

Personal Qualifications and Training

A pleasing personality, working well with people, alertness and good manual dexterity are all important qualities for this occupation. Since the dental assistant and dentist function as a team, one must be well organized and able to anticipate activities to be performed. While many dental assistants have been trained on the job, more and more are now trained in formal school programs. One reason is that they now perform many tasks formerly done by dental hygienists and dentists. Recommended high school courses include biology, health, chemistry, typing and office management. One- and two-year training programs are offered by vocational-technical schools, community colleges and dental schools. Diplomas, certificates or associate degrees are granted, depending on the program. Training is also available through the Armed Forces. Dental assistants who meet the educational requirement and pass the exam are certified by the American Dental Assistants Association.

Outlook

Opportunities for dental assistants, especially those with formal training, are very good. Many people now have dental insurance plans or receive dental services through public programs and therefore are more inclined to use dental services. The public has also recognized the importance of regular dental check-ups. The high demand for dental services therefore increases the need for dental assistants.

Areas of Employment

- . dentists' offices
- . dental group practices
- . hospitals
- . public health departments
- . dental clinics
- . dental schools

Schools in New Jersey

Atlantic County Area Vocational/
Technical School
Atlantic City, New Jersey 08401

Bayonne High School
Bayonne, New Jersey 07002

Bergen Community College
Paramus, New Jersey 07652

Bergen County Area Vocational/
Technical School
Hackensack, New Jersey 07601 and
Paramus, New Jersey 07652

Bryman School
East Brunswick, New Jersey 08816

Camden County Area Vocational/
Technical School
Sicklerville, New Jersey 08081

Camden County College
Blackwood, New Jersey 08012

Cape May County Area Vocational/
Technical School
Cape May Court House, New Jersey
08210

UMDNJ - School of Allied Health
Professions
Newark, New Jersey 07103

County College of Morris
Dover, New Jersey

Essex County Area Vocational/
Technical School
Newark, New Jersey 07017

Gloucester County Area Vocational/
Technical School
Sewell, New Jersey 08080

Hudson County Area Vocational/
Technical School
North Bergen, New Jersey 07047

Kearny High School
Kearny, New Jersey 07032

Lyons Institute
Cherry Hill, New Jersey 08034

Mercer County Community College
Trenton, New Jersey 08690

Middlesex County College
Edison, New Jersey 08817

Monmouth County Area Vocational/
Technical School
Hazlet, New Jersey 07730 and
Neptune, New Jersey 07753

Ocean County Area Vocational/
Technical School
Bricktown, New Jersey 07823 and
Toms River, New Jersey 08753

Union County Technical Institute
Scotch Plains, New Jersey 07076

Union Township High School
Union, New Jersey 07083

For Additional Information

American Dental Assistants
Association
666 N. Lake Shore Drive,
Suite 1130
Chicago, Illinois 60611

2. Dental Services

Dental Hygienist

078.361-010

As a member of the dental health team, dental hygienists provide a number of preventive and therapeutic dental care services. Their services have enabled dentists to serve more patients and attend to work requiring more specialized knowledge. Duties of dental hygienists vary considerably, depending upon the laws of the state and needs of the dentist.

Most commonly, dental hygienists perform teeth "cleaning"--the removal of stains and scaling of deposits to prevent gum disease.

They apply flouride to teeth to prevent tooth decay. As educators, they instruct patients on the care of their teeth (proper techniques of brushing and flossing), and good diet. Dental hygienists also assist dentists in diagnostic procedures such as obtaining medical and dental histories, taking and developing X-rays, and making impressions of the teeth from which models are made. These help the dentist determine the condition and structure of the teeth and the treatment required.

Some dental hygienists work in public school systems. There they may examine children's teeth and indicate the type of treatment needed. Also, they develop and present lessons to students on dental hygiene.

Personal Qualifications and Training

A person considering this occupation should enjoy working with people and be able to help patients overcome their fears and anxieties toward dental work. Manual dexterity and neat work habits are also important. Recommended high school courses include biology, health, chemistry, speech, and mathematics. Most dental hygiene programs are two-year programs and grant an associate degree. Some colleges offer four-year bachelor's degree programs. A few grant master's degrees. Dental hygienists with master's degrees often teach in the training programs or conduct research. Practitioners in New Jersey must be licensed.

Outlook

With the advent of dental health plans as well as population growth, the demand for dental care has increased considerably. Dentists in private practice often have at least one or more dental hygienists working for them. The need for personnel in this occupation is expected to grow.

Areas of Employment

- . dentists' offices
- . dental group practices
- . dental clinics
- . schools
- . public health agencies

Schools in New Jersey

Bergen Community College
Paramus, New Jersey 07652

Camden County College
Blackwood, New Jersey 08012

Essex County College and
UMDNJ - School of Allied Health
Professions
Newark, New Jersey 07103

Fairleigh Dickinson University
Dental School
Hackensack, New Jersey 07601

Middlesex County College
Edison, New Jersey 08817

Union County Technical Institute
Scotch Plains, New Jersey 07076

For Additional Information

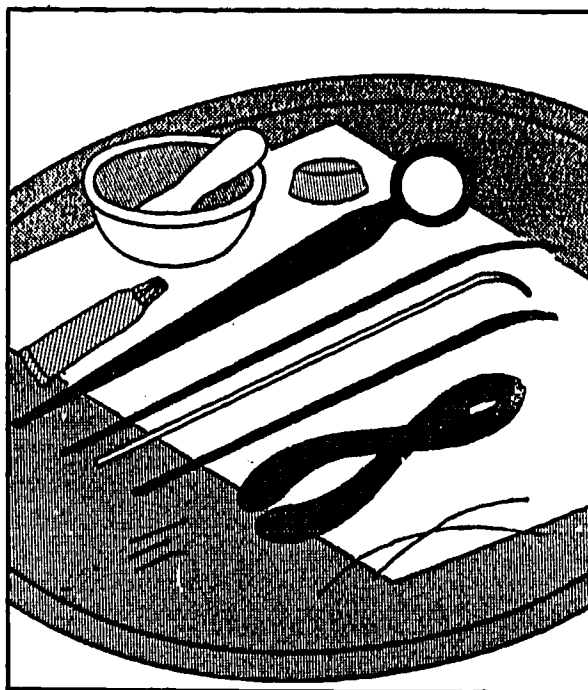
American Dental Hygienist
Association
211 East Chicago Avenue
Chicago, Illinois 60611

2. Dental Services

Dental Laboratory Technician

712.381-018

The behind-the-scene members of the dental health care team are the dental laboratory technicians. They are the crafts people trained to construct artificial replacements of teeth lost through injury or disease. Depending on the dentist's prescriptions, these prosthetic appliances may be complete or partial dentures, crowns, bridges, or inlays. Dental laboratory technicians also construct the appliances used for orthodontics, such as retainers and braces. The work requires the use of hand tools, molding equipment, fabricating machines, and polishing tools.



Dental laboratory technicians can be compared to sculptors. Working from models and impressions, they make reproductions of the replacement part; these are then cast in acrylic or ceramic and finished with polishing tools. Well-fitting, comfortable, and natural looking dentures, for example, depend on the precision and skills of these technicians. For patients who need only a few teeth, the replacements must match the color and size of existing teeth. All these activities require much care and attention to detail.

Most dental laboratory technicians work for commercial dental laboratories which serve large numbers of dentists. A small number work in dental clinics or for dentists in private practice.

Personal Qualifications and Training

Persons desiring to enter the field should enjoy delicate, precision work and working with their hands. A high level of manual dexterity and good color vision are also important. Useful high school courses should include art, ceramics, sculpture, metal shop, chemistry and biology. Many people enter this field by training on the job at commercial dental laboratories. The training period extends three to four years. A number of community colleges and technical schools offer formal two-year programs that lead to an associate degree or diploma. Training is also available through the Armed Forces. Certification is awarded by the National Board for Certification in Dental Laboratory Technology, which administers the certifying exam. Candidates must first meet the education and experience requirements.

Outlook

With the increasing demand for dental care and an older population needing dentures and other prostheses, opportunities in this field are very good. Also, dental appliances must be custom crafted for each patient and therefore cannot be mass produced. Experienced technicians often advance to the position of laboratory managers or become owners of their own laboratory.

Areas of Employment

- . commercial dental laboratories
- . dental clinics
- . dentists' offices
- . dental supply companies

For Additional Information

National Association of Dental
Laboratories
3801 Mt. Vernon Avenue
Alexandria, Virginia 22305

Schools in New Jersey

Camden County Area Vocational/
Technical School
Sicklerville, New Jersey 08081

Lyons Institute
Cherry Hill, New Jersey 08034

Union County Technical Institute
Scotch Plains, New Jersey 07076

3. Dietetic and Nutritional Services

Dietitian

Clinical Dietitian

Public Health Nutritionist
(Community Dietitian)

Dietetic Assistant

Dietetic Technician

3. Dietetic and Nutritional Services

077.----- Dietitian
 077.127-014 Clinical Dietitian
 077.127-010 Public Health Nutritionist
 (Community Dietitian)



We all know that good health is related to what we eat and the proper balance of foods in our diet. Proper nutrition is all the more important for patients recovering from illness or injury. The growth of new tissue, such as mending of broken bones, depends on the necessary building materials which, of course, come from food. Moreover, some diseases can be controlled or cured by special diets. Dietetic service in a hospital is, therefore, a basic part of a patient's total treatment and is closely coordinated with the treatment plan.

The hospital dietitian, trained in the science of food, nutrition, and institutional management, plans and provides for patients' meals. In a large hospital an administrative dietitian heads the dietetic department and has the responsibility of training and supervising staff, purchasing food, supplies and equipment, maintaining health and safety regulations, and ensuring that patients receive appropriate nutrition. The therapeutic dietitian works more closely with patients and physicians in planning meals that meet the medical needs as well as food preferences of the patient. This at times requires much creativity as the sick frequently have little appetite for food. They often must be persuaded to take the nourishment they need, by making the food attractive and appealing to their tastes. Some patients require very restrictive diets, so dietitians must design and plan meals around special types of foods. In addition, they supervise the preparation of the meals.

In some hospitals and clinics, nutrition education and counseling services are provided. Here dietitians instruct individuals or groups on food selection and preparation for their special needs such as for diabetics, expectant mothers, the obese, etc. They may also conduct courses for hospital personnel and interns on various aspects of nutrition and the services of the department.

Research dietitians in hospitals conduct studies and surveys to gain information about the effectiveness of particular diets or information to guide the development of new diet programs.

Public health nutritionists have similar training but work in a somewhat different setting--health agencies, cooperative extension services, and schools. They are involved more with providing information services and developing programs for individuals and groups to improve nutrition and maintain good health.

Personal Qualifications and Training

An interest in food and food preparation is obviously an important qualification, but in addition one should possess a strong interest and background in science. Administrative and organizational skills and ability to communicate with a diversity of people are also important. High school courses in biology, chemistry, business, home economics, and mathematics are good preparation. Basic requirements for dietitians are a bachelor's degree in dietetics and nutrition or home economics, and completion of an approved six to twelve month internship program. Some positions, such as with a public health agency, require a graduate degree. Dietitians who pass the registration examination are registered by the American Dietetic Association.

Outlook

Increased awareness of the importance of proper nutrition in maintaining good health has heightened the role of dietitians. The employment of dietitians has extended into a greater number of institutional, government, and industrial settings. Industry, for example, has recognized the value of providing good nutrition for its employees in their cafeterias. As the concern for good nutrition persists and dietitians become more involved in total health care, the demand for trained dietitians will remain high.

Areas of Employment

- . hospitals
- . health care facilities
- . schools
- . health agencies
- . colleges and universities
- . industrial plants
- . cafeterias
- . restaurants

Schools in New Jersey

College of St. Elizabeth
Convent Station, New Jersey 07961

Montclair State College
Montclair, New Jersey 07043

Rutgers - The State University
of New Jersey
Douglass College
New Brunswick, New Jersey 08903

For Additional Information

American Dietetic Association
430 North Michigan Avenue
Chicago, Illinois 60611

3. Dietetic and Nutritional Services

Dietetic Assistant

Dietetic assistants work under the supervision of dietitians and dietetic technicians. They assist in the supervision of food production and service to insure that meals are properly prepared and delivered to the appropriate patients. They may have charge of

ordering the food and supplies, scheduling employees, overseeing food preparation and presentation, and organizing the daily work. Their activities may also include helping patients select menus, processing the daily orders, and transmitting the information to the food preparation staff. Dietetic assistants are also called food service supervisors.

Personal Qualifications and Training

Working well as a team member, a keen sense of observation, neatness and managerial abilities are useful qualities for this occupation. Although dietetic assistants in the past were trained on the job, employers prefer to hire persons trained through formal, approved programs. One-year training programs for dietetic assistants are offered by community colleges and vocational-technical schools. Graduates from approved programs are eligible for membership in The Hospital, Institution and Educational Food Service Society.

Outlook

As with other workers in the food service field, there is a strong demand for trained personnel in this occupation. The demand will remain high as the number of food service facilities increase.

Schools in New Jersey

Atlantic County Vocational/
Technical School
Mays Landing, New Jersey 08330

Bergen County Vocational/
Technical School
Hackensack, New Jersey 07601

Burlington County Vocational/
Technical School
Burlington Community College
Pemberton, New Jersey 08068

Gloucester County Vocational/
Technical School
Sewell, New Jersey 08080

Mercer County Vocational/
Technical School
Trenton, New Jersey 08690

Middlesex County Vocational/
Technical School
East Brunswick, New Jersey 08816

Morris County Vocational/
Technical School
Denville, New Jersey 07834

Ocean County Area Vocational/
Technical School
Toms River, New Jersey 08753

Passaic County Technical and
Vocational School
Wayne, New Jersey 07470

Sussex County Vocational/Technical
School
Sparta, New Jersey 07871

Union County Technical Institute
and Vocational Center
Scotch Plains, New Jersey 07076

For Areas of Employment and Additional Information,
see DIETETIC TECHNICAN

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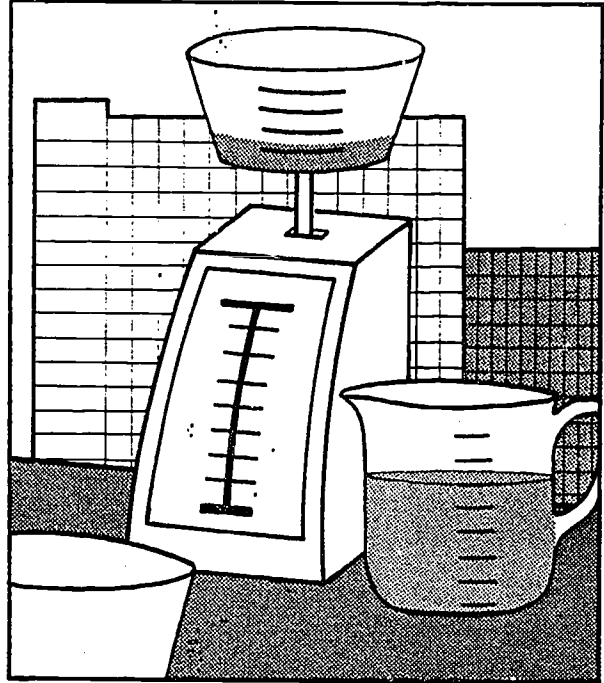
3. Dietetic and Nutritional Services

Dietetic Technician

077.121-010

The shortage of dietitians has led to the expansion of training programs for dietetic technicians, the middle managers of food service facilities. Trained in nutrition and management, they assist dietitians in meal planning, assessing nutritional programs, and the supervision of food preparation and service. In hospitals and extended care facilities, their duties include planning patient menus for diets prescribed by physicians, using established guidelines. They train and supervise dietetic assistants and aides in meal service. In some settings they are

responsible for food services, managing the food preparation personnel, monitoring food production, and planning menus. Other activities of dietetic technicians may include standardizing recipes, testing new products, teaching classes in nutrition and food preparation, and planning nutritional programs for individuals and groups.



Personal Qualifications and Training

Interest in foods, managerial and administrative abilities, and working well with people are important qualities for this occupation. The responsibility of providing good nutrition, keeping the operation cost effective and managing personnel requires good organizational and leadership skills. High school courses should include biology, chemistry, math, business and health. Two-year associate degree programs in dietetic technology are offered by community colleges. Dietetic technicians are registered by the American Dietetic Association.

Outlook

The increased need for dietetic services in recent years has created a high demand for dietetic technicians. This trend is expected to continue as the numbers of food service facilities increase. Also, the public's concern for good nutrition has emphasized the importance of hiring personnel trained in nutrition and food science, in company cafeterias and other places feeding people on a large scale.

Areas of Employment

- . hospitals
- . extended care facilities
- . schools
- . health agencies
- . company cafeterias
- . restaurants

Schools in New Jersey

Camden County College
Blackwood, New Jersey 08012

Middlesex County College
Edison, New Jersey 08817

For Additional Information

The American Dietetic Association
430 N. Michigan Avenue
Chicago, Illinois 60611

The Hospital, Institution and
Educational Food Service Society
430 N. Michigan Avenue
Chicago, Illinois 60611

4. Emergency Medical Services

Emergency Medical Technician-Paramedic

(EMT - basic or ambulance)

(EMT - intermediate)

(EMT - paramedic)

4. Emergency Medical Services

Emergency Medical Technician-Paramedic

079.374-010

(EMT - basic or ambulance)

(EMT - intermediate)

(EMT - paramedic)

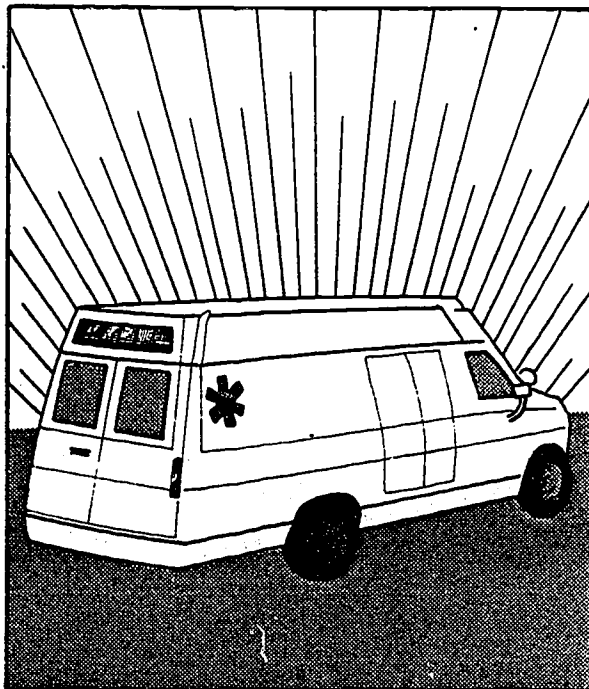
Emergency situations require immediate attention. The treatment patients receive at the accident scene or enroute to the hospital may be the difference between life and death. The crucial role of emergency medical technicians (EMT) has been extensively portrayed on television. Arriving at the scene of the illness or accident, they must quickly assess the nature of the problem and decide how to best proceed. Heart attack victims may

need CPR; drowning victims need airways cleared and breathing restored; burn victims must be protected against shock; the bleeding of accident victims must be controlled. The list is endless, for each situation is different. Oftentimes, EMTs are involved in rescue operations as well.

EMTs provide the immediate first aid and prepare the patients for transport in ambulances. They monitor the patient's condition until hospital personnel take over. Many ambulance services now have advanced life support units and communication systems to maintain contact with hospitals for instructions. EMTs who work in these units have EMT-paramedic registration. They are qualified to administer drugs and fluids as well as provide oxygen and more advanced treatment techniques for the critically ill or trauma victims. EMT-paramedics are trained to administer emergency medical treatment, stabilizing a patient's condition until a doctor is available. With telecommunication and monitoring systems, information from the scene can be transmitted to the hospital medical staff who then relays instructions to the EMT-paramedic. In a sense, EMT-paramedics are an extension of the doctor at the scene of the emergency.

Personal Qualifications and Training

EMTs must be persons who can work calmly, quickly and efficiently under stressful conditions. Wise thinking, care in following prescribed procedures and instructions, and ability to respond to difficult situations are important qualities. Since accidents are not limited to a particular environment, EMTs work indoors and out and must be in good health and physically capable of heavy lifting. Until the last few years, EMTs were not required to have formal training. Laws have since changed. Persons who



are high school graduates, age 18 or over, may enter a training program. An 81-hour program, developed by the Department of Transportation, is offered by police and fire departments, hospitals and health departments. Completion of this basic course and passing the test qualifies one to be registered as an EMT. With additional formal training and experience one can be registered as an EMT-paramedic at the advanced level. Two-year associate degree programs for EMT-paramedics are offered by community colleges.

Outlook

Public awareness of the importance of good ambulance and emergency medical services has greatly expanded these services. In addition, federal laws have encouraged communities to develop and improve their systems. Many communities are also changing from volunteer ambulance services to paid services. All these factors influence the demand for well-trained EMTs.

Areas of Employment

- . ambulance services
- . hospital based ambulance squads
- . fire and police departments
- . hospital emergency departments

For Additional Information

National Registry of Emergency
Medical Technicians
P.O. Box 29233
Columbus, Ohio 43229

Schools in New Jersey

Associate Degree Program

EMT - paramedic

Essex County College and UMDNJ -
School of Allied Health
Professions (joint sponsors)
Newark, New Jersey 07103

EMT training and paramedic programs
are offered by a number of
hospitals. For that listing
contact:

State of New Jersey
Department of Health
Division of Emergency Medical
Services
Stuyvesant Avenue at Whittlesey
Road
Trenton, New Jersey 08625

5. Eye Care Services

Dispensing Optician

Ophthalmic Laboratory Technician
(Optical Mechanic)

Ophthalmologist

Optometric Assistant

Optometrist

Orthoptist

5. Eye Care Services

Dispensing Optician

713.361-014

and

299.474-010

The role of a dispensing optician, in some respects, can be compared to that of a pharmacist. Instead of filling drug prescriptions, an optician fills prescriptions from eye doctors (ophthalmologists) or optometrists for corrective lenses. They help their customers select appropriate frames and then take measurements to determine the lens size and how the lens should be positioned. The optician then writes the order for the optical laboratory to grind the lenses according to his/her specifications. When the glasses are received from the laboratory, the optician uses measuring instruments to check whether the lenses are correctly made. He/She fits the eyeglass on the customer, making necessary adjustments so that it can be worn properly and comfortably. Opticians may also fit contact lenses. Fitting lenses

to the cornea of the eye is a delicate procedure, requiring much skill and care.

As the person who sells lenses and frames, an optician must be knowledgeable about the variety of products so that he/she can best advise the customer. A customer who works actively outdoors may need frames and glasses different from one whose work requires much reading. The size, shape and weight of the frame and how it fits the wearer are critical aspects in seeing well with corrective lenses. Also, different people react differently to wearing glasses. Children, for example, who obtain glasses for the first time are often hostile or embarrassed. They need to be reassured that glasses are beneficial as well as learn how to wear and take care of their glasses. Thus, the optician's work requires much insight, tact and patience.

Most opticians work in their own retail business, retail optical shops or department stores that sell prescriptive lenses. Some work in hospitals and clinics.

Personal Qualifications and Training

Serving customers is a major part of an optician's work, so patience and understanding of others are important assets. The job also involves using measurement equipment and tools, as well as making calculations. Therefore, manual dexterity and mathematical ability are highly desirable. For those wishing to own or manage a store, business training is most desirable. Many opticians learn their occupation from on-the-job training. However, developments in eye care technology during the past 25 years (e.g., the several types of contact lenses) require more sophisticated knowledge. More schools are now offering programs that lead to associate degrees in opticianry. Ophthalmic optical companies offer apprenticeship training programs. These programs are registered by the Bureau of Apprenticeship and Training of the U.S. Department of Labor. Training programs are also offered by the Armed Forces. New Jersey requires that opticians be licensed.

Outlook

Similar to other eye care professionals, the demand for opticians is expected to grow faster than the average for all other occupations. The demand is related to the increase of older persons and a public more educated about eye care. With private and public health insurance programs, people are less likely to postpone having their eyes checked. Also, eyeglass frames have become more fashionable. People who wear glasses often have several pairs--changing them as they do other accessories.

