

The Future of Education in Prosthetics-Orthotics

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What is the most important problem that must be solved by the prosthetics-orthotics profession in the next ten years? Trained manpower makes an occupation a profession, and for this reason I think no other problem we face is as important as recruiting and training enough new manpower to meet the needs of our expanding population for prosthetic-orthotic service. The purpose of this discussion is to analyze this problem and suggest some ways to solve it.

Our experience in giving extension classes for prosthetists-orthotists at UCLA during the past twelve years has convinced me that there is a need for two basic types of manpower in this field if we are to serve the orthopedically handicapped efficiently. One we will call the prosthetist-orthotist, the other the orthopedic technician. The prosthetist-orthotist should possess the following characteristics:

1. He should be professionally trained in a four-year college or university and have the baccalaureate degree as a minimum.
2. Emphasis in his professional work should be on planning, fitting, diagnosis of prosthetic-orthotic problems, and handling patients.
3. He should be qualified to work with physicians, therapists, and other professional people in the clinical environment.
4. He should be bright, intelligent, clean-cut, able to think, solve problems, and apply basic principles in his work.

The characteristics of the orthopedic technician are as follows:

1. He should be technically trained in a two-year college program, with the Associate of Arts degree as a minimum.
2. Emphasis in his work should be placed on laboratory and shop fabrication procedures.
3. He should be qualified to work primarily with prosthetists-orthotists in a relationship somewhat like that between the optometrist and the optical technician.
4. He should be bright, adept at mechanical work, able to solve production problems, and in some instances be a candidate for additional training to advance to prosthetist-orthotist.

A few men who qualify as prosthetists-orthotists in terms of what they are able to do are at present working in the field, some with college degrees, some without. Most of them learned prosthetics-orthotics by serving an apprenticeship. Since no degree programs have been available in prosthetics-orthotics until recently, those with degrees received them in other fields, such as business administration and education. There is general agreement that more well-qualified men are needed, but where can we get such men? Each year the high schools graduate thousands of young men, each one eager to get a job or to enter college for training that will lead to a job. These high school graduates are our major source of new recruits for prosthetics-orthotics

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but we are not the only ones looking them over for likely prospects, we are in competition with every other occupation for the best boys in each graduating class. The better young men choose their careers with care, getting as much information as possible about each occupation in which they are interested, then making their choices after careful study of this information. What information about an occupation do our prospective recruits use as a basis for making a choice? Several studies have been made that reveal some of the factors considered important by high school graduates in choosing a career. Ten of the most significant are listed below, not necessarily in the order of importance:

1. The availability of an organized educational program, preferably on the college level, providing training for and placement in the occupation.
2. The extent of possibilities for advancement and professional growth, and possibilities of entering into business for one's self or into private practice.
3. The magnitude of the financial rewards prevalent in the occupation.
4. The stability of the occupation; what are the possibilities of it being eliminated or seriously reduced in importance by automation, obsolescence, or other changes.
5. To what extent does the occupation provide opportunities to