Areas of Employment

- . retail optical stores
- . department stores
- . ophthalmologists' or
optometrists' offices
- . hospitals
- . clinics
- . wholesalers or manufacturers
or optical goods

For Additional Information

Opticians Association of America
1250 Connecticut Avenue, NW
Washington, D.C. 20036

National Federal of Opticianry
Schools
Ferris State College
Grand Rapids, Missouri 49307

Schools in New Jersey

Camden Community College
(COA accredited)
Blackwood, New Jersey 08012

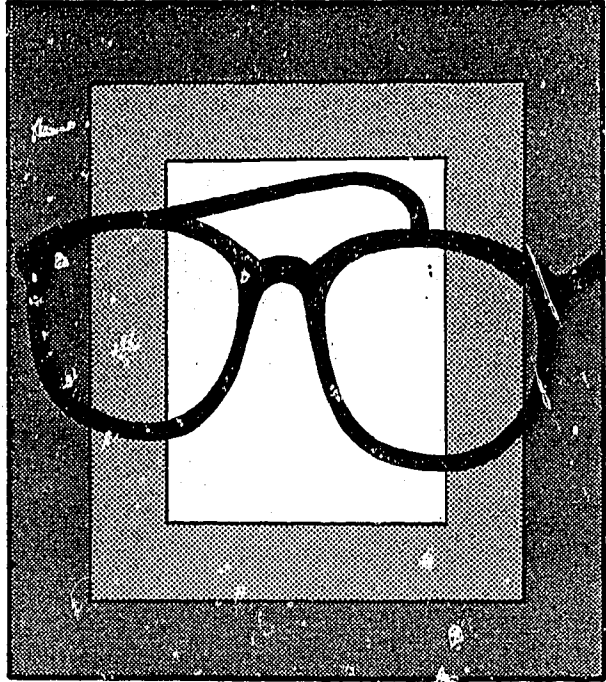
Essex County College
Newark, New Jersey 07102

5. Eye Care Services

Ophthalmic Laboratory Technician (Optical Mechanic)

716.280-014

Corrective lenses are made by changing the surface of blank lenses through the process of grinding and polishing. This is the work performed by ophthalmic laboratory technicians called surfacers or lens grinders. Prescription lenses are made to order and must meet the precise specifications indicated by the doctor. Since surfacers use grinding machines to grind the lens, they must periodically check the progress and accuracy of their work using optical measuring devices and testing instruments. Hence, they need to be knowledgeable in the use of these measuring tools.



The polished lenses then go to the ophthalmic laboratory technician called the bench technician or finisher. This person marks and cuts lenses and smooths the edges to fit the frame. The lenses are mounted into the frame and again inspected for imperfections and checked against the prescription.

In small laboratories this work may be performed by the same person. Larger laboratories, on the other hand, divide the work into separate operations. In very large laboratories, technicians specialize in operating a single type of machinery.

Personal Qualifications and Training

Since the work requires great accuracy and precision, persons in this occupation must be able to work skillfully and carefully with tools. Knowledge of physics, mathematics and mechanical drawing are important in making measurements and using the testing instruments. One should also have sharp vision and good color and depth perception.

Most people enter this occupation through on-the-job or apprenticeship training programs of about two to three years in length. Formal programs are also offered by some vocational technical schools and community colleges. Training is also available through the Armed Services. For licensing, New Jersey requires an associate degree in ophthalmic science or a two-year supervised State Board registered apprenticeship.

The work performed by ophthalmic laboratory technicians is also that learned by dispensing opticians. Therefore, technicians with additional training or retail dispensing experience often become dispensing opticians in retail outlets or open their own business.

Outlook

Job openings for ophthalmic laboratory technicians are expected to increase more rapidly than the average of all other occupations. This growth is related to the increasing demand for corrective lenses and population growth. However, the occupation itself is small so that competition for jobs may be keen. Persons with formal skill training will, of course, be more desirable to employers.

Schools in New Jersey

Camden Community College
Blackwood, New Jersey 08012

Essex Community College
Newark, New Jersey 07102

For Additional Information

Opticians Association of America
1250 Connecticut Avenue, NW
Washington, D.C. 20036

National Federation of Opticianry
Schools
Ferris State College
Big Rapids, Michigan 49307

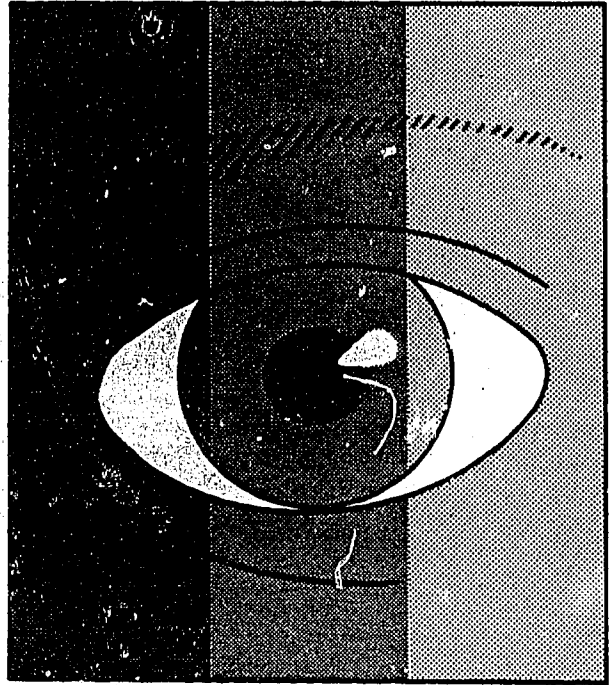
5. Eye Care Services

Ophthalmologist

070.101-058

Ophthalmologists are medical doctors who specialize in the treatment of eye disorders and injuries. They diagnose, prescribe treatment, and perform eye surgery. Their patients range from someone who needs a prescription for corrective lenses, to one who has suffered an eye injury, to one who requires surgery to restore vision.

Ophthalmologists employ specialized and sophisticated instrumentation to aid in eye examinations and diagnosis. These instruments permit the physician to look inside the eye for possible abnormalities. In addition, other tests are performed to determine the extent of vision loss. To restore vision or arrest a disease, treatment may entail corrective lenses, medication, surgery, corneal transplant or eye exercises.



Personal Qualifications and Training

Given that the field of medicine is highly competitive and rigorous, a person desiring to enter this profession must be highly motivated and possess high level thinking abilities. Since the sciences are the basis for understanding medicine, one should enjoy and be well prepared in the sciences. Moreover, because doctors deal with human life, they should be knowledgeable about the human experience. It is therefore important to include courses in the humanities and the arts. Ophthalmologists, in particular, need good manual dexterity and coordination to perform delicate eye operations.

The specialty of ophthalmology requires extensive training. The three or four years of college and four years of medical school are followed by one year of internship and three years of residency training in a hospital with an ophthalmic teaching program. In addition to licensing by the State Board, ophthalmologists must pass their specialty examination administered by the American Board of Ophthalmology.

Areas of Employment

- . private practice
- . health care centers
- . eye clinics
- . hospitals
- . medical colleges

Schools in New Jersey

University of Medicine and
Dentistry of New Jersey
New Jersey Medical School
Newark, New Jersey 07103

Rutgers College of Medicine and
Dentistry of New Jersey
New Brunswick, New Jersey 08903

For Additional Information

American Association of
Ophthalmology
1100 - 17th Street NW
Washington, D.C. 20036

American Medical Association
535 North Dearborn Street
Chicago, Illinois 60610

5. Eye Care Services

Optometric Assistant

079.364-014

Optometric assistants work in optometrists' offices, performing a wide variety of duties. The duties range from record keeping to measuring and fitting eyewear to helping patients with their eye exercises. The work is thus a combination of office administrative activities, patient care activities

and laboratory activities. Their assistance enables the optometrist to devote more time to their professional duties.

The work will vary depending on the size of the practice and the staff. In a larger clinic, for example, optometric assistants may do more specialized work. Some assistants assist in visual training; others help patients select frames and fit eyeglasses, as well as schedule appointments and keep records.

Personal Qualifications and Training

Manual dexterity; ability to work accurately and efficiently, and flexibility are important traits for optometric assistants. In addition, an interest in helping people and a pleasant personality makes the job more enjoyable and interesting.

On-the-job training is how most optometric assistants learn their occupation. However, a number of schools offer one-year training programs or two-year training programs that lead to an associate degree. Such programs will include courses in the anatomy and physiology of the eye, vision training, and office procedures. Training is also available through the Armed Services. Persons who have formal training will, of course, be more desirable candidates for employment.

Outlook

Employment opportunities in this field continue to grow. Although this is not a large field, job prospects for trained personnel are predicted to be very good. The rate of growth will probably be about the same as for other occupations in eye care.

Areas of Employment

- . optometrists' offices
- . retail eye care centers
- . eye clinics
- . hospitals

For Additional Information

American Optometric Association
 Paraoptometric Guidance Department
 243 North Lindbergh Boulevard
 St. Louis, Missouri 63141

5. Eye Care Services

Optometrist

079.101-018

About one-half of the population in the United States have a vision problem and wear corrective lenses. Unless they suffer from an eye disease or incurred an eye injury, it is very likely that they at some time used the services of an optometrist. Optometrists are trained to examine the eyes for vision problems and abnormal or disease conditions. They determine the distance and depth that a person can see, as well as one's ability to coordinate eye movement. After completing the tests and evaluating the problem, they prescribe the necessary treatment. In most cases, the prescription is some form of corrective lens. In other cases, the treatment is visual training, teaching the patient eye exercises to improve vision. If a disease is found, the optometrist refers the patient to the proper medical specialist. Optometrists do not prescribe drugs or perform eye surgery.

Most optometrists in private practice fill their own prescriptions, ordering the proper lenses from an optical laboratory and fitting them into frames. Also,

the fitting of contact lenses on patients requires a number of different specialized skills. Since the majority of optometrists have their own private practice, they also serve as office manager, salesperson and optical lab technician. Some optometrists are in group practice and may have opticians and optical technicians employed in their office and laboratory.

In recent years, there has been an increasing number of optometrists who work in industry rather than in private practice. Optics engineering is an area where an optometrist can apply his/her knowledge in the research, design and testing of optical equipment. Visual research is an expanding field because industry, educational institutions and government agencies are interested in ways to improve products and the safety of products. They also want to know how different environments affect the way people see. With space travel in the future, an important research question is, "How is vision affected when one travels at high speeds?"

Working in hospitals, health clinics, or teaching in colleges are other opportunities for an optometrist.

Personal Qualifications and Training

As an applied scientist who serves the public, an optometrist must be knowledgeable in the biological and physical sciences. He/She should be a good problem solver because the vision problems of each patient are unique. A pleasing personality, patience, and the ability to work with people of all ages are important assets. In addition, good managerial skills are the keys to a successful private practice.

Training for the doctor of optometry degree consists of a four-year program at an accredited optometry school or college. One usually enters an

optometry school after completing at least two or three years of pre-optometry study at an accredited college or university. To practice in New Jersey or any other state, an optometrist must be licensed. The licensing procedure includes passing the National Board of Optometry examination and a clinical examination administered by the State Board.

Outlook

The field of optometry is a growing field and is expected to continue at a rate faster than the average of all other professions. As our population of older people increases, more people will need eye care services. The public is also better educated on the importance of good vision and, therefore, will seek corrective treatment. Optometric services are now covered by many health insurance plans so people are more inclined to use those services.

Areas of Employment

- . private practice
- . hospitals
- . community health clinics
- . commercial vision centers
- . Armed Forces
- . eye clinics
- . optical products manufacturers
- . private and public health agencies
- . educational institutions

For Additional Information

American Optometric Association
243 N. Lindbergh Blvd.
St. Louis, Missouri 63141

Association of Schools and
Colleges of Optometry
1730 M Street, NW, Suite 310
Washington, D.C. 20036

Schools in the Nearby Area

There are no optometry schools in New Jersey. Schools in the nearby area include:

Pennsylvania School of Optometry
Philadelphia, Pennsylvania 19141

State University of New York
College of Optometry
122 E. 25th Street
New York, New York 10010

5. Eye Care Services

Orthoptist

079.371-014

Orthoptists are eye muscle specialists who aid persons with problems in focusing and related eye disorders. Their work includes planning and conducting therapy programs. They use a variety of specialized instruments to test vision, focusing, eye movement and coordination. Using developmental

glasses and prisms, they help patients improve their visual skills, such as focusing with both eyes or hand-eye coordination.

Many patients are young children, so an orthoptist should have good teaching skills as well as an understanding of child psychology. In larger facilities such as a medical center, orthoptists are part of an ophthalmic team and are involved in teaching as well as research and development of new therapy techniques.

Personal Qualifications and Training

The ability to work with people, understanding, and patience are important for this occupation. A good background in the sciences and behavioral sciences is also important. Orthoptic candidates must have completed at least two years of college before they may enter a training program or a preceptorship, a two-year course of study and clinical experience. Following training, an orthoptist may apply for certification by the American Orthoptic Council.

Outlook

This is a small but emerging profession. More positions are open than there are available candidates. However, most positions are located at large cities or in medical centers.

Areas of Employment

- . hospitals
- . eye clinics
- . offices of eye doctors

Nearby Institutions Accredited by the American Orthoptic Council

Preceptorships

Johns Hopkins University
 School of Medicine
 Wilmer Institute
 Johns Hopkins Hospital
 Baltimore, Maryland 21205

St. Charles Hospital
 Eye Treatment Center
 200 Belle Terre Road
 Post Jefferson, New York 11777

Training Centers

New York Eye and Ear Infirmary
School of Orthoptics
310 East 14th Street
New York, New York 10003

School of Orthoptics
Presbyterian Hospital
New York, New York 10032

For Further Information

The American Orthoptic Council
The University of Iowa Hospital
Department of Ophthalmology
Iowa City, Iowa 52242

6. Health Administration, Clerical and Support Services

Health Services Administrators

Hospital Administrator
Institution Director
Public Health Service Officer
Medical Facilities Section Director

Admitting Officer

Hospital - Admitting Clerk
(Admissions Clerk)

Executive Housekeeper

Health Care Manager
(Ward Supervisor, Unit Manager)

Unit or Ward Clerk

Medical Assistant

Medical Secretary
Dental Secretary

Medical Record Administrator

Medical Record Technician

Medical Record Clerk

6. Health Administration, Clerical and Support Services

Health Services Administrators
 187.117-010 Hospital Administrator
 187.117-018 Institution Director
 187.117-050 Public Health Service
 Officer
 188.117-082 Medical Facilities Section
 Director

Hospitals, health clinics and other types of health care/medical facilities, especially the larger institutions, are complex organizations. To keep them operating smoothly and efficiently and insuring that they serve the public well, is the task of health service administrators. Their role is that of a manager who plans, organizes, and supervises the variety of activities that take place in a facility. Health care or medical facilities, large or small, require skillful managers who work well with the staff and the community they serve.



The particular duties of health services administrators vary with the workplace. Approximately half of them are employed in hospitals, others in clinics, medical group practices, community health centers, nursing homes, mental health centers, extended care facilities or government agencies.

Hospital administrators are very similar to the top executive of a corporation but are specially trained and knowledgeable about health care and the delivery of the health services. While the board of trustees establishes the hospital policy, the administrator is the decision-maker of the hospital on a day-to-day basis. The administrator is responsible for the internal operations which involve managing the staff, the supplies and equipment needed to provide the services, and the physical facilities. Another important concern is managing the finances efficiently so that patients receive quality care at a reasonable fee. They need to be knowledgeable about new developments and technology in medicine/health care so that the hospital can improve its patient care facilities and services.

In large hospitals the hospital administrator is assisted by an extensive staff. This staff may include an assistant hospital administrator, an administrative assistant, supervisors of the various departments, business manager, controller, personnel director, purchasing director, and so on. In a small clinic, for example, the administrator may assume most, if not all, of those roles.

Where a health service administrator is employed is very much dependent on his/her training, work experience and specialization. There are a wide variety of different opportunities available in this occupation. Moreover, the occupation offers great challenges because health service administrators chart the course of the quality of health care of this country. By developing and improving services and creating good working environments for those who provide the services (doctors, nurses, technicians, etc.), they directly influence the lives and health of the public.

Personal Qualifications and Training

Managing a complex organization such as a hospital requires high level leadership qualities, good communication skills, and abilities in planning and decision making. The amount of training needed depends on the size of the organization and the level of responsibility. For larger hospitals and health organizations, graduate degrees in health or hospital administration and work experience are required. A college degree in health services administration or business may qualify one to work as an administrative assistant or head of a hospital department. The requirements will vary depending on the nature of the work. Some facilities require greater knowledge of hospital organization and health care practices.

Graduate degree programs in health administration are offered by various college departments and schools. They include graduate business schools, schools of public health, medical schools, schools of health sciences/professions, and schools of public administration. Most are two-year master's degree programs and some include a residency training in a hospital setting. More recently, colleges have developed undergraduate health care administration programs. These programs focus more on preparing students for work in smaller facilities such as clinics, nursing homes, group practices, and as managers of hospital departments.

Outlook

The increasing number and types of health facilities have created a high demand for health services administrators. As health services management becomes more complex, a higher degree of training and specialization becomes necessary for some jobs. The trend toward group medical practice has also increased the need for health administrators. The health care field has become the nation's largest employer, and managers are needed at all levels. However, the larger number of openings are found at the middle management level, as activities become more specialized and new departments are formed.

Areas of Employment

- . hospitals
- . health service agencies
- . health organizations
- . nursing and convalescent homes
- . clinics
- . group practices
- . community health centers

Schools in the Nearby AreaGraduate Programs

City University of New York
School of Business and Public
Administration
New York, New York 10010

Columbia University
School of Public Health
New York, New York 10032

Cornell University
Graduate School of Business
and Public Administration
Ithaca, New York 14853

New York University
Graduate School of Public
Administration
New York, New York 10003

University of Pennsylvania
The Wharton School
Philadelphia, Pennsylvania 19104

Pennsylvania State University
College of Human Development
University Park, Pennsylvania 16802

Temple University
School of Business Administration
Philadelphia, Pennsylvania 19122

Undergraduate Programs

Herbert H. Lehman College
City University of New York
Bronx, New York 10468

Ithaca College
School of Allied Health Professions
Ithaca, New York 14850

Pennsylvania State University
College of Human Development
University Park, Pennsylvania 16802

For Additional Information

Association of University Programs
in Health Administration
One DuPont Circle, Suite 420
Washington, D.C. 20036

American College of Hospital
Administration
840 North Lake Shore Drive
Chicago, Illinois 60611

OTHER MANAGEMENT PERSONNEL

Following are some areas of health service administration that have emerged or become more specialized in recent years. Some of these managers may not be directly categorized as health care personnel because their work is common to other industries as well. However, these personnel have additional training or experience in the health care setting.

Hospital Controller

To meet the ever growing high cost of running a hospital, while still providing medical service at an affordable price, is the challenge before the controller. He/She, as head of the hospital's fiscal affairs, is responsible for budgeting, bookkeeping, accounting, crediting, and collecting of patient bills. Working closely with the managers of other departments and hospital administrators, the controller coordinates the hospital's finances and develops plans and procedures for making best use of the institution's resources and assets.

Data Processing Manager

Hospitals today rely on computers for billing, maintaining patient records, keeping inventory of supplies, scheduling personnel, bookkeeping, and the many other tasks that involve the storage and use of information. The data processing manager is responsible for coordinating the various functions of the information processing department. With rapid developments in computer technology, this manager must keep informed of new computer applications and how computers may be used to further improve hospital operations. The data processing manager's role is in the planning, programming, and processing of data and information.

Business Office Manager

The business office of a hospital prepares patient bills and reports, does the bookkeeping, handles the payrolls and maintains the various types of business records. The business office manager runs this department and supervises the clerical staff.

Personnel Director

How well the staff works together and with patients may very well reflect the efforts of the personnel department and its director. The responsibility of the director is the recruitment, selection, and placement of employees. He/She also develops personnel policies and work procedures, employment practices, salary scales, and grievance procedures. Other duties may include establishing training programs and familiarizing employees with the hospital work environment.

Purchasing Director/Material Manager

The varied supplies and equipment needed to run a hospital and the continued development and changes in medical treatment and health care, makes this a stimulating and challenging position. The purchasing director must develop a keen understanding of the needs of each department and keep up with new products and trends. He/She plans and supervises the different aspects of purchasing, storing, and distributing the multitude of items needed in the hospital.

Risk Manager

Since the life and well-being of patients depend on a competent health care staff and safe conditions, the hospital must continually examine its methods of serving patients. Also, the hospital may be sued if it is negligent in its practice. Hospitals now use a logical and systematic approach called a risk management program to examine their facilities and practices to insure safe environments for patients and staff. The risk manager implements and coordinates this program, working closely with the nursing and medical staff.

Quality Assurance Director

Consumers, better informed and educated, have influenced improvements in the quality of products and services. This trend has extended also to the hospitals. Hospitals have adopted quality assurance programs to promote the quality of patient care. The department headed by the quality assurance director monitors patient length of stay and services received. Through a system of reviews and medical audits, the director determines whether the resources of the institution are adequately used. The purpose is to make sure that patients receive appropriate services and that the facility has provided for the patients' needs.

6. Health Administration, Clerical and Support Services

arranged, and papers of the patient's admission are prepared.

205.137-010 Admitting Officer

The admitting officer is in charge of supervising and coordinating the activities and staff of the admitting department. The role requires efficiency, attention to detail and the ability to make patients feel at ease and comfortable.

205.362-018 Hospital - Admitting Clerk (Admissions Clerk)

The admitting officer or member of his/her staff is probably the first person one encounters upon entering the hospital. He/She interviews the patient or person representing the patient for information needed by the hospital. This information includes personal data and financial arrangements. Using that information, physicians' orders, the nature of illness, and availability of space, the admitting personnel then assigns the patient to the proper department and room. The department is notified, necessary services are

The hospital admitting clerk works under the supervision of the admitting officer. He/She interviews, makes the patient assignment, arranges for the necessary services and equipment, and prepares the various patient forms for the medical, accounting, dietary, etc. departments. Because the hospital needs detailed information and the patient may not feel well, the admitting process must be conducted efficiently, with tact and a friendly attitude.

Personal Qualifications and Training

Work in the admitting department requires people who communicate well with others, exhibit a pleasant personality, and are able to handle emergency or stressful situations. Much of the work involves record-keeping, so typing is essential. There are no college requirements for these positions, but a person who has experience/knowledge in business administration, medical technology, psychology, and sociology is better qualified. Training is acquired on the job. An experienced hospital admitting clerk may advance to the position of admitting officer. In some hospitals, nurses are employed as admitting officers.

Outlook

Employment in this area is expected to grow as population increases. Also, with a larger proportion of elderly persons, there will be a greater need for hospital care.

Areas of Employment

- . hospitals
- . rehabilitation centers
- . extended care facilities

6. Health Administration, Clerical and Support Services

Executive Housekeeper

187.167-046

One of the most important aspects of good patient care in hospitals is a safe, sanitary environment. Just the appearance of cleanliness is not enough. Hospitals must be aseptically clean. For example, patients recovering from surgery and premature infants are highly susceptible to infection and must be protected from any possible exposure to germs. Maintaining the high standards of cleanliness required by hospitals is the responsibility of the execu-

tive housekeeper and staff.

Executive housekeepers of large hospitals may supervise a housekeeping department with a staff of over 100. He/She must therefore be a good administrator, directing and scheduling activities so that the hospital is efficiently maintained. Responsibilities also include ordering cleaning supplies and equipment, analyzing work procedures, instructing the staff and accounting. The executive housekeeper needs to keep up-to-date on new cleaning chemicals, equipment, and techniques. Knowledge of the scientific principles of cleaning procedures, labor laws and safety regulations are also important.

Personal Qualifications and Training

Organizational, business, and problem solving skills are needed for this position. In the past, executive housekeepers advanced through promotions within the department. There is now an increasing trend to hire executive housekeepers with a college degree and a year of internship in the field. It has become recognized that formal education better prepares one for the diverse demands of this management position. A number of universities offer degrees in institutional housekeeping management.

Outlook

Growth in public facilities such as hospitals, hotels, resorts, schools, dormitories, etc. provide opportunities for qualified personnel.

Areas of Employment

- . hospitals
- . hotels
- . resorts
- . schools
- . nursing homes

Schools in New Jersey

Burlington County College
Pemberton, New Jersey 08068

For Additional Information

The National Executive
Housekeepers Association
414 Second Avenue
Gallipolis, Ohio 45631

6. Health Administration, Clerical and Support Services

245.137-010 Health Care Manager
(Ward Supervisor, Unit Manager)

245.362-014 Unit or Ward Clerk

The care of patients in a hospital/health care facility depends upon a variety of support activities that are of a nonmedical nature. Examples of such activities include organizing work schedules; delivering and receiving messages and supplies; assembling charts and recording routine information; ordering supplies; organizing the work area; receiving and assisting visitors; and filling

patient requests on nonmedical matters. Administrative and clerical personnel perform these functions and increasingly have been given duties of greater responsibility, especially those which require business and supervisory skills. Their work frees the nursing and technical health care staff from the daily routine administrative activities and allows them to attend to the medical aspects of patient care.

Depending on the level of duties, these workers come under different job titles. A unit or ward clerk handles the routine clerical and reception work. A health care manager, ward supervisor or unit manager supervises and coordinates the administrative functions of one or more patient care units.

Personal Qualifications and Training

Dependability, neatness in work and appearance, a pleasing personality, and efficiency are useful qualities for this work. Most personnel in this position are high school graduates who receive training on the job. Two-year associate degree programs for health care managers are offered by a number of community colleges. Graduates of these programs are qualified for positions of greater responsibility.

Outlook

With the increase in use of health care services, there is a growing trend to hire nontechnical personnel to assume more of the clerical and managerial functions. The expansion of formal training programs is indicative of the need for more skilled staff to perform higher level functions, such as supervising ward activities. Job opportunities in this areas are expected to remain high.

Areas of Employment

- . hospitals
- . health care facilities
- . nursing homes

Schools in New Jersey

Essex County College
Newark, New Jersey 07102

Union County Technical Institute
Scotch Plains, New Jersey 07076

For Additional Information

American Health Care Association
1200 15th Street, NW
Washington, D.C. 20005

6. Health Administration, Clerical and Support Services

Medical Assistant

079.367-010

In a solo or a small group practice, a medical assistant is a person of many trades. The duties are varied, ranging from secretarial and office management to assisting the physician in clinical activities. Office duties include scheduling patient appointments, typing medical reports, processing insurance claims, and bookkeeping. On the more technical side, duties may include preparing patients for

examination or treatment, taking temperature and blood pressure measurements, preparing instruments, performing simple laboratory tests, and providing patient care under the doctor's supervision.

In larger group practices or clinics, duties are usually divided among several assistants. Some assistants may specialize in secretarial responsibilities while others concentrate on clinical responsibilities. With the help of medical assistants, doctors and nurses can devote more time to patient care and serve more patients.

Personal Qualifications and Training

The ability to work and communicate well with the public and to work efficiently and accurately are useful traits for this position. Being adaptable and dependable are particularly important when working for a doctor who practices alone. In the past, persons with secretarial skills gained their experience in medical assisting on the job. Today, physicians prefer to hire graduates from a certificate, diploma or associate degree program. The reason is because of the increasingly complex nature of the work, such as filling out insurance forms and using laboratory equipment. These programs range from approximately seven months to two years. Certification is awarded by the American Association of Medical Assistants after candidates pass its examination.

Outlook

Trained medical assistants rarely have difficulty finding a position. Job prospects continue to look good in the future. Every practicing physician needs at least one or more assistant.

Areas of Employment

- . physician's office
- . clinics
- . group practices

Schools in New Jersey

Atlantic Community College
Mays Landing, New Jersey 08330

Bergen Community College
Paramus, New Jersey 07652

Burlington Community College
Pemberton, New Jersey 08068

The Bryman School
East Brunswick, New Jersey 08816

Camden County Vocational/Technical
School
Sicklerville, New Jersey 08081

Cape May County Vocational/
Technical School
Cape May Court House, New Jersey
08210

Essex County Vocational Technical
School
Newark, New Jersey 07017

Hudson County Community College
Commission
North Bergen, New Jersey 07047

Hudson County Vocational Technical
School
North Bergen, New Jersey 07047

Institute for Advancement of
Medical Science
Cherry Hill, New Jersey 08034

Lyons Institute
Cherry Hill, New Jersey 98034

Mercer County Vocational/Technical
School
Trenton, New Jersey 08690

Salem Community College
Penns Grove, New Jersey 08069

Salem County Vocational/Technical
School
Woodstown, New Jersey 08098

Union County Technical Institute
Scotch Plains, New Jersey 07076

For Additional Information

American Association of Medical
Assistants
One East Wacker Drive, Suite 1510
Chicago, Illinois 60601

6. Health Administration, Clerical and Support Services

201.362-014 Medical Secretary Dental Secretary

Medical and dental secretaries who work for physicians and dentists in private practice provide the services necessary to keep the office and practice operating efficiently. Their organizational skills in scheduling patients, maintaining case histories, and processing reports and bills enable doctors to attend to the medical/dental needs of the patients. In addition to the typical secretarial skills, medical/dental secretaries need a knowledge of medical/dental terms as well as insight into health problems. Records must be accurately maintained so that patients receive proper treatment. As persons who receive the patient or answer the phone, medical/dental secretaries must be aware of medical situations that require immediate attention. Their responsibilities can be quite extensive depending on the size of the practice, other personnel on staff, and needs of the doctor.



Medical/dental secretaries are also employed in hospitals and other health care facilities. In larger organizations the functions may be more specialized than in a solo practice office where one tends to perform a wide range of tasks.

Personal Qualifications and Training

A medical/dental secretary is usually the initial person patients meet at a doctor's office and should have a pleasing personality and neat appearance. Patients frequently are under stress or pain and need to feel confident about the care they will receive, as well as be made to feel comfortable. The ability to follow directions and work efficiently, managing skills, good common sense, patience, and tact are all qualities important to the employer. Although a high school diploma and secretarial skills are the usual requirements, employers prefer to hire persons with some formal training in medical/dental secretarial work. Formal training courses that lead to a diploma, certificate or associate degree are offered by vocational-technical schools and community colleges. Useful courses in high school include English, biology, chemistry, and health, as well as courses that promote communications skills and public relations.

Outlook

As the number of doctors and health care facilities increase, so too will job opportunities for medical/dental secretaries. Also, the widespread subscription to health insurance plans has greatly increased the amount of paperwork, requiring additional office personnel.

Areas of Employment

- . doctors' offices
- . hospitals
- . extended care facilities
- . clinics
- . health agencies

Schools in New Jersey

Bryman School
East Brunswick, New Jersey 08816

Burlington County College
Pemberton, New Jersey 08068

Dover Business School
Dover, New Jersey 07801

Essex County College
Newark, New Jersey 07102

Middlesex County Vocational/
Technical School
East Brunswick, New Jersey 08816

Roberts-Walsh Business School
East Orange, New Jersey 07017

6. Health Administration, Clerical and Support Services

Medical Record Administrator

079.167-014

For every hospital patient who receives medical services, a detailed medical record is maintained. The record contains information on the patient's medical history, the illness/injury, X-rays, lab reports, treatment and

medication. The medical record administrator is responsible for maintaining those records and developing the plans and methods for storing and retrieving that information. The records are important not only for keeping track of patients, but for evaluating the hospital's performance, studying the treatment of disease, and future planning. Therefore, statistical analysis of data is another important function.

Personal Qualifications and Training

Since the work revolves around the gathering and organizing of information, the ability to work accurately and alertness to detail are important for this work. Also, as an administrator, one must work well with people and have abilities in planning and management. A background and interest in business, mathematics and the sciences is advantageous.

Specialized college programs that lead to a degree in medical record administration are available at a number of colleges and universities. These are four-year programs, but a person with a bachelor's degree with prerequisite requirements may qualify for a one-year certificate program. Medical record administrators are registered by the American Medical Record Association after passing their examination.

Outlook

Medical record keeping has grown and become more complex and extensive because of increased number of patients, government regulations, research needs and insurance requirements. Therefore, job prospects are good for well-qualified persons, especially in larger institutions. There are increasing needs for experienced people to work as consultants in outpatient clinics, community health centers and health maintenance organizations to design and develop information systems.

Areas of Employment

- . hospitals
- . clinics
- . health maintenance organizations
- . nursing homes
- . insurance companies

Schools in the Nearby Area

Temple University
Philadelphia, Pennsylvania 19122

For Additional Information

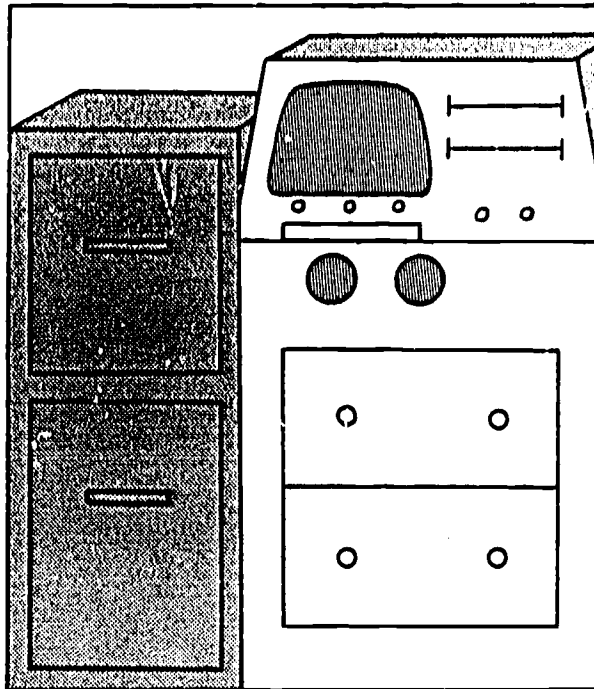
American Medical Record
Association
875 North Michigan Avenue
Suite 1850
Chicago, Illinois 60611

6. Health Administration, Clerical and Support Services

Medical Record Technician

079.367-014

Maintaining the medical information system is the function of medical record technicians. In larger institutions, they work under the supervision of a medical record administrator. In a small hospital or clinic, the medical records department may be headed by an experienced medical record technician. Duties include transcribing medical reports, analysis and coding of information, maintaining registries, reviewing and updating records and compiling statistics. The medical information is used by different health personnel in a variety of ways. Therefore, the technician must be knowledgeable about the cataloging, storing, and retrieval of that information.



As the practice of medicine and health care delivery has become more sophisticated, the work of medical record technicians has become more technical. Hence, employers prefer to hire applicants with formal training and knowledge of medical terminology and practices.

Personal Qualifications and Training

Accuracy, attention to detail, and analytical abilities are important assets for this type of work. High school courses in biology, mathematics and office practice are useful. Two-year associate degree programs or ten-month certificate programs in medical record technology are offered by a number of colleges and schools. Graduates from accredited programs may take a registry examination given by the American Medical Record Associates to be recognized as an Accredited Record Technician.

Outlook

The demand for medical record technicians is expected to grow as patient numbers grow and requirements for information, such as for insurance purposes, increase. Opportunities are more favorable for people with associate degrees in this specialty.

Schools in New Jersey

Union County Technical Institute
Scotch Plains, New Jersey 07076

Hudson County Community College
North Bergen, New Jersey 07047

Camden County College
Blackwood, New Jersey 08012

For Areas of Employment and
Additional Information see

MEDICAL RECORD ADMINISTRATOR

Medical Record Clerk

245.362-010

Medical record clerks perform more of the clerical functions of the medical records department--filing, typing, transcribing and assembling information. They work under the supervision of the medical record administrator and/or medical record technician. This is an entry level position that requires a high school diploma and secretarial skills. Training is on the job. With experience and some additional formal training, medical record clerks may advance to the position of medical record technician.

7. Health Education and Community Services

Environmental Health Technician
(Pollution Control Technician)
(Industrial Hygiene Technician)

Occupational Health and Safety Professionals
Industrial Hygienist
Safety Engineer
Occupational Health and Safety Engineer

Public Health Educator

Sanitarian
(Public Health Sanitarian)
(Environmentalist)

Vocational Rehabilitation Counselor

7. Health Education and Community Services

Environmental Health Technician
029.261-014
(Pollution Control Technician)
(Industrial Hygiene Technician)

This group of health technicians comes under different job titles depending on their area of work. They may work as a member of the industrial health team or assist environmental health engineers. They do much of the field work and laboratory testing of environmental pollutants found in air, water, soil, and food. Laboratory analysis of materials involves chemical, bacteriological, physical or microscopic tests, and

the use of a variety of analytical and quantitative instrumentation. Field investigations may include collecting water samples from rivers and streams or water treatment plants, collecting emissions from smoke stacks, setting up equipment to monitor air quality, or collecting data for research studies. Working with engineers, they investigate conditions of water supply facilities, food production plants, or manufacturing plants, and prescribe methods to improve or control the situation. Part of the work therefore includes writing reports and communicating ideas to others. These activities help to protect the public from substances in the environment that may endanger health.

Personal Qualifications and Training

A keen sense of observation, patience, and mechanical abilities are important qualities. A large part of the work requires the installation, operation, and maintenance of testing instruments. In addition, one should have skills in analyzing and interpreting information and be able to communicate effectively, verbally and in writing. Some jobs may involve extensive time outdoors, so preference for travel and outdoor work may be important. Useful high school courses include the social sciences as well as biology, chemistry, physics, and mathematics. Associate degree programs in public health inspection technologies, environmental health technologies, and industrial hygiene technologies are being developed and offered by community colleges. Since this is a relatively new field, many technicians currently employed have two years of community college or technical school education in related areas that include courses in the social, physical, and biological sciences.

Outlook

Concern for protecting the environment and public health, and new research evidence linking pollutants to disease, has created a high demand for trained technicians in this field. This field has grown appreciably in recent years and is expected to continue.

Areas of Employment

- . industry
- . governmental health agencies
- . government regulatory agencies
- . research facilities
- . manufacturing plants
- . food service establishments

For Additional Information

New Jersey Department of Public
Health
Trenton, New Jersey 08825

Schools in New Jersey

Middlesex County College
Edison, New Jersey 08817

Salem County College
Penns Grove, New Jersey 08069

Somerset County College
Somerville, New Jersey 08873

7. Health Education and Community Services

Occupational Health and Safety
 Professionals
 079.161-010 Industrial Hygienist
 012.061-014 Safety Engineer
 168.167-062 Occupational Health and
 Safety Engineer

Health and safety of employees in the workplace is a major concern of industry, government agencies, and insurance companies. It is estimated that 100,000 Americans die each year from work-related illnesses. In 1978, there were 2.2 million workplace injuries of a disabling nature; among those, 80,000 were permanent disabilities. Work-related accidents resulted in 13,000 deaths. These numbers highlight the need to reduce accidents and illness, identify sources of hazards and potential disease-causing agents, and develop new techniques for detecting environmental threats to health.

One area of special concern is that of controlling toxic materials that cause chronic illnesses, such as lung diseases and cancer, a disease that frequently does not show up for many years (often years after an employee has left the job). Asbestos, benzene, and coal dust, for example, have made media headlines and have been named in court suits instigated by disabled workers or surviving relatives. Some of these health risks were previously unknown and have come to recent attention only because of improved detection methods and extensive research.

Also, concern for a safer work environment has led to the establishment of new regulations, safety procedures, and monitoring systems.

Perhaps the landmark event is the passage of the Occupational Safety and Health Act in 1970. A number of new jobs have been created to insure that health and safety standards are met. They involve the evaluation of the workplace and helping to eliminate hazardous conditions.

Industrial Hygienists are concerned with industrial hazards, such as air and noise pollution and radiation, and work to eliminate conditions that create health risks. Their work will vary depending on their employer -- industry or government agency. Some duties may include: conducting programs to enhance safety or prevent disease; collecting samples of dust, vapors or chemicals for testing; checking for safety of equipment, lighting, or ventilation systems; testing for noise levels that may cause hearing loss; checking levels of radiation exposure; instructing employees on safety procedures; and working with engineers and occupational physicians to develop procedures or control measures to improve the work environment.

Safety Engineers focus on the machinery and equipment used in the workplace and manufacturing processes. They utilize knowledge from various disciplines that include engineering, chemistry, psychology, and industrial health and safety laws. Their task is to develop and implement safety programs to prevent accidents. By understanding the machinery, how they are to be used, and the way workers do the job, safety engineers can then determine methods to reduce hazards. They may recommend modifications of equipment or addition of safety guards. They also conduct studies of accidents and suggest changes in work procedures or placement of equipment. Some of their duties include worker education, teaching safety precautions, and creating awareness of potential dangers.

Occupational Health and Safety Engineers are employed by government agencies to inspect places of employment to insure that government standards are met. They examine the work environment, machinery, and equipment to determine that conditions are safe and do not endanger health. An inspection tour may include interviews with employers and employees, observing the work process

and examining injury reports. They may propose new work methods or suggest corrective measures. Employers who fail to meet standards are subject to penalties or law suits. These engineers very frequently specialize in inspecting particular types of equipment or machinery or conduct inspection in specific areas, such as transportation, mining, construction, etc.

Personal Qualifications and Training

This type of work requires persons who have a keen sense of observation and are good problem solvers. Since people tend to be suspicious or hostile toward those who monitor their work, occupational health and safety professionals should be able to work and communicate well with people and display tact and patience. Preparation for these jobs will vary depending on the industry and the employers. A bachelor's degree in engineering, biology, chemistry, occupational health and safety, radiation safety, or industrial hygiene are usually a prerequisite. Some positions may require a specialized graduate degree. Positions with government agencies may also require passing an examination.

Outlook

With increased awareness of the importance of good health and safety practices, laws and court decisions that place responsibility on employers to protect workers from hazards, and productivity and monetary loss resulting from injuries and illnesses, job opportunities in this field are good. Most job openings are located in industrial centers and large cities. The rate of growth of this relatively small field will also depend on future regulations and the degree to which government pursues enforcement.

Areas of Employment

- . industry
- . government agencies
- . insurance companies
- . manufacturing associations

Schools in Nearby Area

(undergraduate degree programs in Industrial Hygiene)

Johns Hopkins University
Baltimore, Maryland 21250

Quinnipiac College
Hamden, Connecticut 06518

For Additional Information

American Industrial Hygiene
Association
475 Wolf Ledger Parkway
Akron, Ohio 44311

American Society of Safety
Engineers
850 Busse Highway
Park Ridge, Illinois 60068

Environmental Management
Association
1701 Drew Street
Clearwater Park, Florida 33515

7. Health Education and Community Services

Public Health Educator

079.117-014

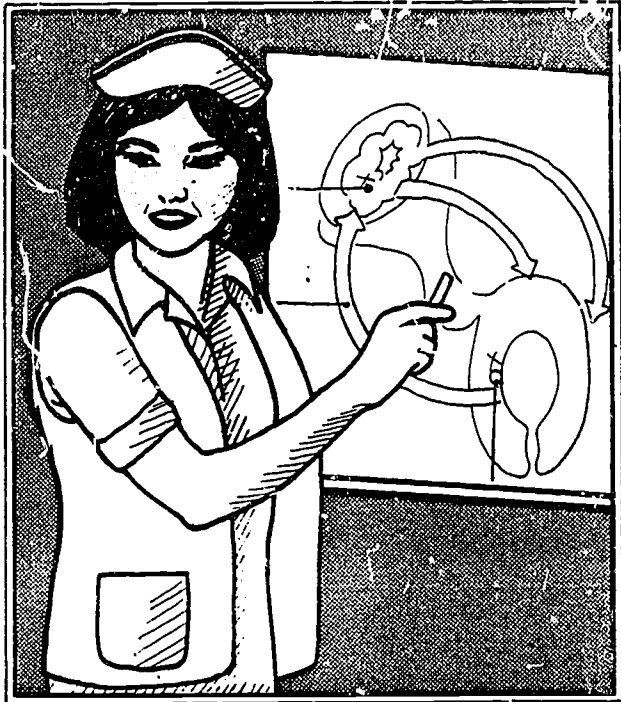
Although the idea of preventive health care is not new, there is today even greater emphasis on prevention. Enormous benefits result when people are more knowledgeable about maintaining good personal health and seek early treatment of disease before it becomes acute. Especially with the steep rise in medical care costs, good health is related to the country's economy both in worker productivity and money saved.

Public health educators are responsible for educating all segments of the community in matters that concern health and safety. They develop and present health education programs for community groups, industry, and businesses. They conduct research and survey the health needs of the community and determine the kinds of health problems that need to be addressed. Such information is used to guide the establishment of programs to meet those special needs. They may help to coordinate the various health related activities between professional organizations, civic groups, and health agencies.

The work also involves preparation of materials for presentations, distributing health information pamphlets and employing various communication media to convey information to the public. Some health problems may be unique to an area so public health educators need to develop an in-depth understanding of the environment and people they serve. Often they may need to alert the public about health hazards or dispel fears created by misinformation or misinterpretation of scientific/medical information.

Personal Qualifications and Training

Work in this area requires the combined skills of teaching, leadership and communications, and public health knowledge. An interest in working with people and concern for good health are also important qualities. High school courses in the sciences, health, and communications are good preparation. A bachelor's degree in community health education is a minimum requirement, but a master's degree is preferred for many positions.



Outlook

This small field has expanded rapidly in recent years and reflects the growing importance of health education. The need for qualified health educators is expected to increase.

Areas of Employment

- . federal, state or local health agencies
- . voluntary health agencies
- . health planning agencies
- . schools and colleges
- . hospitals
- . clinics
- . industries

For Additional Information

Society for Public Health
Education
703 Market Street
San Francisco, California 94103

Schools in New Jersey

Rutgers - The State University of
New Jersey
College of Arts and Sciences
Newark, New Jersey 07103

Cook College
New Brunswick, New Jersey 08903

Livingston College
New Brunswick, New Jersey 08903

Stockton State College
Pomona, New Jersey 08240

William Paterson College
Wayne, New Jersey 07470

7. Health Education and Community Services

Sanitarian

079.117-018

(Public Health Sanitarian)

(Environmentalist)

Sanitarians are concerned with the quality of the air we breathe, water we drink, and food we eat. They design and implement plans and methods to insure that pollutants in the environment do not jeopardize the public's health. A major part of their work entails investigations of water supplies, sewage treatment facilities, garbage disposal, food service facilities, and food processing plants. They inspect places that serve the public such as restaurants, hotels, and motels to make sure that established health standards are maintained. Signs of cockroaches or

rodents in a restaurant, for example, are indicators of unsanitary conditions and a potential source of disease. Places which serve large numbers of people, such as schools and institutions, need to be frequently checked for possible sources of health problems.

Other aspects of a sanitarian's work involves educating the public in the maintenance of a healthy environment and helping people solve poor sanitation problems. If a food processing plant does not meet health codes, the sanitarian may help the operator identify the source of the problem and develop plans to improve conditions. They also serve as a member of a public health team to study ways to control or prevent disease by gathering and analyzing data.

Personal Qualifications and Training

Good observational and problem solving skills and working well with people are important for work in this area. Strong interest and proficiency in the sciences and public health are also necessary. High school preparation should include courses in the sciences, mathematics, and the social sciences. A bachelor of science degree in biology, chemistry, environmental science, or public health is prerequisite for beginning positions. Some positions require a master's degree in environmental health. Sanitarians in New Jersey must be licensed.

Outlook

The job outlook in this field is good. Increased opportunities in this area will be associated with population growth and government's regulation of sanitary standards. Establishment of new regulations and health standards require additional personnel to insure that these laws and regulations are adhered to. Also, advances in scientific knowledge have brought to attention new public health concerns as well as new methods to solve those problems. These factors all contribute to the growth of this profession.

Areas of Employment

- . federal, state and local health departments
- . food products manufacturers and processors

For Additional Information

National Environmental Health Association
1200 Lincoln Street
Denver, Colorado 80203

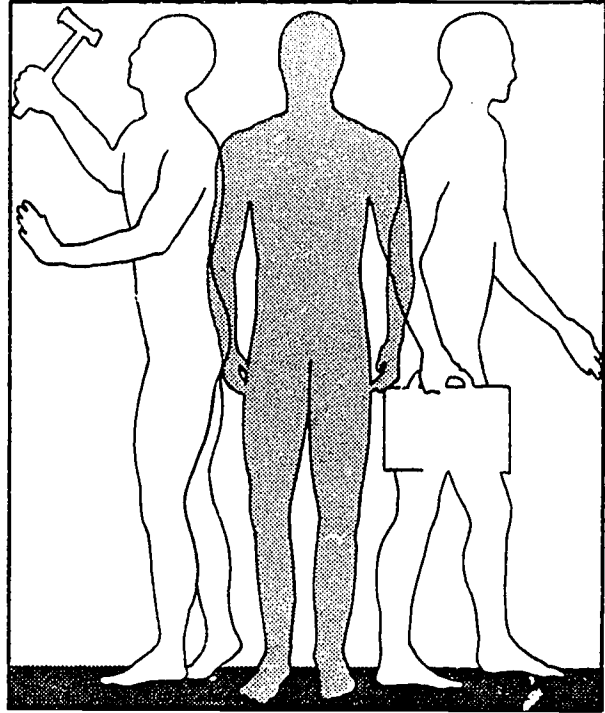
Environmental Management Association
1701 Drew Street
Clearwater, Florida 33515

7. Health Education and Community Services -

Vocational Rehabilitation Counselor

045.107-042

Our sense of worth and feeling that we are active members of society is linked to our ability to work. For the disabled, rehabilitation goes beyond recovering from, or compensating for, the results of illness or accident. It extends to doing useful and meaningful work and living as normal a life as possible. Vocational rehabilitation counselors play a vital role in assisting the physically or mentally disabled enter or re-enter the world of work.



A vocational rehabilitation counselor begins by determining the extent of the client's disabilities, his/her interests, and what he/she can do. The evaluation includes interviews with the client and the client's health care team, and a variety of aptitude and interest tests. Then the counselor matches available jobs with the client's interests and abilities. Often training or retraining is required and arranged accordingly. Clients may also need counseling to help them adjust to their jobs. In addition to counseling clients, the counselor works with businesses in the community to interest and encourage them to employ the disabled. In many instances, the community needs to be educated about the benefits derived from helping the disabled become more self-sufficient and the ways in which it can support those efforts. Hence, public relations is another role of the counselor.

Personal Qualifications and Training

Understanding of people and communicating well, patience, and leadership qualities, are important for a career in rehabilitation counseling.

One should plan a well-rounded program of college preparatory courses in high school. One may enter this occupation with a bachelor's degree in psychology or sociology. However, a master's degree in vocational rehabilitation counseling is preferred by most employers. Positions of greater responsibility and advancement opportunities depend on a graduate degree. The National Commission on Rehabilitation Counselor Certification certifies counselors who pass the certification exam.

Outlook

This occupation has expanded rapidly in the past decade. The growth is related to: 1) the public's increased concern for the disabled and helping them gain greater independence, and 2) government financing or rehabilitation programs. The trend is expected to continue in the future although the increase may not be quite as rapid as in the past. Nonetheless, more jobs are available than there are trained personnel.

Areas of Employment

- . state and federal agencies
- . rehabilitation centers
- . hospitals
- . public schools

Schools in New Jersey

(Graduate Training Programs)

Seton Hall University
South Orange, New Jersey 07074

For Additional Information

American Rehabilitation Counseling
Association
1605 New Hampshire Avenue, NW
Washington, D.C. 20009

National Rehabilitation Counseling
Association
1522 K Street, NW
Washington, D.C. 20005

8. Information and Communication Services

Biological Photographer
(Biomedical Photographer)

Medical Communications Scientist
(Medical Communications Specialist)
(Science and Technical Writers)
(Health Information Specialist)

Medical Illustrator
(Biomedical Illustrator)

Medical Librarian
(Health Science Librarian)

8. Information and Communication Services

Biological Photographer

(Biomedical Photographer)

143.362-010

Still photographs and motion pictures are used in a variety of different ways in the health care field. Photographs of microscopic cells are used in diagnosis of disease or teaching. Motion pictures of tissue growth are used in research. Pictures taken at high speed or with infrared light enable investigators to "see" and record reaction or phenomena invisible to the unaided eye. More familiar to us are films, slides,

and photographs used in training and classroom demonstrations.

Biological photographers prepare and produce the many different types of communication and information materials in health care and the health sciences. Their work may extend from working with researchers on experimental projects to planning and directing the production of audiovisual programs for public information purposes. Biological photographers frequently specialize in particular areas such as: photography of disorders and injuries of the eye; photography of microscopic objects; production of motion pictures on medical topics; or photography of surgical procedures.

Personal Qualifications and Training

Biological photography offers an opportunity to apply one's talents in photography in health care communications. In addition to photography, one should be knowledgeable in the sciences and communication techniques. Personal qualities should include observation skills, patience and the ability to interact well with others. Most biological photographers have entered the field through on-the-job training. As the work requires an amount of specialized knowledge, a number of programs have been established that offer associate degrees or bachelors' degrees in biological photographic communications. Biological photographers who pass a certifying exam are certified by the Biological Photographic Association.

Outlook

The employment of biological photographers has increased as the health care field has expanded. In addition to technical education materials, there is an increased emphasis on providing information to the public. The public, in general, is better educated, desires to be more informed about advances in medicine, and has a greater interest in personal health care. Photographers with specialized biomedical experience are expected to have good opportunities in these times when knowledge is advancing at a rapid rate and where information needs to be continuously updated. Moreover, advances in photography have extended its application in a greater number of different teaching and research settings.

Areas of Employment

- . hospitals
- . clinics
- . medical schools
- . research institutes
- . graphic arts production companies
- . pharmaceutical firms
- . textbook publishers

Schools in the Nearby Area

Germain School of Photography
New York, New York

Rochester Institute of Technology
Rochester, New York

West Pennsylvania Hospital
Pittsburgh, Pennsylvania 62901

For Additional Information:

Biological Photographic
Association
Box 2603, West Durham Station
Durham, North Carolina 27705

8. Information and Communication Services

Medical Communications Scientist (Medical Communications Specialist) (Science and Technical Writers) (Health Information Specialist)

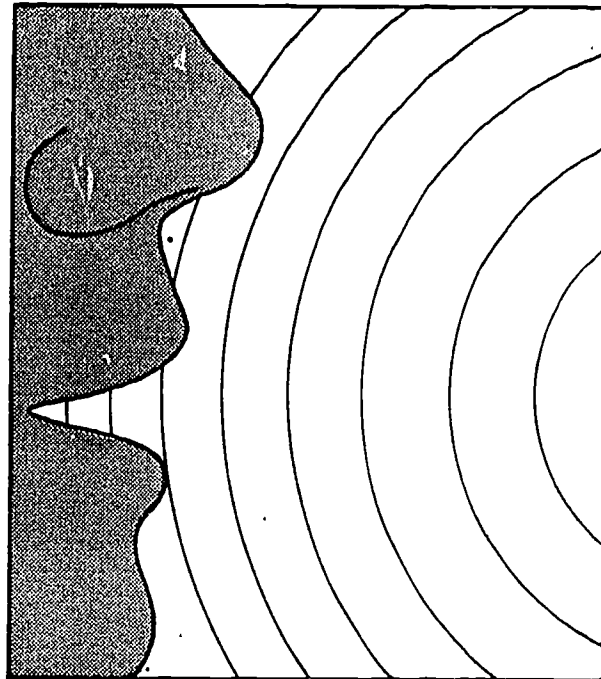
Medical communications scientists employ the various communications channels -- journals, newspapers, magazines, radio, television, film, and exhibits -- to provide information to health educators, health care professionals, and the public. They report on new developments in medical research or health care delivery. They develop materials describing the services of a hospital or clinic or produce instructional programs on new treatment procedures. The type of communications medium they use and the subject matter depends on their

particular work setting and the information to be conveyed. As translators and transmitters of information, they work closely with health care professionals to gain knowledge of the topic and develop the presentation strategy.

Some medical communications scientists specialize in producing materials and scripts for audiovisual programs, while others specialize in the writing of materials for print publications. Depending on their specialization and the nature of their work, they may be classified as technical or science writers or health information specialists. Technical writers, for example, write for health professionals, presenting articles and reports on new scientific and technical developments. Science writers, on the other hand, write on the same topics but focus the presentation for the general public. Health information specialists are employed by health organizations to inform the public about the organization's services as well as its accomplishments. The information may be presented in a pamphlet or as a television special.

Personal Qualifications and Training

The ability to write and speak effectively is critical for this profession. Moreover, one should be skilled in the analysis and synthesis of new information and understand the audience to be addressed. Medical communications is a relatively new field, and persons who work in it have come from a variety of backgrounds, with degrees in English, journalism, the sciences, communications, or a combination of several areas. More recently, programs have been established that lead specifically to a bachelor's degree in medical communications.



Outlook

Medical communications is an emerging field and is expected to expand significantly in the future. Persons with a strong technical background and creative in the use of communications techniques and media should be in high demand. The demand is related to the growth of information and the need for effective training materials in health care education, continuing education materials for personnel in the field, and keeping the public informed. Also, improvements in health care and delivery systems will depend upon the transfer of knowledge gained from research to practitioners who apply that knowledge.

Areas of Employment

- . hospitals
- . health care facilities
- . medical schools
- . health organizations
- . public agencies
- . publishing houses
- . news media

Schools in New Jersey

Stockton State College
Pomona, New Jersey 08240

For Additional Information

American Medical Writers
Association
5275 River Road
Bethesda, Maryland 20016

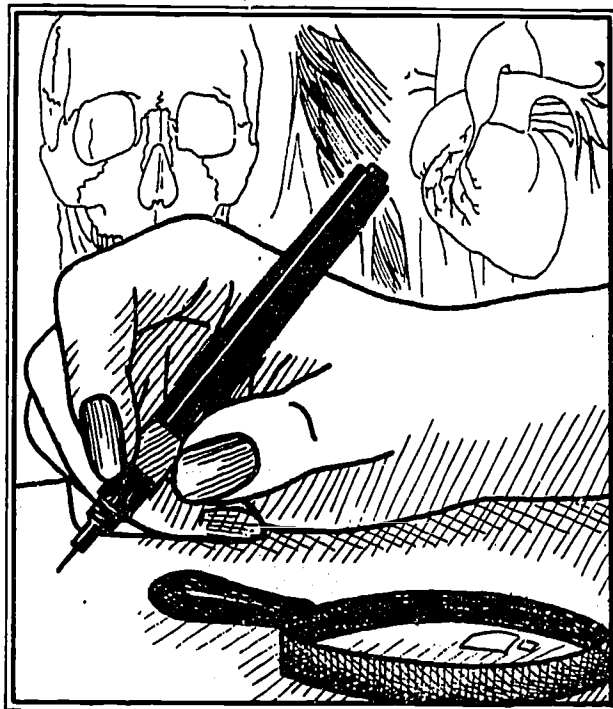
Health Sciences Communications
Association
2343 N. 115th Street
Wauwatosa, Wisconsin 53226

8. Information and Communication Services

Medical Illustrator (Biomedical Illustrator)

141.061-026

Medical illustrators help the medical and health care community communicate their ideas through artwork. They work with physicians, research scientists, medical educators, and writers to produce drawings, illustrations, models, and audiovisual materials. Their artwork may be found in research journals, medical texts, public information publications, television shows, exhibits, and other types of medical and health education materials. Because scientific concepts are often complex and intricate, visual presentations are especially useful, if not necessary, for conveying the information.



Medical illustrators play an important role in the education of both the scientific community and general public. With health care personnel requiring higher levels of training and the expansion of continuing medical education programs, the demand for medical illustrators has increased. Also, with advances in educational technology such as in the audiovisual area (filmstrips, video disks and tapes, etc.), visual presentations are being applied in new and different ways.

Medical illustration offers a unique opportunity to combine one's artistic and creative skills with an interest in science and medicine.

Personal Qualifications and Training

Artistic abilities, especially drawing, and observation skills, are the basic qualifications for this profession. In addition, a good scientific background with an emphasis in biology is important. Programs in medical illustration are offered by a small number of medical schools and are four to five years in length. Master's degree programs in medical illustration are also available.

Outlook

Although this is a relatively small profession, skilled medical illustrators are in high demand. The demand is related to the increased

educational needs of the health care community--training materials, textbooks, models and diagrams. Also, the services of medical illustrators are utilized in a wider variety of communication mediums. They work in full-time positions or as free lancers.

Areas of Employment

- . hospitals
- . clinics
- . medical schools
- . research institutes
- . graphic arts production companies
- . pharmaceutical firms

For Additional Information

Association of Medical Illustrators
5820 Wilshire Blvd.
Los Angeles, California 90026

Schools in the Nearby Area

Johns Hopkins School of Medicine
Dept. of Art as Applied in Medicine
Baltimore, Maryland 21205

Rochester Institute of Technology
College of Fine and Applied Arts
Rochester, New York 14623

University of Rochester
Division of Medical Education/
Communication
School of Medicine and Dentistry
Rochester, New York 14642

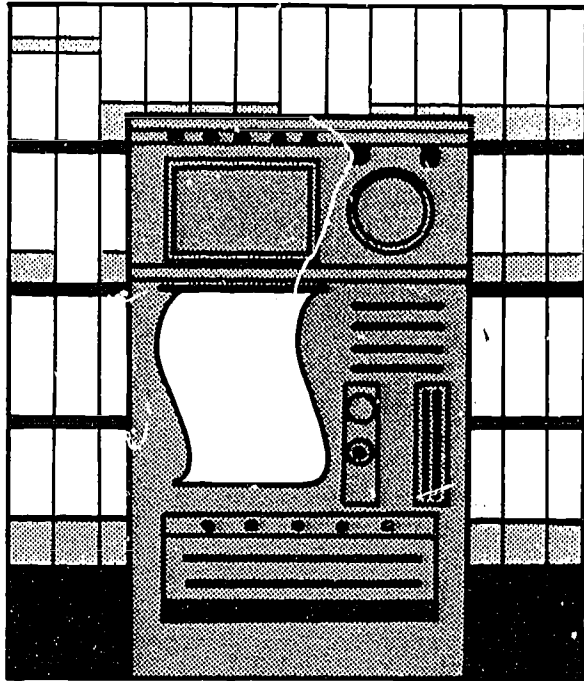
8. Information and Communication Services

Medical Librarian (Health Science Librarian)

100.167-022

Medical librarians are librarians who serve the health care community -- medical researchers, health professionals, students, etc. With the rapid proliferation of knowledge and new techniques for storing and accessing information, their role is critical to advancements in medicine and health care. They select and maintain materials used by health professionals in research, teaching, and up-dating their knowledge. Health science libraries are located in hospitals, medical schools, colleges, research and industrial institutions, and health agencies.

While most work with scientific and technical information, some provide for the reading needs of patients and are called patient librarians.



Medical librarians have additional training in hospital and medical librarianship so that they are able to provide specialized services to the library users. They may assist users in conducting literature searches, compiling bibliographies, reviewing materials or preparing abstracts. With the increased storage of information in computers, medical librarians are increasingly involved with computerized data bases and retrieval of information from the various sources.

A more recent role is that of clinical librarianship. Here the librarian works closely with physicians, accompanying them on rounds and conferences. Based upon the information from patients' charts and other sources, the librarian then obtains materials, such as medical journal articles, research studies, case histories, etc. for the physician to use in planning and conducting patients' treatment.

The duties of a medical librarian vary depending on the size of the library. In large libraries the personnel perform more specialized tasks. Some may concentrate in cataloging, indexing, or developing classification systems. Some may be involved in research, while others prepare reviews for information bulletins distributed to the institution's staff.

Personal Qualifications and Training

Similar to other librarians, medical librarians should enjoy working both with people and information. A sense of curiosity and organizational skills are also important. Since medical librarians work with scientific information, an interest and familiarity with the sciences and health care services are useful. Also, proficiency in a foreign language is an asset. Medical librarians usually have a master's degree in library science and take additional courses in hospital and medical librarianship, approved by the Medical Library Association. Certification is granted by the Medical Library Association.

Outlook

Among the various types of specialized librarians, the opportunities for medical librarians is perhaps the greatest. This is especially true for librarians with a strong scientific and technical background with experience in information retrieval and automation. The demand in this area is related to the growth of the health care field in general and the rapid rate of increase in scientific knowledge. Also, advances in medicine are dependent on the exchange of information and research findings.

Areas of Employment

- . hospitals and other health care facilities
- . colleges
- . universities
- . public health departments
- . insurance companies
- . pharmaceutical firms
- . research institutions

Schools in New Jersey

Rutgers - The State University of
New Jersey
New Brunswick, New Jersey 08903

For Additional Information

Medical Library Association
919 North Michigan Avenue
Chicago, Illinois 60611

9. Medical Instrumentation and Machine Operation Services

Biomedical Engineer
Clinical Engineer

Biomedical Equipment Technician
(Biomedical Engineering Technician)

Electrocardiograph Technician

Diagnostic Medical Sonographer
(Ultrasound Technologist)

Electroencephalographic Technologist and Technician

Dialysis Technician

Radiologic Technologist
(X-ray Technologist)

Respiratory Therapist
(Inhalation Therapist)

Respiratory Therapy Technician

9. Medical Instrumentation and Machine Operation Services

Biomedical Engineer

Clinical Engineer

019.061-010

Our rapid advances in medical diagnosis, treatment, and research are intimately linked to developments in biomedical engineering. Ultrasound equipment, cardiac pacemakers, artificial blood vessels, computerized laboratory testing instruments--all are products of engineering applied to medicine and biology. Biomedical engineering activities range from the design of medical instruments and artificial body parts to planning hospital facilities. Professionals in this field apply engineering principles and techniques to solve problems in medicine and biology. Biomedical engineers may work with surgeons to develop new surgical tools, or they may be employed by a drug company to design automated equipment. Some work with computers to develop monitoring systems, such as those used to monitor patients undergoing

surgery or to monitor astronauts in space flights.

Clinical engineers work in a hospital setting. They focus on improving the health care delivery system. Their work includes analyzing the equipment needs of the facility and how equipment can be best used so that services are performed efficiently and economically. For example, they may conduct studies to determine whether a new diagnostic machine should be purchased, weighing the factors of cost, safety and how patients and the hospital will benefit. They may be involved in redesigning or modifying equipment to meet the special needs of the hospital.

Biomedical and clinical engineers draw upon knowledge from different fields. These fields include chemistry, physics, biology and mathematics, as well as psychology and sociology. In this work, one must have a good understanding of engineering as well as medicine and be able to communicate effectively with people in the medical field.

Personal Qualifications and Training

Strong interests and abilities in the sciences and mathematics are important qualities for working in this field. In addition, good problem solving and communication skills are useful assets. Since biomedical engineering encompasses many disciplines, one's high school preparation should include the sciences, higher mathematics, English, history, and the social sciences. Typically persons enter graduate programs in biomedical engineering after completing a bachelor's degree in one of the engineering disciplines--chemical, civil, electrical, mechanical, aeronautical, or industrial. Some schools have now developed undergraduate degree programs in biomedical engineering. A few schools, including Rutgers, offer a combined Ph.D./M.D. degree program. The specialty area in which one intends to work will determine the type of training. For example, an engineer who develops artificial bone and joint parts is trained differently from one who develops information systems for medical record keeping.

Outlook

This small field has expanded very rapidly in the past few years. This growth is related to increases in health care needs and government support of research and development in biology and medicine. Also, modern hospitals today rely on the use of sophisticated instrumentation and need biomedical engineers to supervise the use and maintenance of such equipment. Whether this high rate of expansion will continue depends on a number of economic, political and social factors. Since many schools have recently established programs in biomedical engineering, significant numbers of graduates are now entering the field. Hence, competition may be keen. However, opportunities will vary depending on one's specialty area; some specialities may be in greater demand than others.

Areas of Employment

- . colleges and universities
- . hospitals
- . research laboratories
- . equipment manufacturers
- . pharmaceutical companies

For Additional Information

Alliance for Engineering in
Medicine and Biology
4405 East-West Highway
Bethesda, Maryland 20014

Biomedical Engineering Society
P.O. Box 2399
Culver City, California 90230

Schools in New Jersey

Fairleigh Dickinson University
Teaneck, New Jersey 07666

New Jersey Institute of Technology
Newark, New Jersey 07102

Rutgers - The State University of
New Jersey
New Brunswick, New Jersey 08903

Stevens Institute of Technology
Hoboken, New Jersey 07030

UMDNJ - Graduate School of
Biomedical Sciences
Newark, New Jersey 07102

9. Medical Instrumentation and Machine Operation Services

Biomedical Equipment Technician (Biomedical Engineering Technician)

019.261-010

719.261-010

Advances in medical treatments today have come about largely because of advances in the equipment used in research, diagnosis, monitoring, and treatment. Compared to hospitals 50 years ago, hospitals today may appear like a maze of sophisticated machinery. As with any other type of machinery, they must be serviced regularly to insure perfect performance. When human lives are at stake, it is all the more critical that the equipment is dependable. Biomedical equipment technicians--BMETs--are the personnel trained to install, repair, calibrate, and maintain medical equipment and instruments. In addition to servicing equipment, they are responsible for checking the proper use of the equipment so that the staff and patients are not exposed to safety or health hazards.

The type of equipment used by a facility will of course depend on its size and specialty. The work

of a BMET at a large hospital may be more specialized, such as working primarily with electronic equipment or X-ray equipment. At a small clinic the BMET may be responsible for all the equipment. Wherever the workplace, a BMET must be a good problem solver to find the source of the trouble and make the necessary adjustments or repairs, using hand or power tools and measuring devices. In addition to knowledge about biomedical equipment, BMETs need to have an understanding of medical terminology, human anatomy and physiology, and safety regulations. They are frequently called upon to modify equipment to suit the needs of the hospital or to provide advice on purchasing of new equipment.

Not all BMETs work in hospitals or health care centers or clinics. Some work for equipment manufacturers, sales companies, medical research organizations, or contract maintenance companies. Working for a sales company, for example, a BMET's role may be more that of an educator, instructing others on the function and use of the equipment. Working for a manufacturing company, a BMET may be involved in equipment design and production, as well as writing instruction manuals.

Personal Qualifications and Training

Interest and aptitude in electronics and math are important for this occupation. Good manual dexterity, working neatly and orderly, and attention to details are also highly desirable qualities. BMET training may be attained through one-year certificate or two-year associate degree programs offered by community colleges or technical institutes. Also, an associate degree in electronics technology with courses in biomedical equipment can qualify one for work in this field. Persons currently employed as electronic technicians can, with additional biomedical equipment course work, qualify to work as BMETs. BMETs who satisfy the training and work experience requirements and pass the examination may be certified by the Association for the Advancement of Medical Instrumentation.

Outlook

This is an expanding field with diverse opportunities. However, it has only been within the past decade that biomedical equipment technicians have been recognized as a distinct and separate profession. Formerly, the functions were performed by electronics technicians or medical equipment repairers. Because of the specialized and sophisticated nature of biomedical equipment today, as well as stricter hospital safety regulations, the need for persons especially trained in the area has been found to be essential. The demand for qualified personnel for this emerging field has been acute. Schools and colleges are just beginning to develop courses and programs.

Areas of Employment

- . hospitals
- . health care centers
- . manufacturing firms
- . sales and distribution firms
- . medical research organizations
- . government agencies

Schools in New Jersey

County College of Morris
Dover, New Jersey 07801

Middlesex County College
Edison, New Jersey 08817

For Additional Information

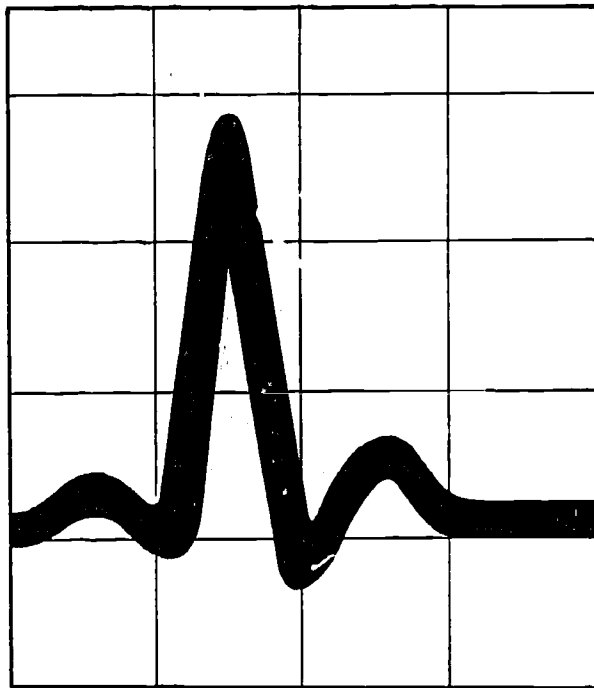
Society of Biomedical Equipment
Technicians
1901 North Fort Meyer Drive,
Suite 602
Arlington, Virginia 22209

9. Medical Instrumentation and Machine Operation Services

Electrocardiograph Technician

078.362-018

We are all familiar with doctors using the stethoscope to measure our heartbeat. Another and more sensitive method to examine heart activity is the electrocardiograph. Electrocardiograph (EKG) technicians are specially trained to operate this instrument and test patients. The instrument detects electrical changes that occur during a heartbeat and translates that information onto a graphic record that appears as line tracings on paper.



Electrocardiographic technicians must understand the equipment as well as the anatomy of the chest and heart. Because the instrument is so sensitive, it must measure accurately and provide reliable information for doctors to make proper diagnosis of heart abnormalities. A good electrocardiogram depends on technicians knowing where to correctly place the electrodes on the chest. EKG technicians must be able to detect possible errors in recording and make the necessary corrections or adjustments on the instrument. Some also operate other machines to obtain vectorcardiograms (three-dimensional traces), and phonocardiograms (recordings of heart valve sounds as blood flows through).

Personal Qualifications and Training

Mechanical abilities and attention to details are important traits for this occupation. Useful high school courses are biology, health, and typing. Most EKG technicians are trained on the job following high school graduation. This training may vary from one month to a year depending on the complexity of tests performed at the facility. Formal one- or two-year training programs are offered at a number of vocational schools and community colleges as well as the Armed Forces.

Outlook

This field is growing as health care services expand. Since heart disease is a major disease in this country, there is increased interest in preventative care and early diagnosis. As a result, the services of trained technicians are needed.

There are also opportunities for advancement to other technologist and supervisory levels. New developments in biomedical technology offer possibilities in operating more sophisticated instruments and performing new types of tests.

Areas of Employment

- . hospitals
- . offices of cardiologists

For Additional Information

American Hospital Association
840 North Lake Shore Drive
Chicago, Illinois 60611

9. Medical Instrumentation and Machine Operation Services

Diagnostic Medical Sonographer (Ultrasound Technologist)

078.364-010

The use of high frequency sound waves in medical diagnosis is relatively new but has grown rapidly. Sound waves are used to produce an image of internal body organs on a TV screen. Because the scanning procedure is simple, painless, and does not have the potential hazards of radiation, it is beginning to replace X-rays for diagnosing illnesses and injuries.

Diagnostic medical sonographers operate the equipment to produce the ultrasound pattern which is in turn converted into a

visual image or a paper printout for a permanent record. Also, photographs may be taken of the image on the screen to serve as a record. Operating this equipment requires specialized training in engineering as well as anatomy and physiology. In order to obtain an adequate image for physicians to make a diagnosis, one must be able to recognize body structures and scan the appropriate parts.

The technology of ultrasound has permitted physicians to perform delicate operations, such as on fetuses while still in utero. It guides physicians as they work allowing them to "see" what they are doing. In these operations, the technologist works closely with the other members of the health care team in planning the procedures and selecting the appropriate equipment to use.

Personal Qualifications and Training

An analytical mind, good problem solving skills and enjoyment of working both with machines and people are important qualities for this profession. A background in biology, physics, and mathematics is good preparation. At one time diagnostic medical sonographers were trained on the job. But the increasing complexity of the machines requires technologists with more extensive training. Two-year associate degree programs are offered by community colleges and a few universities offer a four-year bachelor's degree program. Sonographers are registered by the Society of Diagnostic Medical Sonographers.

Outlook

There has been a shortage of trained technologists in this field, and it is predicted that the demand will remain high. Until recently ultrasound technology has been used primarily in obstetrics. Now its use has expanded into most areas, and so the need for trained technologists is also expanding.

Areas of Employment

- . hospitals
- . related health care facilities
- . college teaching

Schools in the Nearby Area

State University of New York's
Downstate Medical Center
Brooklyn, New York 11203
(B.S. degree)

For Additional Information

Society of Diagnostic Medical
Sonographers
P.O. Box 31782
Dallas, Texas 75231

9. Medical Instrumentation and Machine Operation Services

Electroencephalographic Technologist and Technician 078.362-022

Among the various tests used to diagnose brain disorders (e.g., tumors, strokes, or head injuries), is the electroencephalogram. This test is a measurement of brain wave activity made by recording the electrical impulses from the brain. The record produced is a graphic tracing on paper.

To perform the test, the electroencephalographic (EEG) technician places small electrodes on the patient's scalp, operates the EEG machine, and monitors the tracing. As the test is in progress, the EEG technician must pay careful attention to the patient and how the machine is working. Electrical interferences from other sources may result in an inaccurate

record. The record and a written report are then submitted to the neurologist or electroencephalographer (a doctor who specializes in electroencephalography) who makes the diagnosis.

Because of the very sensitive nature of the test, the technician must have a good understanding of the instrument to properly select the controls as well as make necessary repairs. Life and death decisions often rest on EEG recordings, so EEG technicians must be alert to details and be able to detect possible problems with the equipment.

EEG technologists perform similar tasks. However, they have had more detailed training and experience and are more knowledgeable about the equipment and procedures. They also have administrative duties such as supervising the activities of the department and technicians and maintaining records.

Personal Qualifications and Training

Interest and ability to work with electronics, manual dexterity and good vision are important qualities for work in this area. One should also be able to respond quickly to emergencies. Biology, health, and mathematics courses in high school are good preparation. Most EEG technicians are trained on the job following high school graduation. Formal training which includes classroom instruction and laboratory work of one or two years is available through some hospitals, medical schools, or community colleges. As medical instrumentation becomes more complex and sophisticated, technicians will need more extended training. With work experience and additional training, EEG technicians advance to the technologist position. EEG technologists with at least one year of training and one year of experience may take a registration test given by the American Board of Registration of Electroencephalographic Technologists to become a registered EEG technologist.

Outlook

The demand for EEG technicians/technologists is expected to continue to expand. Advances in diagnostic procedures and instrumentation and an increasing population, requiring medical services, will create new job opportunities.

Areas of Employment

- . hospitals
- . offices of neurologists
or neurosurgeons

For Additional Information

American Hospital Association
840 North Lake Shore Drive
Chicago, Illinois 60611

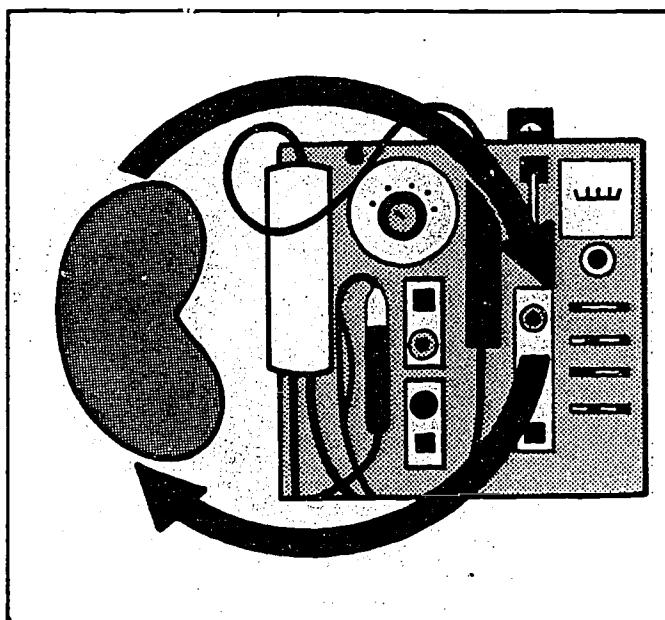
Council on Medical Education
(of the A.M.A.)
535 N. Dearborn Street
Chicago, Illinois 60610

9. Medical Instrumentation and Machine Operation Services

Dialysis Technician

078.362-014

The development of the artificial kidney machine has provided a life support system for persons suffering from kidney disease. Moreover, it has enabled them to lead a relatively normal life. Artificial kidneys, or dialysis machines, are like giant bathtubs designed to remove waste products from the blood. Several times a week patients are connected to the machines which circulate their blood through semipermeable membrane tubing. As the blood flows through, the metabolic waste products diffuse into the fluids surrounding the tubing. This "cleansing" of the blood requires four to six hours.



Dialysis technicians, working under a supervising nurse, prepare the patient for the dialysis and monitor the process. They also set up the machine, mix the solutions, and sterilize the equipment used. They must insure that the fluid is at the proper strength and temperature and that the equipment is functioning normally. Periodically they take readings of the patient's blood pressure and perform tests to determine the condition of the blood.

Personal Qualifications and Training

Alertness, good manual dexterity, and care to details are important traits for this work. Since patient care is a large part of the duties, dialysis technicians should be able to relate well to people. Many dialysis technicians are persons who have worked in the health care area, such as practical nurses or medics from the military. They receive the specialized training on the job, supervised by doctors and other experienced personnel. Persons who are high school graduates may qualify for the training programs offered at dialysis facilities. Training is approximately three months. A number of colleges offer certificate or associate degree programs. After one year of dialysis experience, they may take the certification examination offered by the Board of Nephology Examiners, Nursing and Technology to become a certified dialysis technician.

Outlook

Kidney dialysis is a relatively new type of treatment that has grown most rapidly during the past decade. Much of this has come about since 1972 when a law was enacted to provide for the cost of kidney dialysis and care of persons with end-stage renal disease. Dialysis facilities are expected to increase to serve the growing population. Also, as there are more elderly, the incidence of kidney problems will rise. Although new techniques have been developed for patients to perform dialysis at home, there remains a need for dialysis technicians to service those requiring in-patient and out-patient treatment.

Areas of Employment

- . hospitals
- . renal dialysis facilities

For Additional Information

American Association of Nephrology
Nurses and Technicians
6900 Grove Road
Park Ridge, Illinois 60068

Schools in New Jersey

Bergen Community College
Paramus, New Jersey 07652

9. Medical Instrumentation and Machine Operation Services

Radiologic Technologist

(X-ray Technologist)

078.362-026

Radiation has medical applications both as a diagnostic procedure and for treatment. Persons operating radiographic equipment for diagnosis are called radiographers. Radiation therapy technologists, on the other hand, operate machines that produce radiation for treatment purposes.

Radiographers

Many of us have at one time or another had X-rays taken for fractures, other injuries, or illness. Pictures are made with the use of ionizing radiation that passes through the body onto photographic film to produce an image of the internal structures. Radiographers, working under the supervision of the physician, prepare the patient, take the X-rays, and process the film. They must be knowledgeable about human anatomy in order to correctly position the body part to be examined and adjust the distance of the machine so a precise picture can be obtained. They must also be well versed on the principles of radiation and the equipment in order that the amount and length of exposure will produce a distinct radiograph. Physicians rely on good X-rays to make an accurate diagnosis. Because excessive radiation is potentially harmful, the machine must be

carefully controlled so that only a minimum amount of radiation is used. Also, unaffected parts of the patient's body must be shielded with lead coverings. Hence, much care is necessary in performing tasks associated with X-rays.

Radiation Therapy Technologist

A number of different forms of cancer can be successfully treated with radiation therapy. Radiation therapy technologists have the responsibility of administering the treatment. They work under the supervision of the physician (therapeutic radiologist or radiation oncologist). Operating equipment such as high-level energy linear accelerators and particle generators, they expose the area to be treated with ionizing radiation. The correct dosage must be precisely controlled and correctly delivered as prescribed. Because normal tissue can be easily damaged, the technologist must take every precaution to insure proper functioning of the machine to protect the patient, as well as the hospital staff. During the course of treatment, the patient must be carefully monitored for possible signs of adverse reactions.

Radiation therapy technologists work with patients who often are quite distressed about their condition. Technologists should possess a reassuring manner to help patients feel calm and comfortable during treatment.

Personal Qualifications and Training

A critical mind, good manual dexterity, and working well with the sick or injured are important qualities for work in this area. High school courses should include mathematics and science. Training programs vary from two to four years. Two-year training programs are offered by hospitals which confer a certificate and colleges which confer an associate degree.

Four-year bachelor's degree programs are offered by colleges and universities. Following graduation from an approved program, radiologic technologists may take the registration examination given by the American Registry of Radiologic Technologists. New Jersey requires that X-ray practitioners be certified either by passing the state certification exam or the registry exam.

Outlook

This area is expanding as with other areas in health care. Also, X-rays are increasingly used for diagnosis and treatment. However, because of the large number of training programs, graduates may find competition for the jobs. This is especially true in areas where there are already large numbers of radiologic technologists.

Areas of Employment

- . hospitals
- . clinics
- . health care centers
- . physicians' offices
- . public health facilities

For Additional Information

American Registry of Radiologic
Technologists
2600 Wayzata Boulevard
Minneapolis, Minnesota 55405

9. Medical Instrumentation and Machine Operation Services

079.361-010 Respiratory Therapist (Inhalation Therapist)

Respiratory Therapy Technician

Respiratory Therapist

Among the members of the health care team, respiratory therapists may be the ones most frequently called upon to administer emergency life saving treatment. Their role is critical because patients who stop breathing longer than three to five minutes can suffer from severe brain damage, even when breathing is restored. Lack of oxygen for more than nine minutes results in death.

Respiratory therapists set up and operate equipment that provide oxygen and other gases necessary for breathing as prescribed by the doctor. Such equipment includes respirators, iron lungs, oxygen tents, mechanical ventilators, as well as monitoring devices. Patients may be anyone who has difficulty breathing--a newborn who needs short-term assistance or a stroke victim who needs breathing apparatus over an extended period. Therapists also provide training lessons for patients to help them

overcome their lung disabilities such as asthma and pneumonia. Some patients may require the use of special equipment at home and must learn how to use and care for that equipment.

Some respiratory therapists work primarily in pulmonary laboratories where they perform tests to provide doctors with the information to make the diagnosis. Some tests measure lung volume. Other tests isolate the type and source of the disease or determine the progress of treatment.

Respiratory Therapy Technician

Respiratory therapy technicians are graduates from one-year training programs. They perform essentially the same duties as respiratory therapists. However, because therapists have a higher level of training, they may be involved more with teaching and supervisory activities. The technicians, on the other hand, deal more with direct patient activities.

Following graduation and one year of clinical experience, technicians may take the certification examination to become a certified respiratory therapy technician.

Personal Qualifications and Training

Mechanical abilities, manual dexterity and ability to work calmly under emergency situations are important skills for this occupation. Also, an interest in working with people, patience, and attention to details are other useful qualities. To prepare for this occupation, high school courses should include health, biology, mathematics, physics, and bookkeeping. Formal programs two to four years in length are offered by colleges, community colleges, technical schools and hospitals. Graduates from four-year programs receive a bachelor's degree while associate degrees or certificates are granted in the two-year programs. Following graduation and a year of clinical experience, respiratory therapists are eligible to take the registration examination of the American Association for Respiratory Therapy.

Outlook

Job opportunities in this field are good. There are more jobs than there are trained personnel. Places such as clinics, nursing homes and home care programs have recognized the value of having a therapist or technician on the staff. Also, with improved diagnostic techniques, more patients are identified who need the specialized services of respiratory therapy workers.

Areas of Employment

- . hospitals (respiratory therapy, anesthesiology or pulmonary medicine departments)
- . oxygen equipment rental companies
- . ambulance services
- . nursing homes
- . clinics
- . colleges

For Additional Information

American Association for Respiratory Therapy
1720 Regal Row
Dallas, Texas 75235

Schools in New JerseyRespiratory Therapist

Atlantic Community College
Mays Landing, New Jersey 08330

Bergen Community College
Paramus, New Jersey 07652

Brookdale Community College
Lincroft, New Jersey 07738

Fairleigh Dickinson University
Madison, New Jersey 07940

Union County Technical Institute
Scotch Plains, New Jersey 07076

Respiratory Therapy Technician

Atlantic Community College
Mays Landing, New Jersey 08330

Burlington County Memorial Hospital
Mount Holly, New Jersey 08060

Gloucester County College
Sewell, New Jersey 08080

Passaic County Community College
Paterson, New Jersey 07506

St. Barnabas Medical Center
Livingston, New Jersey 07039

UMDNJ - School of Allied Health Professions
Newark, New Jersey 07103

10. Medical Services

Chiropractor

Osteopathic Physician

Physicians

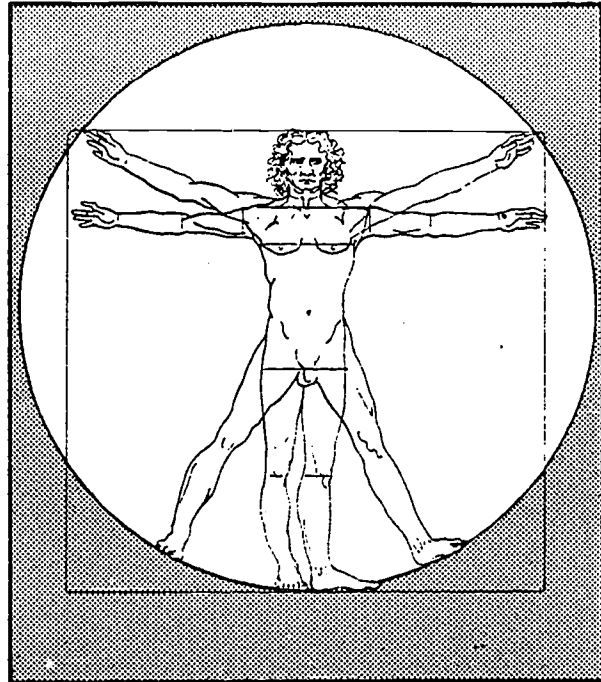
Podiatrist

10. Medical Services

Chiropractor

079.101-010

The practice of chiropractic is based upon the principle that good health and resistance to disease is related to effective functioning of the nervous system. By identifying where nerve activity is impaired, chiropractors apply corrective procedures to restore or maintain the proper function of the nervous system. Pressure and stress on nerves frequently result when vertebrae deviate from their normal position. A major part of a chiropractor's work, therefore, involves making adjustments or realigning the spinal column through manipulation by hand.



Chiropractors use X-rays and other chiropractic measuring devices in analyzing the spinal condition. Besides manipulation, treatment may then include therapy using heat, water, light, electricity or ultrasound. They do not prescribe drugs or perform surgery.

Although the profession is relatively small, there is a growing public awareness and recognition of chiropractic services. This acceptance is perhaps related to people's interest in total body health and the inter-relationship among the body's systems. Chiropractic may thus be viewed as both preventive and therapeutic health care.

Personal Qualifications and Training

Chiropractors depend on their keen sense of observation to detect physical abnormalities. In performing adjustments, hand dexterity is essential. Therefore, good hand and eye coordination is an important trait for this profession. Also desirable are an understanding of people and a pleasing personality. A good science background is a pre-requisite for entering chiropractic college. To be eligible for entrance into the four-year chiropractic program, students must have completed two years of college and fulfilled the basic course requirements. The doctor of chiropractic degree is awarded upon completion of the program. To practice in New Jersey one must be licensed.

Outlook

Chiropractic is a growing profession. Although the colleges are graduating more students, there is no apparent over-supply of chiropractors. In some areas, chiropractic is better established and has achieved greater public recognition. Now that chiropractic services are covered by health insurance and health care plans, it is expected that the public will make greater use of those services.

Most chiropractors are in their own private practice. Some work in a chiropractic group or clinic. There is an increasing interest in chiropractic research and a number of chiropractors are engaged in those activities. Others teach at chiropractic colleges.

Areas of Employment

- . private practice
- . chiropractic clinics
- . chiropractic colleges

For Additional Information

The Council of Chiropractic
Education
3209 Ingersoll Avenue
Des Moines, Iowa 50312

Schools in the Nearby Area

New York Chiropractic College
Glen Head, New York 11545

10. Medical Services

Osteopathic Physician

071.101-010

Osteopathic physicians diagnose and treat illnesses, diseases, and injuries. However, doctors of osteopathy (D.O.s) approach the practice of medicine from a somewhat different perspective than doctors of medicine (M.D.s). In addition to treating the immediate symptoms of illness and disease, they also focus on restoring to balance the functioning of all body systems. That is, they view disease or illness as an outward symptom of disturbance of a body system which, in turn, affects the normal functioning of all other body systems. They give particular attention to the musculoskeletal system (muscles, tendons, and bones) because it accounts for over 60% of the body's total structure. To correct abnormal stresses on the musculoskeletal system, D.O.s employ manipulative procedures, such as aligning the spinal vertebrae.



The concern of D.O.s is on the interrelationship of all body systems rather than just on the disorder at a specific site. They take into account the person as a whole. Therefore, most are in general or family practice. They are trained and qualified to practice all branches of medicine and surgery. Similar to M.D.s, D.O.s also specialize in areas such as pediatrics, obstetrics/gynecology, radiology, surgery, psychiatry, and sports medicine. They differ from M.D.s in some of the techniques they employ in diagnosis and treatment, practicing what they view as a "holistic" approach to medical care.

Personal Qualifications and Training

A concern and desire for helping others, good intellectual abilities, emotional stability, integrity, working well with one's hands, patience, and a good personality are all important characteristics for a successful career in osteopathic medicine. Because the training and subsequent practice are rigorous and demanding, a person should be in better than average physical health.

Osteopathic physicians are trained in colleges of osteopathic medicine after graduation from college or attending college for three years. The basic courses of the programs are similar to those of medical schools but with greater emphasis on the structure and function of the musculoskeletal

system. In addition, community, family, and preventive medicine are emphasized.

After completing the four-year program, doctors of osteopathy then serve for a year as an intern at an approved osteopathic hospital. Some may continue in residency training in one of the medical specialties. A license to practice is then granted when the doctor passes the licensing board examination.

Outlook

The demand for osteopathic physicians continues to grow. About 10% of the population seek the services of a D.O. Opportunities are more favorable in locales where osteopathic medicine is popular. Over half the practicing D.O.s practice in small towns or rural areas. New Jersey is among the states with a large number of osteopathic physicians.

Areas of Employment

- . private practice
- . group practice
- . hospitals
- . osteopathic colleges
- . government agencies

Schools in New Jersey

College of Medicine and Dentistry
of New Jersey
New Jersey School of Osteopathic
Medicine
300 Broadway
Camden, New Jersey 08103

For More Information

American Association of Colleges
of Osteopathic Medicine
4720 Montgomery Lane, Suite 609
Washington, D.C. 20014

American Osteopathic Association
212 E. Ohio Street
Chicago, Illinois 60611

10. Medical Services

Physicians

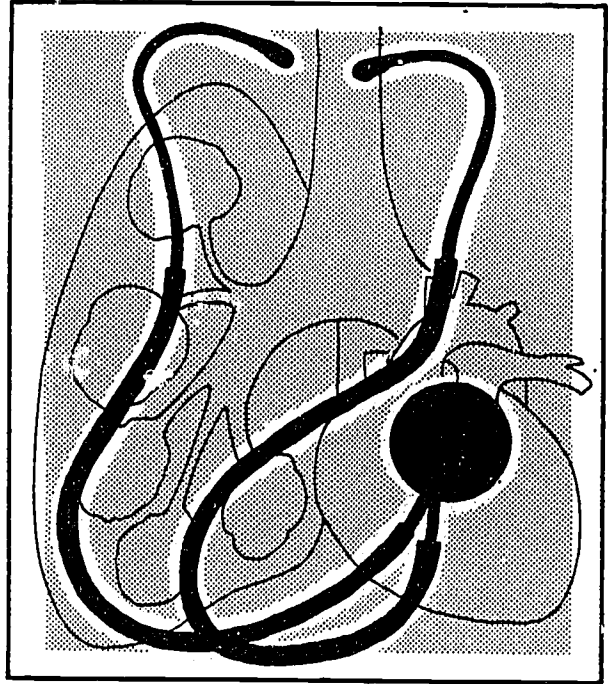
070.061-010
through
070.107-014

Medical doctors since early recorded history have held an important role in society, serving the sick and injured. While our recovery from illness, disease, and wounds depends on the services of many health care professionals, scientists, nurses, technicians, etc., it is the doctor who makes the diagnosis and directs the course of treatment. Our stereotypic image of doctors as omnipotent is not unwarranted and is indeed a tribute to their humanitarian services. However, like the

work of most professionals, the work is not magical, nor are physicians superhumans. Persons who enter this profession are those interested in the science of medicine, are dedicated to serving others, and are willing to devote their efforts and time in the training. There is no one single "type" of person who enters medicine but a diverse range of people with different interests and different assets.

The practice of medicine has changed dramatically in this century. With rapid advances in knowledge and technology, it is no longer possible to "know" everything about medicine. Where once most physicians practiced general medicine, the number of general practitioners has declined to less than 15%. Physicians today are specialists in one of the over 40 different specialties. In complex cases of disease or injury, a team of physicians works together, each contributing in his/her area of expertise. The different specialties depend on different sets of skills and range from those that require good manual dexterity such as the surgical specialties, to those requiring good interpersonal skills such as psychiatry and pediatrics, to those that require keen perceptual skills such as pathology. Although most physicians work directly with patients, some physicians do not even see patients but are involved in research, administration, or writing and editing medical education materials.

The following lists are some of the areas of specialization. Among the larger specialties include internal medicine, general surgery, obstetrics and gynecology, psychiatry, and pediatrics.



General Practice

Medical Specialties

Allergy
 Cardiovascular diseases
 Dermatology
 Family Practice
 Gastroenterology
 Internal medicine
 Pediatrics
 Pulmonary diseases

Surgical Specialties

Anesthesiology
 Colon and rectal surgery
 General surgery
 Neurological surgery
 Obstetrics and gynecology
 Ophthalmology
 Orthopedic surgery
 Otolaryngology
 Plastic surgery
 Thoracic surgery
 Urology

Psychiatry and Neurology

Child psychiatry
 Neurology
 Psychiatry

Other Specialties

Aerospace medicine
 General preventive medicine
 Occupational medicine
 Pathology
 Physical medicine and
 rehabilitation
 Public Health
 Radiology

Personal Qualifications and Training

A well-rounded personality, emotional stability, and good judgment are important qualities for a physician.

Since medicine is the practical application of scientific knowledge, one should have a strong interest and aptitude in the sciences and proficiency in mathematics. Also, competition for the number of available places in medical school is great, so academic achievement serves as one critical measure of one's qualifications. However, the ability to attain high marks does not insure a good physician, and medical schools look for candidates who show dedication to serving others, leadership qualities, resourcefulness, and motivation.

Among the health care professionals, the length of training for physicians is perhaps the longest, at least 8 years after high school, and residency training if one specializes. One may apply to medical school after three years of college. Most medical students, however, have their bachelor's degree. There is no required college major but applicants must complete the premedical course requirements. Most medical school programs are four years, but a small number of schools offer a concentrated three-year program. A few schools with six-year programs accept students directly from high school. Medical school graduates then train for an additional one to three years as interns and residents in hospitals. Some specialties may require longer residency training.

Outlook

The shortage of physicians has gradually diminished in recent years, as medical schools are graduating more students and foreign trained physicians establish practice in the U.S. Also, greater use of technicians and assistants, more effective methods of treatment, group practice and health maintenance organizations, and advances in technology have allowed physicians to attend to more patients. However, the need for physicians remains strong, especially in less sparsely populated areas where the demand is particularly acute. Most physicians tend to practice around large metropolitan areas, especially specialists who need the facilities of large hospitals and medical centers. The need for physician services will continue to rise with population growth and increase in the number of elderly who require more medical care. With prepaid medical plans, health insurance, and federal health care programs, people are less reluctant to seek medical attention because of their inability to pay.

Areas of Employment

- . private practice
- . group practices and health maintenance organizations
- . hospitals
- . research institutions
- . government agencies
- . public health agencies
- . schools
- . industry
- . Armed Forces

Schools in New Jersey

University of Medicine and Dentistry
of New Jersey
New Jersey Medical School
Newark, New Jersey 07103

University of Medicine and Dentistry
of New Jersey
Rutgers Medical School
New Brunswick, New Jersey 07103

For Additional Information

American Medical Association
535 N. Dearborn Street
Chicago, Illinois 60610

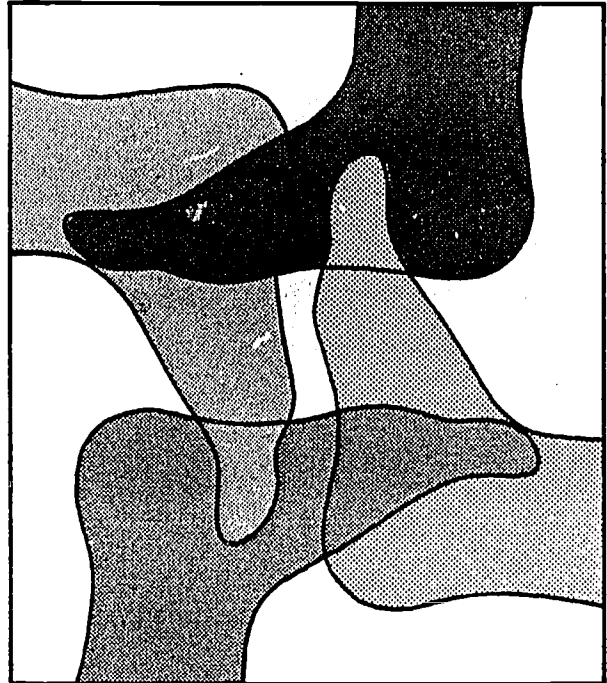
Association of American Medical
Colleges
One Depont Circle, NW, Suite 200
Washington, D.C. 20036

10. Medical Services

Podiatrist

079.101-022

Foot problems are the specialty of podiatrists, doctors of podiatric medicine. They are trained to diagnose and treat disease, injuries, and deformities of the foot. Foot ailments, like ailments in other parts of the body, are treated with medication or surgery, but in addition may also require shoe and special appliance therapy or physical therapy. Podiatrists usually handle most surgery such as removal of bunions, cysts, nails and warts right in the office. More complicated surgery that might require general anesthesia would take place in the hospital.



The range of foot disorders that podiatrists encounter span from skin infections such as "athlete's foot" to gross abnormalities such as a "club-foot" that requires major surgery as well as corrective footwear. A large part of a podiatrist's practice involves physical therapy to strengthen muscles and improve flexibility of joints to restore the function of the foot. Whirlpool baths, paraffin baths, infrared lamps, ultrasound waves and electric currents are among the items used in therapy. Other aspects of the practice include the prescribing and fitting of corrective devices and appliances. These activities may involve making plaster casts from which foot appliances or moulded shoes are then made in a laboratory.

Podiatrists have patients of all ages and from all walks of life. According to a 1980 government survey, foot disorders are the major cause of disability in 20 out of every 1,000 Americans. For every person suffering from a foot disability, it is estimated that 30 more may be suffering from some type of foot problem. Foot ailments are widespread and perhaps go undetected in many cases. People may complain about their "aching feet" but often do not realize that something can be done about the problem.

However, there is a growing awareness of good foot care as people participate in more physical fitness activities such as jogging, long distance running, dancing and hiking. Podiatrists are playing a vital role in the preventive aspect of foot care such as in design of sport shoes, foot exercises, and proper use of the feet.

Proper Qualifications and Training

Interest and competence in science, good manual dexterity and enjoyment of detailed work are requirements for a successful career in podiatry. A good personality and ability to communicate with all types of people are also important assets. Students may enter a college of podiatry after two years of college work, but most have attained their baccalaureate degree. The podiatry program is four years in length. Doctors of podiatry must complete one year of internship before they are eligible to be licensed in New Jersey. Additional residency is necessary for podiatrists who wish to specialize in areas such as foot surgery, orthopedics, podopediatrics (children's foot ailments) or podogeriatrics (foot ailments of the elderly). A relatively new specialty is podiatric sports medicine where the podiatrist is trained to deal with leg and foot problems of athletes.

Outlook

A population more active in sports, a larger elderly population, and increasing population in general, has created high demands for podiatrists. The majority of podiatrists practice in and around large metropolitan areas, so smaller suburban and rural areas are less well serviced. Nursing homes are recognizing the value of podiatrists serving their facilities. With good foot care and treatment, the elderly who might be otherwise bedridden are able to move about (a major cost-saving measure, because it costs much more to care for the bedridden). Industry has also found that foot problems of employees reduce productivity and engage podiatrists to screen and treat employees for foot ailments.

Areas of Employment

- . private practice
- . hospitals
- . clinics
- . teaching at podiatric colleges

For Additional Information

American Podiatry Association
20 Chevy Chase Circle, NW
Washington, D.C. 20015

Schools in the Nearby Area

There are only six podiatric colleges in the U.S. Closest to New Jersey are:

New York College of Podiatric
Medicine
New York, New York 10035

Pennsylvania College of Podiatric
Medicine
Philadelphia, Pennsylvania 19107

11. Nursing and Physician Extender Services

Homemaker - Home Health Aide
(Home Attendant)
(Home Health Aide)

Licensed Practical Nurse

Registered Nurses

Community Health Nurse
(Public Health Nurse)

General Duty Nurse
(Hospital Nurse)

Gerontological Nurse Practitioner

Nurse Anesthetist

Nurse Educator

Nurse - Midwife

Occupational Health Nurse

Office Nurse

Private Duty Nurse

School Nurse

Nurse's Aide
Orderly

Operating Room Technician
(Surgical Technician)

Psychiatric Aide

Physician's Assistant

11. Nursing and Physician Extender Services

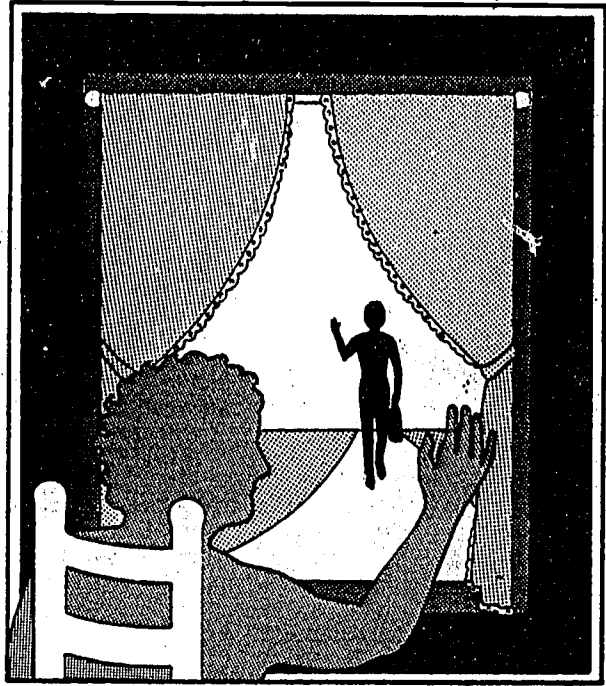
Homemaker - Home Health Aide

354.377-014

(Home Attendant)

(Home Health Aide)

Until modern hospitals that we know of today came into being, the sick and disabled were cared for in their own homes. As hospitals became more accessible and provided specialized services, they became the centers for treatment and care. However, this has changed with the rise in hospital costs and a larger population of elderly and others needing long-term care. There is a growing trend to care for patients who are not dependent on the more sophisticated hospital services at home. Also, it has been found that being in one's own home environment often improves the patient's attitude and speeds recovery.



Home care programs have grown dramatically and are run by various health agencies, such as visiting nurse associations, public health agencies, and hospitals. These programs serve patients ranging from those who need a variety of visiting therapists and specialized nurses to those who need basic convalescent care. Home health aides provide basic patient care services under the supervision of a nurse, social worker, or therapist, as well as the physician. They help patients perform daily routine activities such as bathing, dressing, exercising, eating, and taking medication. Some household services, such as meal planning and cleaning, are often included.

The work of home health aides vary greatly, depending on the patient's condition. Some may require much bedside attention while others may simply need help or instruction in certain activities. Some require daily care while others are visited on a weekly basis.

Personal Qualifications and Training

Good judgment, emotional maturity, and desire to help others are important qualities for this work. Tact, patience, and a cheerful disposition are especially useful in helping the sick in their recovery process. There are no specific requirements for employment. However, knowledge of first aid and household management are useful. Nearly all training is conducted on the job. A few community colleges and vocational-technical schools are beginning to offer courses in personal care services:

Because of greater emphasis in home care, service agencies are beginning to establish standards for this work and develop more extensive training materials.

Outlook

The number of workers in this area has grown dramatically. The increase can be attributed to the high cost of hospitalization, more elderly who need long-term care, and payment of home care services by health insurance and social service funds. Since home care programs greatly benefit both patient and the community, the need for home health aides far exceeds the number of workers in the field.

For Additional Information

National Home Caring Council
67 Irving Place
New York, New York 10003

11. Nursing and Physician Extender Services

Licensed Practical Nurse

075.374-014

The persons who attend to a great part of a patient's nursing needs are the licensed practical nurses (LPNs). Working under the supervision of registered nurses and doctors, they take and record temperature readings, change dressings, administer medication, bathe and dress patients, and monitor patients' progress. The work, of course, varies with the hospital ward, the type of hospital, or other patient care facilities. In the hospital nursery, for example, LPNs may be responsible for the changing, feeding, and caring of

newborns. In an intensive care unit, they may need to operate and monitor specialized equipment to care for the seriously injured or ill. Working in a private home, they attend to the all-around daily needs of the patient. Working in a doctor's office, they may assist the doctor during an examination and perform simple laboratory tests.

Since LPNs provide much of the bedside patient care, patients perhaps see more of the LPN than any of the other members of the health care team. As such, they work closely with the patients as well as their families.

LPNs are the second largest group of health care providers.

Personal Qualifications and Training

The desire to help others, working well with people, patience and emotional stability are all important qualities for an LPN. Good health and physical stamina are especially desirable since one comes in contact with patients with infectious diseases, as well as patients who cannot move without assistance. High school courses in biology, chemistry, health and psychology are useful. To become an LPN one must complete a one-year approved training program offered at hospitals, vocational-technical schools, high schools or community colleges and pass the state licensing examination.

Outlook

The number of LPNs has more than doubled in the past 20 years and indicates their increased role in providing health care services. In addition to hospitals, there has been a growing need for LPNs in nursing homes and extended care facilities. Also, with the rising costs of hospital care, there is a trend to provide medical care at home whenever feasible for long-term illness--another factor in the rising need for LPNs.

Areas of Employment

- . hospitals
- . mental health facilities
- . nursing homes
- . extended care facilities
- . doctors' offices
- . child care centers
- . clinics
- . public health agencies
- . private homes

Schools in New JerseyDiploma Programs OnlyPublic Two-Year Colleges

Hudson County Community College
Commission
North Bergen, New Jersey 07047

*Salem Community College
Penns Grove, New Jersey 08069

Union County Technical Institute
Scotch Plains, New Jersey 07076

Vocational/Technical and
High Schools

Atlantic County Area Vocational/
Technical School
Atlantic City, New Jersey 08401

Bayonne High School
Bayonne, New Jersey 07002

Bergen County Area Vocational/
Technical School
Hackensack, New Jersey 07601

Burlington County Area
Vocational/Technical School
Mt. Holly, New Jersey 08060

Camden County Area Vocational/
Technical School
Sicklerville, New Jersey 08081

Camden High School
Camden, New Jersey 08103

*certificate program

Cape May County Area Vocational/
Technical School
Cape May Crt. House, New Jersey
08210

Cumberland County Area Vocational/
Technical School
Bridgeton, New Jersey 08302

Essex County Area Vocational/
Technical School
Newark, New Jersey 07017

Gloucester County Area Vocational/
Technical School
Sewell, New Jersey 08080

Hunterdon County Adult School
Flemington, New Jersey 08822

Jersey City Public Schools
Jersey City, New Jersey 07304

Mercer County Area Vocational/
Technical School
Trenton, New Jersey 08690

Middlesex County Area Vocational/
Technical School
East Brunswick, New Jersey 08816

Monmouth County Area Vocational/
Technical School
Marlboro, New Jersey

Morris County Area Vocational/
Technical School
Denville, New Jersey 07834

Ocean County Area Vocational/
Technical School
Toms River, New Jersey 08753

Passaic County Area Vocational/
Technical School
Wayne, New Jersey 07470

Perth Amboy Adult School
Perth Amboy, New Jersey 07561

Somerset County Area Vocational/
Technical School
Somerville, New Jersey

Sussex County Area Vocational/
Technical School
Newton, New Jersey 07860

Union County Area Vocational/
Technical School
Union, New Jersey 07083

Vineland High School
Vineland, New Jersey 08360

Warren County Area Vocational/
Technical School
Washington, New Jersey 07882

Hospitals

Bergen Pines County Hospital
Paramus, New Jersey 07652

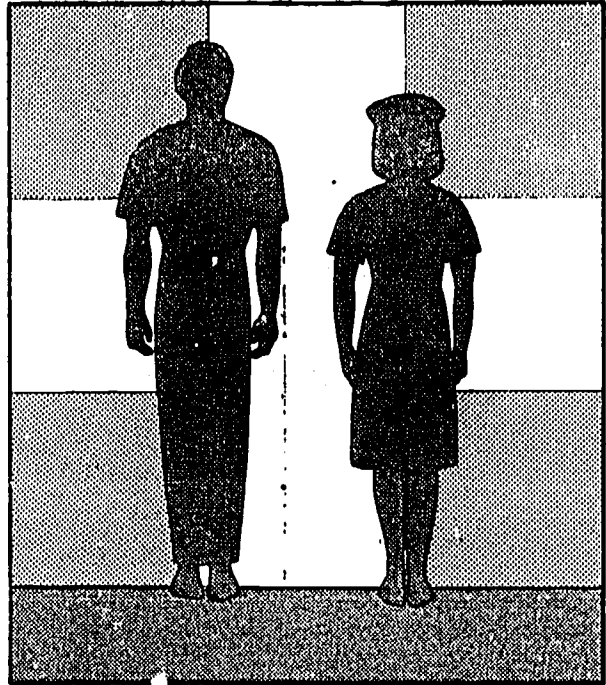
*Holy Name Hospital
Teaneck, New Jersey 07666

Medical Center at Princeton
Princeton, New Jersey 08540

*certificate program

11. Nursing and Physician Extender Services

- 075. Registered Nurses
- 075.124-014 Community Health Nurse
(Public Health Nurse)
- 075.374-010 General Duty Nurse
(Hospital Nurse)
- Gerontological Nurse Practitioner
- 075.371-010 Nurse Anesthetist
- 075.121-010 Nurse Educator
- 075.264-014 Nurse - Midwife
- 075.374-022 Occupational Health Nurse
- 075.374-014 Office Nurse
- 075.374-018 Private Duty Nurse
- 075.124-010 School Nurse



Registered nurses make up the largest single group of professional health care workers. The above list of titles gives only a small indication of the various areas where nurses work and their important roles in health care. The different work settings determine the duties, responsibilities and special skills required of registered nurses. The particular nursing career one seeks depends largely on one's interests and type of training program one enters. Most of us have a general notion of nurses' roles in caring for and assisting in the treatment and recovery of the ill and injured. The descriptions that follow may provide a glimpse of the diverse opportunities in nursing and how nurses function as members of the health care team. Keep in mind, however, that as the degree of specialization and responsibilities increase, the amount of required training is also increased. In some positions, a graduate degree, in addition to a bachelor's degree, is prerequisite.

Hospital nurses are, of course, the largest group of nurses. They provide patient care in the various hospital units such as surgery, pediatrics, obstetrics, emergency room, psychiatry, and so on. They usually attend to patient care duties requiring specialized clinical knowledge and supervise the other nursing staff, practical nurses, nurses' aides, and orderlies in the more routine and less complex aspects of nursing. Hospital nurses carry out the treatment plan prescribed by the physicians--preparing equipment; administering medication; making measurements such as temperature, pulse, blood pressure, etc.; monitoring the patient's progress; and providing for the patient's general comfort.

Within a hospital are several levels of nursing positions. Registered nurses usually start as general duty nurses and advance to head nurse or supervisor of a unit. The director of nursing services administers the nursing program of the hospital, managing and directing nursing personnel and developing and implementing policies.

Office nurses work for physicians in private or group practice. They prepare patients for examination or treatment. Assisting the physician in a variety of tasks, they administer medication and injections, clean and dress wounds, prepare and sterilize equipment, and instruct patients. Their work in an office may also involve administrative and record keeping activities.

Private duty nurses care for an individual patient in the hospital or his/her home. They attend to the various needs of the patient as directed by the physician. Patients, requiring a private duty nurse, usually need constant observation as well as special types of treatment.

Community health nurses work in community settings such as homes, clinics, schools, and health agencies. They participate to a greater extent in preventive medicine, instructing on good health care, organizing immunization and disease screening programs, and implementing community health activities. They serve as the community's health educator and help to develop programs to improve the community's health services. Often they assist or guide families in obtaining appropriate medical care.

School nurse practitioners are familiar to every school child. They provide the emergency first aid services in the schools, as well as examine students for conditions that may require medical attention. Other activities include preparing and conducting lessons on health care; maintaining medical records; developing programs to meet health needs of the school community; conferring with parents and physicians on students' emotional problems that interfere with learning; and immunizing students. School nurses in New Jersey are required to have a bachelor's degree and additional training in student health education.

Nurse educators are teachers of nursing students as well as nurses who seek further training or training in specialized skills. They give instruction in the classroom and in clinical settings. Nurse educators must keep up with new developments in the field in order to develop and design educational programs as the need arises.

Occupational health nurses are employed by businesses or manufacturing concerns, providing nursing services to employees of the company. They treat minor illnesses or administer first aid for injuries that occur in the workplace. Nurses in industry instruct employees on health maintenance and provide counseling on health matters. Companies are becoming increasingly aware of the importance of illness prevention as well as safety in the workplace. As a result, nurses have become involved in developing procedures to reduce accidents as well as physical fitness programs.

Nurse - midwife is a nurse who specializes in the care of expectant mothers, delivery of babies, and post-delivery care. Nurse-midwives work under the supervision of an obstetrician. They also instruct patients in family planning, pre-natal care as well as infant care and family living.

Nurse anesthetists are trained in the techniques of administering anesthetics for surgery, delivery, or other situations requiring pain relief. Anesthetics are given as fluids intravenously, spinally, or in muscle tissue; or as gases delivered through complex equipment. When patients are under anesthesia their breathing, pulse and other vital signs must be carefully watched and recorded. The nurse anesthetist is thus at the same time skilled in nursing and the science of anesthesiology. Additional training is required for work in this area.

Gerontological nurse practitioners is a rapidly growing group of nurses who have additional specialized training in the health care of the aged. They are knowledgeable about the processes of aging and the various medical needs of the elderly. Much of their work involves evaluating the health conditions of patients and planning for the care required. Some work in nursing homes while others work in outpatient facilities.

Personal Qualifications and Training

As we are well aware, nurses should possess a strong desire to serve others and an understanding of the needs of others. In addition, one should be able to make wise judgments, perform tasks calmly under stressful situations, follow directions precisely, and be emotionally mature. Good health and physical stamina are also important assets. High school courses should include the sciences and social sciences.

There are basically three types of programs that prepare one for professional nursing. Four- or five-year programs that lead to a bachelor's degree in nursing are offered by colleges and universities. This degree is a prerequisite for many managerial and supervisory positions, as well as work in health agencies and the public schools. Nurses who graduate from these programs may enter graduate (master's or doctorate) degree programs in specialized areas, teaching, or research.

Diploma programs have long been the traditional route to a nursing career. They are offered by hospitals (often in affiliation with colleges and universities) and are two to three years in length.

Associate degree programs are offered by community colleges and are two years in length. These programs include courses in general education as well as nursing theory and practice.

Selecting from among the three types of programs depends upon one's career goals. Nurses with diplomas or associate degrees work primarily as staff nurses, providing the nursing care we typically associate with nurses. A greater diversity of work settings and advancement opportunities are available to nurses with bachelor's and graduate degrees. Upon completion of one of the three programs, graduates must take a state licensure examination to become a registered nurse.

Outlook

The role of registered nurses has undergone appreciable change in the past decades as nurses have become better educated. They have assumed greater responsibility and make more independent decisions concerning patient care, as well as administrative policies. No longer do they only implement orders but participate as a member of the health care team in planning and decision making. Moreover, nurses have expanded into diverse areas that call for higher levels of technical expertise. As medicine advances, new areas of nursing specialties have emerged, offering nurses a greater number of career options.

There has been and continues to be a large demand for staff nurses or primary/bedside patient care nurses. With population growth and the public's increasing use of health care services, the need for nurses will remain high. Opportunities for nurses in the clinical specialties, managerial and administrative positions, and teaching are also very good for nurses with post-graduate training.

Areas of Employment

- . hospitals
- . clinics
- . community health centers
- . nursing homes
- . extended care facilities
- . physician's offices
- . schools
- . college and universities
- . industrial plants
- . infirmaries
- . patients' homes
- . public health departments
- . social service agencies

*Rutgers - The State University of
New Jersey
College of Arts and Sciences
Camden, New Jersey 08102

*Rutgers - The State University of
New Jersey
College of Nursing
Newark, New Jersey 07102

*Seton Hall University
South Orange, New Jersey 07079

Stockton State College
Pomona, New Jersey 08240

*Trenton State College
Trenton, New Jersey 08625

Schools in New Jersey

Bachelor of Science Degree Program

*Bloomfield College
Bloomfield, New Jersey 07003

College of St. Elizabeth
Convent Station, New Jersey 07961

*Fairleigh Dickenson University
Rutherford, New Jersey 07070

*Felician College
Lodi, New Jersey 07644

*William Paterson College
Wayne, New Jersey 07470

Associate Degree Program

*Atlantic Community College
May's Landing, New Jersey 08330

*Bergen County Community College
Paramus, New Jersey 07652

*Brookdale Community College
Lincroft, New Jersey 07738

* signifies accreditation by National League for Nursing

- *Camden County College
Blackwood, New Jersey 08012
- *County College of Morris
Dover, New Jersey 07801
- *Cumberland County College
Vineland, New Jersey 08360
- *Essex County College
Newark, New Jersey 07112
- *Felician College
Lodi, New Jersey 07644
- *Gloucester County College
Sewell, New Jersey 08080
- *Mercer County Community College
Trenton, New Jersey 08690
- *Middlesex County College
Edison, New Jersey 08817
- *Ocean County College
Toms River, New Jersey 08753
- *Passaic County Community College
Paterson, New Jersey 07505
- *Somerset County College
Somerville, New Jersey 08876
- *Union College
Cranford, New Jersey 07016
- Diploma Program
- *Ann May School of Nursing
Jersey Shore Medical Center
1945 Corlies Avenue
Neptune, New Jersey 07753
- Bayonne Hospital School of Nursing
East 130th Street
Bayonne, New Jersey 07002
- *Charles E. Gregory School of Nursing
Raritan Bay Health Services Corp.
Perth Amboy General Hospital
Old Bridge Region
530 New Brunswick Avenue
Perth Amboy, New Jersey 08861
- *Christ Hospital School of Nursing
176 Palisade Avenue
Jersey City, New Jersey 07306
- *Clara Maass Memorial Hospital School
of Nursing
1A Franklin Avenue
Belleville, New Jersey 07109
- Cooper Medical Center School of
Nursing
300 Broadway
Camden, New Jersey 08103
- *East Orange General Hospital
East Orange, New Jersey
- *Elizabeth General Hospital School of
Nursing
925 E. Jersey Street
Elizabeth, New Jersey 07201
- *Englewood Hospital School of Nursing
350 Engle Street
Englewood, New Jersey 07631
- *Helene Fuld School of Nursing at
West Jersey Hospital
Mt. Ephraim Avenue
Camden, New Jersey 08104
- *Helene Fuld Medical Center
School of Nursing
750 Brunswick Avenue
Trenton, New Jersey 08638
- *Holy Name Hospital School of Nursing
690 Teaneck Road
Teaneck, New Jersey 07666

* signifies accreditation by National League for Nursing

*Mercer Medical Center
 School of Nursing
 Box 1658
 Trenton, New Jersey 08607

*Mountainside Hospital School of
 Nursing
 Bay & Highland Avenue
 Montclair, New Jersey 07042

*Muhlenberg Hospital School of
 Nursing
 Park Avenue & Randolph Road
 Plainfield, New Jersey 07061

*Orange Memorial Hospital
 The Hospital Center at Orange
 School of Nursing
 188 South Essex Avenue
 Orange, New Jersey 07051

*Our Lady of Lourdes School of
 Nursing
 1565 Vesper Blvd.
 Camden, New Jersey 08103

*St. Francis Community Health Center
 School of Nursing
 One McWilliams Street
 Jersey City, New Jersey 07030

*St. Francis Hospital School of
 of Nursing
 601 Hamilton Avenue
 Trenton, New Jersey 08629

St. Mary's Hospital
 Hoboken, New Jersey 07030

*St. Peter's General Hospital
 School of Nursing
 254 Easton Avenue
 New Brunswick, New Jersey 08903

For Additional Information

National League for Nursing
 10 Columbus Circle
 New York, New York 10019

American Nurses Association
 2420 Pershing Road
 Kansas City, Missouri 64108

* signifies accreditation by National League for Nursing

11. Nursing and Physician Extender Services

Nurse's Aide

355.674-014

Orderly

355.674-018

This group of workers constitutes the largest group of health care workers. They provide services that do not require technical training but which are basic and vital to patient care. Their duties vary depending on the type of health care facility and patient needs. Nursing aides and orderlies may perform similar tasks, but

orderlies and attendants are usually men who handle heavier duties such as lifting and transporting patients. Working under the direction of the nursing and medical staff, they serve and assist patients with meals, clean rooms and change linens, bathe and dress patients, prepare equipment such as sterilizing instruments, and transport patients to treatment areas.

There are no specific educational requirements. Most skills and tasks are learned on the job, and some facilities provide classroom instruction and demonstration. Aides and orderlies with additional formal education may advance to nurse and technician positions.

Personal Qualifications and Training

The desire to care for those in need, dependability, and willingness to perform less glamorous tasks, are important for work in this area. Employees prefer high school graduates, but a high school diploma is not always required. However, people who are mature and emotionally stable are especially needed in caring for the seriously ill and disabled patients.

Outlook

With the increased need for health care and rising medical costs, job opportunities are very good. Personnel who can assist professionals in the more routine duties can significantly help to reduce the cost of health care. A large number of aides and orderlies work in hospitals, but there will be many more job openings in nursing homes, convalescent homes, and extended care facilities.

Areas of Employment

- . hospitals.
- . nursing homes
- . convalescent homes
- . mental health facilities
- . extended care facilities

11. Nursing and Physician Extender Services

Operating Room Technician (Surgical Technician)

079.374-022

Operating room technicians are part of the operating team that includes surgeons, nurses, and anesthesiologists. Working under the supervision of registered nurses, they assist in operations--passing instruments and supplies, holding retractors, and keeping track of the materials used. Prior to the operation they prepare the instruments, equipment, linens, and fluids needed during surgery. They may also prepare the patient for surgery. Following the operation, they straighten out the room and prepare it for the next use. Operating room technicians are, in essence, all-around assistants to doctors and nurses in the operating area.



The work environment during an operation is demanding and often very tense. The technician must be able to respond to the minute-to-minute changes that take place and anticipate the needs of the doctors and nurses. Because of the critical nature of surgery, one must be alert to details and work with great care and in an orderly fashion.

Personal Qualifications and Training

An operating room technician should have good manual dexterity and be emotionally stable. Science, mathematics and health courses in high school are good preparation for subsequent training. Formal training may be obtained at a variety of institutions, and programs range from one to two years. Two-year college programs offer their graduates an associate degree. Training programs are given at technical and vocational schools, community colleges, hospitals, and medical schools. Certification is awarded by the Association of Surgical Technologists when one passes its examination.

Outlook

Jobs in this area are expected to expand with growth in the health care field in general. Also, there is an increasing trend to have operating room technicians attend to many of the routine duties previously performed by nurses. Experienced technicians may advance to administrative and supervisory positions in the operating room. In administrative positions they would be in charge of running the operating room, ordering supplies,

and arranging work schedules. In supervisory positions they would supervise other technicians and aides.

Areas of Employment

. hospitals

Schools in New Jersey

Bergen Community College
Paramus, New Jersey 07652

Institute for the Advancement of
Medical Science
Cherry Hill Medical Center
Cherry Hill, New Jersey 08034

UMDNJ - School of Allied Health
Professionals
Newark, New Jersey 07652

11. Nursing and Physician Extender Services

Psychiatric Aide

355.377-014

Psychiatric aides are nursing workers who work in facilities for the mentally handicapped--mental hospitals, state institutions, and training schools. Working under the supervision of nurses, they provide much of the basic personal care services needed by the patients, such as dressing, grooming, bathing, and perhaps eating. The needs of patients vary greatly, and psychiatric aides attend to a vast range of non-

medical activities that include assisting in the cleaning of rooms and wards, accompanying patients on outings, and teaching basic skills necessary for everyday living. Another important dimension is interacting with patients to help them develop social skills and participate in recreational activities. Socializing with others is an essential factor in the recovery process. Since psychiatric aides work very closely with the patients, their observation of patient changes and needs provide useful information to the professional mental health care team in planning therapy or treatment.

Personal Qualifications and Training

Persons who work in this area should possess a strong desire to assist the handicapped. Qualities such as understanding of others, patience, and emotional maturity are important. A high school diploma is preferred, and courses that promote communication skills are useful. Psychiatric aides are trained on the job, learning duties through informal demonstrations and sometimes in formal classes.

Outlook

Population growth and concern for the care of the mentally handicapped has led to an increase in mental health care facilities. The number of workers in this area has grown in the past decade and demand remains high.

Areas of Employment

- . psychiatric hospitals
- . mental health centers
- . schools for the handicapped

II. Nursing and Physician Extender Services

Physician's Assistant

079.364-018

With the increased needs for medical services and doctors' high workload in the 1960s, the idea of training a new health care professional to provide some of the patient services came into being. These professionals are physician assistants--PAs--who perform technical procedures and provide patient care under a physician's supervision. Among some of the tasks are taking patients' histories, physical examinations, making preliminary diagnoses, ordering or performing laboratory tests, suturing minor wounds and handling emergencies.

By assuming these responsibilities, PAs enable physicians to attend to more specialized activities and see more patients. Some of the other activities include counseling of patients and their families, and providing instruction on preventive health care topics and nutrition.

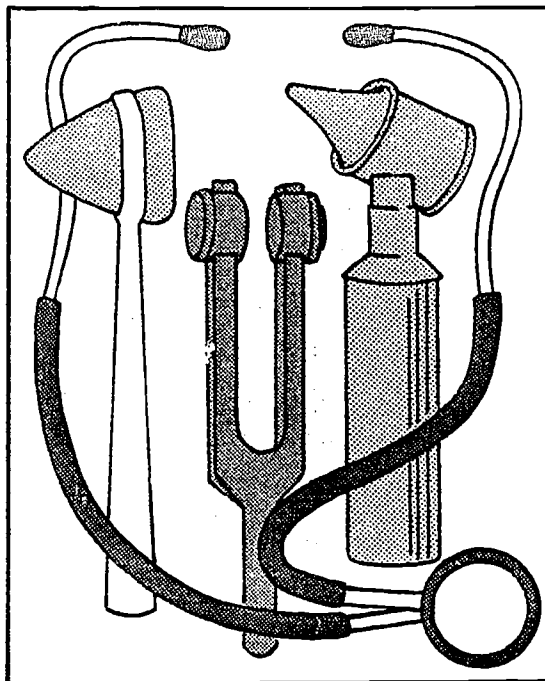
The employment of PAs has grown in popularity as indicated by a single training program with four students in 1965 to over 50 programs today. They may work in a variety of settings such as private practice, clinics, or hospitals--in essence, wherever a physician can be assisted. Most PAs are trained in general medicine. There are, however, specialized training programs. Some examples are urologic physician assistant, surgeon's assistant, orthopedic physician assistant, and childbirth associate.

People who have entered this profession have come from a wide variety of backgrounds. The first four PA graduates were former military medics. Others have had backgrounds in nursing, respiratory therapy, other allied health fields, or degrees in the sciences. Today, however, more people are entering the profession through direct training programs.

New Jersey is currently the only state where PAs are not allowed to practice. However, this situation may soon change.

Personal Qualifications and Training

Interest in patient care, knowledge in the sciences, emotional stability, and critical thinking skills are all important qualities for persons desiring to work in this area. Training programs vary from two to four years in length. Persons entering two-year programs usually have had



two years of college or some college and prior experience in the health care field. Some states require PAs to be licensed. PAs are certified by the National Commission on the Certification of Physician Assistants, after passing its examination.

Outlook

Studies have indicated that PAs contribute to more efficient health care delivery as well as reduce patient costs. On this basis, one can predict that the demand for PAs will continue to increase. Physician assisting is a profession that is gaining greater recognition and support.

Areas of Employment

- . physicians' offices
- . hospitals
- . clinics
- . extended care facilities
- . government health agencies
- . private health agencies

Schools in New Jersey

Livingston College
Rutgers - The State University
New Brunswick, New Jersey 08903

Rutgers - The State University
New Brunswick, New Jersey 08903

UMDNJ - Rutgers Medical School
New Brunswick, New Jersey 08903

For Additional Information

Association of Physician's
Assistant Programs
2341 Jefferson Davis Highway,
Suite 700
Arlington, Virginia 22202

12. Pharmaceutical Services

Pharmaceutical Detailer

Pharmacist

Pharmacy Helper

12. Pharmaceutical Services

Pharmaceutical Detailer

262.157-010

Pharmaceutical detailers or professional service representatives, represent pharmaceutical firms and provide drug information to physicians, dentists, and other health professionals. They keep those who prescribe or dispense drugs and medications up-to-date on new developments. They also offer information about the proper dosage, use, and effects of the products. Pharmaceutical detailers serve as the link between the drug industry and the medical community and, of course, try to develop more

customers for their product. Therefore, they must be thoroughly knowledgeable about the technical aspects of their products (chemistry, physiological effects, merit, safety, etc.) and competitors' products. An understanding of business and public relations is also important. They are commonly referred to as "detail" men or women because they provide all the details about the particular drug.

The job of a pharmaceutical detailer requires extensive travel because they must personally call on the health professionals at their work place. These places range from physicians' offices, pharmacies, hospitals, clinics, nursing homes, drug wholesalers, to pharmacy schools.

Personal Qualifications and Training

A pharmaceutical detailer should have a pleasing personality, be able to interact with a variety of different people, be well organized and be able to learn new things quickly. A good memory is also a valuable asset. There is no prescribed course of training for this occupation. Companies hire college graduates with degrees in business, education, liberal arts, psychology or the sciences. College courses that include science and business are especially desirable. Pharmacists who enjoy travel and working with people are particularly well qualified for work in this area. Also, new drugs are often used for very specific purposes. As a result, there is a growing trend to hire nurses, technologists and other health care personnel who have had experience in working with patients with particular types of illness or disease.

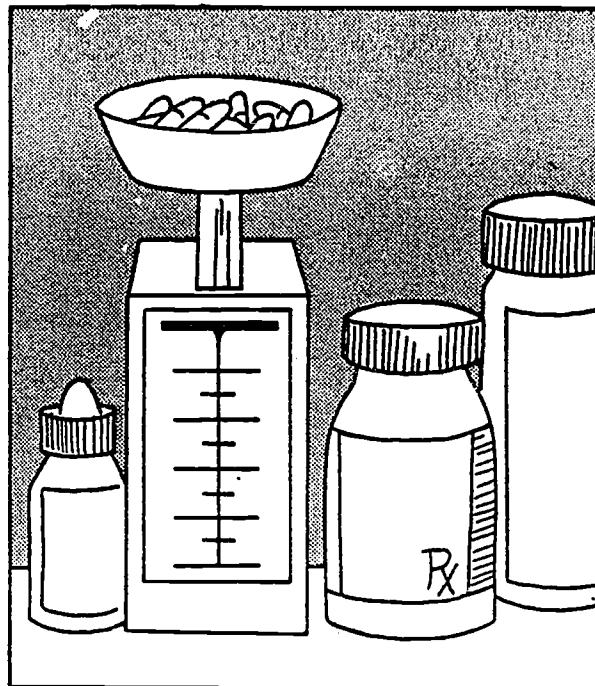
Specialized training is provided directly by the employer. Training does not end once one is on the job, but is an ongoing process as new products are introduced.

12. Pharmaceutical Services

Pharmacist

074.161-010

Pharmacists fill prescriptions of drugs and medicine ordered by doctors and dentists. They possess specialized knowledge about the composition of drugs, their usage and effects on the user. They may also compound or mix chemicals to produce medicine in tablet, powder or liquid form, but this activity is becoming less frequent. Pharmacists serve as important information specialists and health educators to the public and doctors who rely on them for accurate and up-to-date knowledge about various medications. They instruct patients on how to apply or take medication and alert them about possible side effects. In addition, they must be knowledgeable about health problems in order to offer advice about the hundreds of non-prescription drugs available to the public.



COMMUNITY PHARMACIST - Community pharmacists are perhaps the best known member of the pharmaceutical profession. They own or work in a local pharmacy or in a pharmacy of a chain store. Their duties include dispensing prescriptions, responding to health inquiries, maintaining records, and ordering supplies. Managerial, administrative, and public relation skills are important because many pharmacists are also the store manager. They oversee the daily operations of a drugstore which also sells non-pharmaceutical merchandise. Other responsibilities are hiring, training, and supervising the sales and delivery staff. Pharmacists who are owners or part owners of a pharmacy need good business and organizational skills.

HOSPITAL PHARMACIST - With increasing numbers of hospitals and other types of health care institutions, many more pharmacists practice in hospital settings. Hospital pharmacists deal less with the public-at-large and more with the health care team, consulting with doctors about patients' medication programs/schedules and providing nurses with information about how to administer drugs and drug reactions. For example, patients in hospitals often need to receive their drugs intravenously. Therefore, the pharmacist must make the sterile IV solutions and check that they are properly given to the patients. In larger hospitals pharmacists perform more administrative and teaching duties--managing the distribution of pharmaceutical services and insuring that patients receive correct and safe drug treatment. Because specialized knowledge about hospitals is required, hospital pharmacists receive additional training through hospital residency or graduate pharmacy programs.

INDUSTRIAL PHARMACIST - A number of pharmacy school graduates work for pharmaceutical manufacturers. Industrial opportunities are particularly favorable in New Jersey which has some of the world's largest pharmaceutical firms. Pharmacists in the manufacturing industry may work in research and development of new drugs, drug testing, controlling the quality of production as well as developing educational materials for public information and marketing or sales.

PUBLIC PHARMACIST - Pharmacists employed by federal, state or community agencies fall into the category of public pharmacists. While the majority work as dispensing pharmacists in government hospitals, institutions and clinics, public pharmacists also work for numerous regulatory agencies. These regulatory agencies are concerned with insuring the quality and safety of consumer products, such as food, drugs, cosmetics and medical devices. Pharmacists in these agencies may test and evaluate new drugs or food, conduct drug research, inspect manufacturing facilities or write consumer information materials.

Personal Qualifications and Training

Ability to make wise and accurate judgments, to communicate effectively, to work well with one's hands, and to attend closely to detail, are important traits in this profession.

High school college preparatory courses with an emphasis in the sciences (biology, chemistry and physics) and mathematics are important to gain entrance into colleges of pharmacy. All practicing pharmacists must be licensed. To qualify for a license one must graduate from an accredited pharmacy college, and pass a state board examination. The length of post high school study varies among the pharmacy schools. Schools granting a BS degree in pharmacy require five years of study while schools granting a doctor in pharmacy degree require at least six years of study.

Outlook

The demand for pharmacists is expected to grow with population growth, longer life expectancy and expansion of health care facilities. Opportunities for community pharmacists may be greater in more rapidly expanding suburban areas. The largest number of job openings will be in hospitals, clinics, nursing homes and other health facilities. In those settings, pharmacists will work closely with doctors, nurses and therapists as part of a health care team, providing consulting services.

Areas of Employment

- . pharmacies
- . hospitals
- . clinics
- . nursing homes
- . pharmacy schools
- . pharmaceutical manufacturers
- . government agencies
- . Armed Forces

Schools in New Jersey

Rutgers - The State University of
New Jersey
College of Pharmacy
New Brunswick, New Jersey 08903

For Additional Information

American Association of Colleges
of Pharmacy
4630 Montgomery Avenue
Bethesda, Maryland 20014

American Council on
Pharmaceuticals
One East Wacker Drive
Chicago, Illinois 60601

12. Pharmaceutical Services

Pharmacy Helper

074.387-010

Pharmacy helpers work under the supervision of a pharmacist and perform duties such as: mixing pharmaceutical preparations, check-

ing inventory and ordering supplies, labeling and preparing prescriptions, keeping and maintaining the work area and making deliveries. A pharmacy helper assists in a wide variety of tasks to insure the safe delivery of pharmacy services to patients.

Personal Qualifications and Training

Alertness, accuracy, attention to detail and neatness are personal characteristics for this type of work. Most pharmacy helpers are trained on the job after high school graduation. Because of the technical nature of the work, employers look for people who have experience in hospitals. Science and typing courses in high schools are especially useful for this position. The Armed Forces offer formal training programs in this area. Schools in some areas are beginning to offer associate degree programs for Pharmacy Technicians.

Outlook

At present there is only a moderate need for pharmacy helpers. However, as the number of formal training programs increase and more graduates to perform more responsible duties, the demand for pharmacy helpers (pharmacy technicians) may increase.

13 Rehabilitation Services

Art Therapist

Audiologist
Speech Pathologist
(Speech Therapist)

Corrective Therapist

Manual Arts Therapist

Music Therapist

Occupational Therapist
Occupational Therapist Assistant

Orthotist
Prosthetist

Physical Therapist
Physical Therapy Aide
Physical Therapist Assistant
(Physical Therapy Technician)

Recreational Therapist

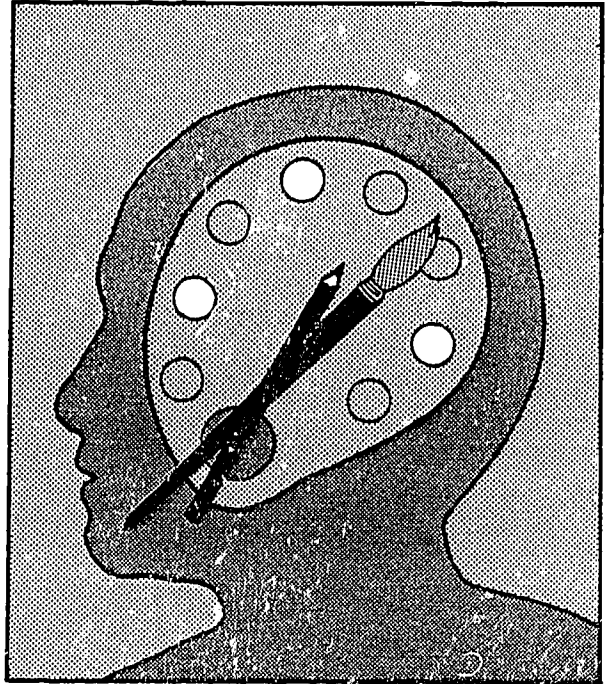
Therapeutic Recreation Technician
(Recreation Assistant)

13 Rehabilitation Services

Art Therapist

076.127-010

Art applied in therapy is a relatively new idea, considering that art is one of the oldest forms of human communication. It communicates at a more basic level and as such has proven to be a very useful and effective form of therapy. Art provides a means to express one's feelings, emotions, and ideas. It is also a creative process that leads to greater self-awareness and personal growth, and can help in resolving emotional conflict. Art therapy is thus used with patients of all ages and in numerous settings.



Art therapists combine their knowledge of the visual arts with human behavior to assist patients in overcoming their handicaps and enhancing their personal development. Observing and evaluating a patient's behavior and artwork, the art therapist diagnoses the patient's needs and develops a treatment plan. Appropriate art activities are designed and provided. For example, a young child may be unable to tell an adult his or her frustrations, but those feelings can be expressed through his/her artwork. How that child can best be helped can then be determined.

Art therapists may work with patients individually or in groups. Depending on the patient and his/her needs, art activities are used to treat abnormal behavior, serve as a form of rehabilitation, help a patient gain self-confidence, or to develop a better understanding of oneself.

Personal Qualifications and Training

The ability to work with all types of people, understanding of others, and patience are important qualities for this work. Although one need not be a trained artist, one should have a variety of art experiences. High school courses in the arts and social sciences are useful preparation. A master's degree in art therapy is the preferred training for employment. However, clinical training after one has received a bachelor's degree is offered by some institutions. Persons who enter graduate programs in art therapy usually have a bachelor's degree in liberal arts, art, psychology or education.

Outlook

This is a small but growing profession. Opportunities are expected to be good with increased demand for health services and the greater emphasis on rehabilitation. Also, research in the area of art therapy and psychology has led to new and more sophisticated applications of this specialty.

Areas of Employment

- . hospitals
- . clinics
- . rehabilitation centers
- . community centers
- . schools
- . nursing homes
- . prisons

Schools in New Jersey

Trenton State College
Trenton, New Jersey 08625

For Additional Information

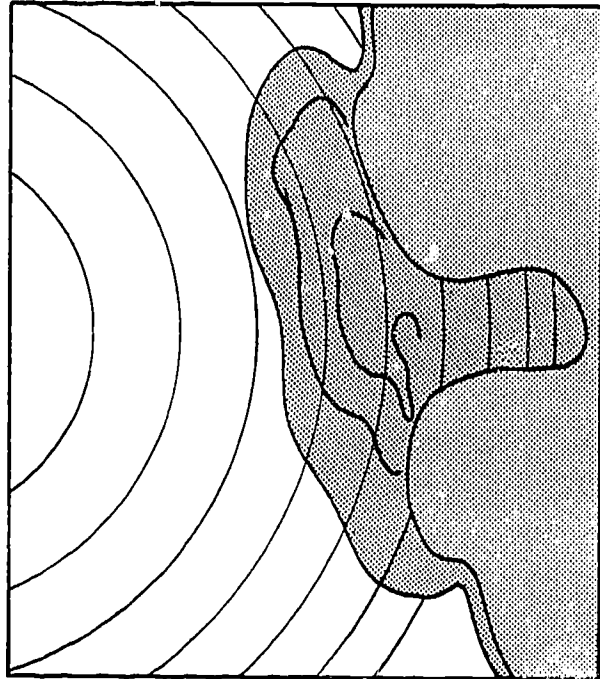
American Art Therapy Association
428 E. Preston Street
Baltimore, Maryland 21202

13 Rehabilitation Services

076.101-010 Audiologist

076.107-010 Speech Pathologist
(Speech Therapist)

Speech and language are unique human abilities that are the basis of our rich life experiences. Yet, speech disorders are common. It is estimated that one out of ten Americans cannot speak or hear clearly. Being unable to communicate effectively places one at a disadvantage both in social and work situations. Specially trained to help people with speech and hearing disorders are speech pathologists and audiologists. They diagnose and evaluate speech, hearing and language problems, and plan and conduct treatment programs.



Although speech pathologists focus on speech and audiologists on hearing, each must be knowledgeable about the other area. Speaking and hearing cannot be easily separated. For example, an audiologist may need to train a person with hearing loss how to speak. Similarly, a speech pathologist may need to know about a patient's hearing difficulties in order to provide the proper type of speech therapy.

Audiologists use a variety of testing equipment as well as patients' background information to determine the extent and cause of the hearing loss. The course of treatment is then developed. Treatment may include hearing aids, counseling and guidance, speech reading and speech training. An important aspect of the work is helping patients adjust to their disability so that they can participate more fully in everyday living, school, and work.

Speech disorders result from a variety of different causes. Among those are impaired or loss of hearing, brain injury, cleft palate, mental retardation, emotional problems, or a combination of several factors. Since speech problems often are symptoms of more complex disorders, speech pathologists must be skilled in diagnostic testing to accurately evaluate the patient. They, in many instances, may need to work closely with physicians, psychologists, physical therapists and counselors in designing the proper course of treatment.

Nearly one-half of all speech pathologists work in the public schools, especially at the elementary level. When students first enter school is frequently the time that speech impairments are first detected. Early therapy can avert possible learning and behavioral problems of students. In the schools, speech pathologists devote a large part of their time in testing and evaluating students, in addition to providing therapy.

Other speech and hearing therapists work in hospitals and clinics where more severe disorders are treated. A number of speech pathologists and audiologists conduct research to explore the origins of hearing and speech disorders and to develop improved treatment procedures. Teaching at colleges and universities is another workplace.

Personal Qualifications and Training

Persons who wish to enter this field should possess a high degree of patience, enjoy working with people and be good problem solvers. Undergraduate degree programs are offered by a number of colleges and universities. A larger number offer master's degrees. A master's degree is required by many states and government agencies. To qualify for certification by the American Speech and Hearing Association, one must have a master's degree, one-year clinical training, and pass the national examination. A teaching certificate is required to work in public schools in New Jersey.

Outlook

Growth in population and improved diagnostic techniques are expected to create a continued demand for speech pathologists and audiologists. Many school children who were thought to have learning disabilities turned out actually to have language or hearing disorders. This finding has emphasized the importance of earlier diagnoses and treatment. As a result, the need for therapists has increased.

Persons with a master's degree will have more opportunities in the job market. However, the large number of graduates in this field may make for keener competition in areas where large numbers of therapists are in practice (e.g., large metropolitan areas).

Areas of Employment

- . public schools
- . hospitals
- . clinics
- . government agencies
- . colleges and universities

Schools in New Jersey

- Kean College of New Jersey
Union, New Jersey 07083
(BA and MS programs)
- Montclair State College
Upper Montclair, New Jersey 07043
(BA and MA programs)
- Richard Stockton State College
Pomona, New Jersey 08240
(BS program)

Rutgers - The State University
of New Jersey
Douglass College
New Brunswick, New Jersey 08903
(BA program)

Rutgers - The State University
of New Jersey
The Graduate School
New Brunswick, New Jersey 08903
(MS program)

Trenton State College
Trenton, New Jersey 08625
(BA, MS and MEd programs)

Seton Hall University
South Orange, New Jersey 07070
(BA and MA programs)

William Paterson College
Wayne, New Jersey 07470
(BA and MS programs)

13 Rehabilitation Services

Corrective Therapist

076.361-010

The value of exercise in recovery from disease and injury and overcoming disabilities gained recognition during World War II. It was found that wounded servicemen who participated in physical reconditioning programs had a shorter hospital stay. Also, their emotional problems were reduced. Thus, the profession of corrective therapy--physical education applied in medical treatment--became firmly established.

Corrective therapists treat patients using exercise and physical education techniques, following the program prescribed by the patient's doctor. Activities are designed to help patients coordinate and regain muscle use and prevent muscle deterioration. They work with other members of the

health care team in developing the patient's treatment plan. Patients may range from handicapped children to injured athletes to persons with new artificial limbs. Treatments vary with the patient and type of disability. Some are individual exercises while others include group activities or sports. In therapeutic exercises, corrective therapists may assist patients in the use of specialized equipment such as exercycles, tables with weights and pulleys, parallel bars, and other devices.

Corrective therapists need to be knowledgeable about various forms of illness and injuries in order to provide the appropriate therapy. Their sensitivity to their patients' feelings and desires guides them in adjusting the extent and length of a therapy session. They must be able to assess patients' capabilities in order to provide challenging activities without overstressing or frustrating their patients.

Personal Qualifications and Training

Persons entering this field should have an interest and dedication in helping the handicapped and disabled. It requires a high level of patience and understanding of others. High school courses should include the sciences and social sciences. Corrective therapists are college graduates with a bachelor's degree in physical education and an additional one-year specialized graduate study in corrective therapy, plus 400 hours of supervised clinical work. They are certified by the American Corrective Therapy Association.

Outlook

With the increasing emphasis on exercise in medical treatment, corrective therapists are employed in an ever increasing number of different settings. Also, with population increase and an aging population, more therapeutic services will be required. Hence, the demand for corrective therapists is expected to be higher than for the average of all other occupations.

Areas of Employment

- . veteran administration facilities
- . rehabilitation centers
- . public schools
- . hospitals
- . mental institutions
- . community health centers
- . alcohol and drug treatment centers
- . camps for the handicapped

Schools in the Nearby Area

CUNY
 Lehman College
 Bronx, New York 10468

Hunter College,
 New York, New York 10021

New York University
 New York, New York 10010

For Additional Information

American Corrective Therapy
 Association
 Route Elm Hill
 Jonesboro, Tennessee 37659

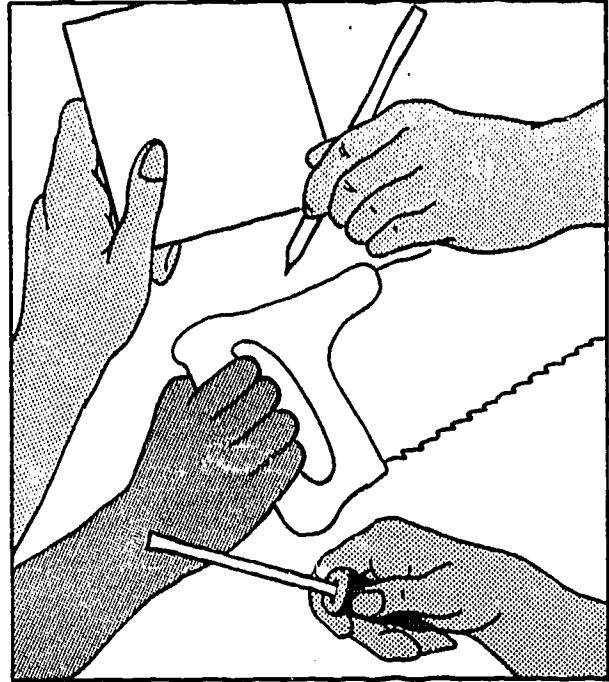
13 Rehabilitation Services

Manual Arts Therapist

076.124-010

Manual arts therapists use industrial activities in the training of disabled persons for living and working after hospitalization. Activities focus on helping patients learn or relearn skills for future employment as well as for everyday living. The goal is to build up patients' confidence and to provide them a means to learn a livelihood within the limits of their disability.

Therapy programs include activities in a simulated or actual work environment. They may involve metal- or woodworking, graphic arts or agriculture. In this way, patients become familiar with working in the outside world and gradually develop their independence. Manual arts therapists work with other members of the rehabilitation team in designing appropriate activities and in following patients' progress. Their role is that of a teacher--planning, organizing, and providing instruction. They need to be creative in designing learning situations that provide motivation and encouragement to their patients.



Personal Qualifications and Training

As teacher-therapists, persons in this occupation should possess patience, alertness to the needs of others, and creativity. Manual dexterity is important in working with tools and mechanical equipment.

A bachelor's degree in industrial art education or manual arts therapy plus a minimum of two months' clinical training is required. Manual arts therapists are registered by the American Association for Rehabilitation Therapy.

Outlook

Helping the handicapped or disabled enter or return to the work world has become more widely supported. As rehabilitation programs expand, the need for manual arts will increase accordingly.

Schools in New Jersey
(BA in Industrial Education)

Glassboro State College
Glassboro, New Jersey 08028

Kean College of New Jersey
Union, New Jersey 07082

Trenton State College
Trenton, New Jersey 08625

For Additional Information

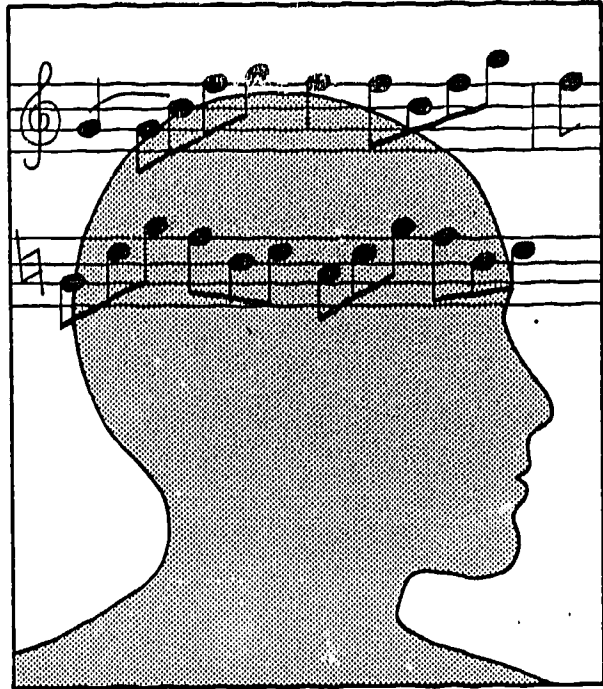
American Association of
Rehabilitation Therapy
P.O. Box 93
North Little Rock, Arkansas 72116

13 Rehabilitation Services

Music Therapist

076.127-014

As we gain new knowledge about methods to help persons recover from illness, disease or injury, new areas of treatment and therapy emerge. Music therapy is one of these areas. Through music, patients have developed more positive feelings about themselves and others. The result is a more speedy recovery. Music therapy has been particularly useful in the treatment of mental illness. Music therapists work together with the patient's physician, psychiatrist and/or social worker to determine the patient's needs and capabilities and to set goals for the treatment. They combine their knowledge of music and psychology in designing programs and activities for their patients.



Most often the music therapist deals with the patient on an individual basis, using vocal and instrumental music, combined sometimes with body movement. Other times, they organize music programs and activities for groups of patients.

Personal Qualifications and Training

A good background in music and an interest in helping handicapped persons are useful prerequisites for this occupation. While a number of music therapists are graduates of music education programs, we are seeing more therapists who are specially trained in music therapy programs that offer a bachelor's or master's degree. In addition to a degree, a six-month clinical training at an approved facility is required. They are registered by the National Association for Music Therapy, or certified by the American Association for Music Therapy.

Outlook

With increased awareness in the value of music therapy, hospitals and institutions will further incorporate music therapy in their rehabilitation programs. Positions will increase accordingly. Music therapy is a challenging and creative occupation for one who desires to combine one's talents and interests in music, psychology and education.

Areas of Employment

- . hospitals
- . psychiatric institutions
- . nursing homes
- . schools for the handicapped
- . public schools

Schools in New Jersey

Montclair State College
Montclair, New Jersey 07043

For Additional Information

National Association for Music
Therapy
P.O. Box 610
Lawrence, Kansas 66044

13 Rehabilitation Services

Occupational Therapist

076.121-010

The role of an occupational therapist is to help physically or mentally disabled persons develop or regain skills so that they will be able to live a more fulfilling life. Clients range from children suffering from birth defects to accident victims to the elderly who have lost speech or movement due to a stroke. Because disabilities vary widely and affect people differently, therapy programs must be specially designed to meet the needs of the individual.

Occupational therapists must first determine what the person can do and what skills need to be developed. The testing and evaluation are usually conducted as a team effort. The team may include the patient's doctor, nurse, physical therapist, social workers, vocational counselor and other health care professionals. Goals for the patient are set. The occupational therapist then plans and directs the therapy program to meet those goals. Depending on the disability, the program may include recreational and educational activ-

ities. To help a mechanic with a hand injury regain the use of his/her hands, the therapist may teach him/her how to type. A person who is partially paralyzed may need to be taught how to dress and bathe, using one hand. Since each case is unique, there is no single type of therapy. Even with the same disability, one person may respond to the training while the other person may not. The therapist must be highly imaginative and creative in helping the patient achieve greater independence or regain the necessary functions for everyday living.

Some therapists (about two out of five) work with emotionally or mentally handicapped patients, while others work with the physically handicapped. A therapy program may only last a few weeks or extend over years and require a wide variety of skills training. In addition to devising craft and manual skill activities, therapists may design and make special equipment and devices to aid disabled persons in participating in activities.

Besides working with patients, a therapist may be involved in training and supervising student therapists, occupational therapist aides, and volunteers.

Personal Qualifications and Training

Teaching skills, imagination and patience are important characteristics for occupational therapy work. Moreover, one should have a strong background in the sciences and social sciences. Occupational therapists first complete a four-year college program with a major in occupational therapy and then receive six to nine months of training in a clinical setting. For persons who have graduated from a related health field, some schools offer programs that will lead to a master's degree in occupational therapy. To become a registered occupational therapist one must pass a certification examination given by the American Occupational Therapy Association.

Outlook

The demand for occupational therapists has been very high and is expected to continue in that direction. This is due to increased concern in rehabilitating disabled persons so that they can better lead a productive and more satisfying life. The success of therapy programs has also led to recognition of the importance of occupational therapy in patient treatment. Occupational therapists are being employed in a wider range of settings, such as in the public schools. There they work with students with mental retardation, learning disabilities, physical handicaps, or behavioral difficulties as well as consult with teachers and parents.

Areas of Employment

- . hospitals
- . rehabilitation centers
- . community health centers
- . mental health centers
- . extended care facilities
- . schools for the handicapped
- . public schools
- . industrial clinics
- . private practice

Schools in New Jersey

Kean College
Union, New Jersey 07083

For Additional Information

American Occupational Therapy
Association
1383 Picard Drive
Rockville, Maryland 20850

13 Rehabilitation Services

Occupational Therapist Assistant

076.364-010

Occupational therapist assistants work with disabled patients under the supervision of an occupational therapist. They help plan

and design activities for patients in physical skill development, self care skills, and creative skills such as crafts and the arts. Similar to the occupational therapists, they teach patients to regain normal functions or develop alternative skills to overcome their disability. They organize craft projects, design and make equipment, and keep patient records.

Personal Qualifications and Training

Interest and ability to work with people, good physical and mental health, and patience are important for work in this occupation. Manual skills are also useful in order to teach patients how to use materials and tools. High school graduates may enter a one- or two-year vocational or technical school program or obtain an associate degree in occupational therapy from a junior or community college. The Armed Forces also offer training for this occupation. Because of the wide variety of activities that an occupational therapist assistant is involved with, high school preparation should include biology, typing, crafts, health and the social sciences.

Graduates of approved programs who have completed clinical training may take a certification test to become a certified occupational therapist assistant. This examination is administered by the American Occupational Therapy Association.

Outlook

The need for occupational therapist assistants has grown with the increase in therapy programs. While assistants are needed in all types of health care facilities, there appear to be greater needs in nursing homes and community health centers.

Schools in New Jersey

Atlantic Community College
Mays Landing, New Jersey 08330

Union County Technical Institute
Scotch Plains, New Jersey 07076

Areas of Employment and Additional Information
See under Occupational Therapist

13 Rehabilitation Services

078.261-022 Prosthetist

078.261-018 Orthotist

New materials and advances in technology and design have brought about major changes in the field of artificial limb construction. Where artificial limbs in the past were primarily a cosmetic appendage, today many types of artificial limbs offer greater function and mobility. As a result, professionals who work in this area now need higher levels of education and training. Prosthetists make and fit artificial limbs while orthotists make and fit orthopedic braces (orthosis) to support weakened body parts or to correct physical disabilities. Some work in both areas.

Prosthetic appliances are custom made to fit patients who have suffered loss of limb through disease or injury. They must be comfortable and provide patients with maximum mobility. Therefore, the prosthetist works closely with the physician and the patient to

determine the patient's needs and design a suitable device to meet those needs. Design and production of the device depends on knowledge of the patient's condition and how to best promote mobility. Careful and exact measurements are taken, materials (plastic, leather, wood, steel or aluminum) are selected, and casts are made. Using the cast as a model, the device is then constructed, adjusted and fitted to the patient. Sometimes it is necessary to modify or redesign some parts to improve comfort and function. Finally, the patient is then instructed on its use and care.

Orthotists work in a similar manner with physicians and patients, applying their technical expertise to produce and fit an effective brace.

Prosthetists and orthotists must be knowledgeable about human anatomy and mechanics of body movement in order to produce devices that work well. They are craftsmen who combine scientific knowledge with their skills in design and construction.

Personal Qualifications and Training

Persons in this field should be skilled in and enjoy working with their hands and mechanical equipment. Good visual and design abilities are important qualities as well as patience and tact in working with the disabled. High school preparation should include courses in physics, biology, algebra, geometry, mechanical drawing, and metal and wood shops. Although it is possible to enter this field through on-the-job training and taking selected college courses, a bachelor's degree in prosthetics/orthotics is becoming the preferred route. Since 1980, the American Board for Certification in Orthotics and Prosthetics requires that candidates for certification have a bachelor's degree.

Outlook

Skilled and qualified professionals in this area are in high demand. With an increasingly more elderly population who need supportive devices and continued high numbers of automobile and industrial accident victims, as well as those disabled by disease, the need is expected to rise.

Areas of Employment

- . private laboratories
- . hospitals
- . rehabilitation centers
- . government agencies

Schools in Nearby Area

Medical School
University of New York
New York, New York 10010

For Additional Information

American Orthotic and Prosthetic
Association
1444 N. Street, NW
Washington, D.C. 20005

13 Rehabilitation Services

Physical Therapist

076.121-014

Physical therapists work with patients who are disabled through injury or illness or who are born with a handicap that affects their movement. Their goals are to help patients regain or improve their mobility using muscle strengthening techniques and activities. Therapy methods include the use of exercise, massage, heat and cold, water and electricity.

Patients vary in age and type of disability. A patient recovering from leg surgery may require physical therapy to prevent the leg muscle from deteriorating because of disuse or poor blood circulation. Burn patients may be assisted with exercises in a water tank to keep their limbs mobile and to soften dead skin tissue for easier removal. A child with cerebral palsy may be taught how to crawl and perhaps eventually to walk. A victim of stroke who lost use of his arms may need exercises to relearn arm movements.

No two patients are identical. Physical therapists must therefore work closely with the patient's doctor and other members of the health care team to evaluate the extent of the disability and design the treatment plan. During the course of the treatment, the physical therapist must be constantly aware of the patients' needs to build up self confidence and keep up their spirits. Recovery or improvement is slow and often painful. So, in addition to knowledge about the function of muscles, nerves and joints, a physical therapist needs to understand human behavior and how to provide encouragement.

Although physical therapy for patients may begin during their hospital stay, many may require therapy long after discharge. While many physical therapists work in hospitals, others work in nursing homes, rehabilitation clinics, schools for handicapped children, and even the patient's home. With a growing interest in the development of new techniques, a greater number of physical therapists are engaged in research or teaching.

Personal Qualifications and Training

In addition to interest and abilities in science and teaching, physical therapists must possess tact and patience. Their sensitivity to people and their own emotional stability are important in helping patients learn to deal with disability and/or disfigurement. Physical strength and agility are useful when one must lift and support patients. Physical therapists are trained through a four-year bachelor's degree program in physical therapy. Persons with a bachelor's degree in other fields may enter an intensive one- or two-year program that grants a certificate or a master's degree. To practice in New Jersey requires a license.

Outlook

The job prospects for physical therapists continues to be favorable, growing faster than the average of all other occupations. The importance

of rehabilitation has been recognized by the public, and rehabilitation programs have expanded. The increase in nursing homes will also create new positions for physical therapists.

Areas of Employment

- . hospitals
- . rehabilitation centers
- . nursing homes
- . clinics
- . schools for handicapped children
- . government agencies
- . college teaching

Schools in New Jersey

Kean College and UMDNJ
 School of Allied Health Professions
 Newark, New Jersey 07103
 (joint program)

For Additional Information

American Physical Therapy
 Association
 1156 15th Street, NW
 Washington, D.C. 20005

13 Rehabilitation Services

Physical Therapy Aide

355.354-010

Physical therapy aides help patients get ready for their treatment such as helping them get into their artificial limbs or treatment equipment and transporting them to the treatment area. They may also assist therapists in testing and

treating patients. Their work, to a large extent, may involve the care and preparation of the equipment and work area.

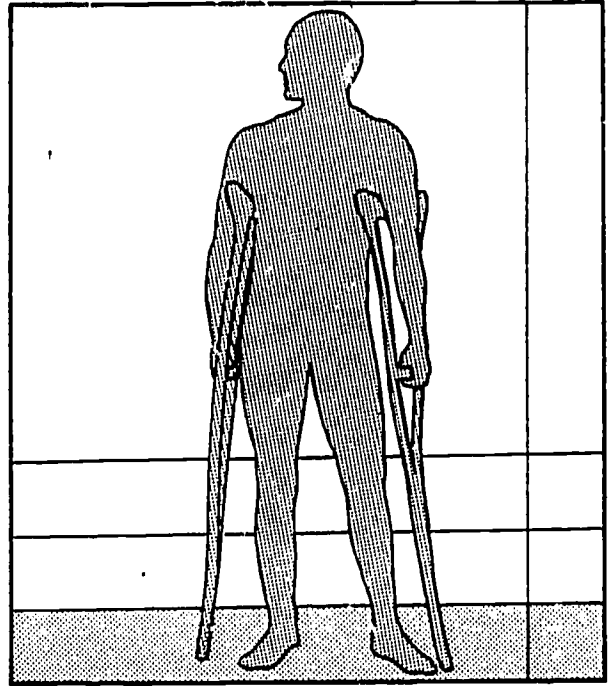
Physical therapy aides receive their training on the job following high school graduation. Employers tend to prefer hiring those with some hospital work experience. The extent of their duties and responsibilities will depend on the training given by the physical therapist and needs of the particular department.

13 Rehabilitation Services

Physical Therapist Assistant (Physical Therapy Technician)

076.224-010

Working under the supervision of physical therapists, physical therapist assistants are involved in helping patients regain or develop their mobility. They often use special equipment to administer exercise, massage, heat, cold, light, ultrasound and electrical treatments. They instruct patients in exercises to use or strengthen their muscles. Their patients may have recently acquired artificial limbs, braces or splints and require instruction on how to use them. They may also prepare the equipment necessary for treatment such as hydro-therapy tanks, whirlpool baths, ultrasound machines and so on. Physical therapist assistants must closely observe patients' progress or response to treatment. They prepare reports for the physical therapist who evaluates the treatment program and makes changes if necessary.



Personal Qualifications and Training

Similar to physical therapists, physical therapist assistants should possess patience and tact. A cheerful disposition is also important as persons with disabilities need continual encouragement. Two-year associate degree programs in physical therapy are offered by colleges and community colleges. Persons practicing in New Jersey must pass a licensing examination.

Outlook, Areas of Employment, and Additional Information

See under Physical Therapist.

Schools in New Jersey

Atlantic Community College
Mays Landing, New Jersey 08330

Essex County College
Newark, New Jersey 07102

Fairleigh Dickinson University
Madison, New Jersey 07940

Union County Technical Institute
Scotch Plains, New Jersey 07076

13 Rehabilitation Services

Recreational Therapist

076.124-014

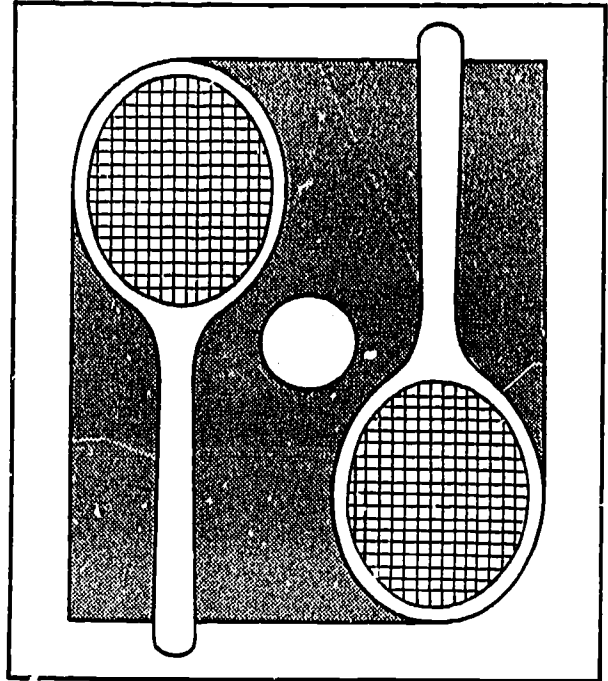
The use of recreation as therapy dates back to 3,000 B.C. to the Chinese who employed medical gymnastics to promote health. More recently, during World Wars I and II, the concern for rehabilitation of disabled veterans stimulated greater use of recreation as a form of therapy. Its demonstrated value has established recreation as an important form of treatment for a wide variety of health problems.

Recreation therapists plan, supervise and teach leisure skills to the physically, mentally, or socially handicapped to promote their rehabilitation. The diversity of activities may include arts and crafts, music, drama, dancing, gardening, hobbies, games, trips, and even community service projects. The recreational therapists need to understand the needs of their patients as well as the physical and mental demands of the activities. Appropriate activities are then selected and designed for individuals or groups of patients. Sometimes a sports activity has to be modified or incorporate new techniques so that the handicapped can participate. Examples that are familiar to us are basketball teams who play in wheelchairs or the blind who ski.

Therapeutic recreation is therefore the application of recreation and leisure activities to help the disabled or handicapped lead a fuller life, overcome their disability, and gain self-confidence. The programs are conducted in many different types of settings, hospitals, rehabilitation centers, mental health centers, camps for handicapped children, and nursing homes.

Personal Qualifications and Training

A wide range of different interests and creativity are important assets for one who works with people with different needs and abilities. Sensitivity to others, adaptability, and patience are qualities necessary in helping others overcome their disability. High school courses may include art, drama, music, psychology, and health. Participation in different extra-curricular activities will broaden one's experiences as well as provide leadership opportunities. Recreation therapists usually have a bachelor's degree in therapeutic recreation or in one of the activity specialties such as art therapy. Persons employed in therapeutic recreation are registered by the American Association for Rehabilitation Therapy.



Outlook

The changing attitudes toward the disabled and new approaches in rehabilitation have greatly expanded and extended therapeutic recreation programs. Therapists are employed in many diverse types of settings and may find new opportunities in areas yet to establish programs. The demand for trained therapists is expected to be high. Some positions may require a master's degree.

Areas of Employment

- . hospitals
- . rehabilitation centers and related facilities
- . community agencies
- . schools for the handicapped
- . parks and recreation departments
- . extended care facilities
- . nursing homes

Schools in New Jersey

Fairleigh Dickinson University
Madison, New Jersey 07940

Kean College
Union, New Jersey 07083

Montclair State University
Upper Montclair, New Jersey 07043

Trenton State College
Trenton, New Jersey 08625

For Additional Information

National Therapeutic Recreation
Society
1601 North Kent Street
Arlington, Virginia 22209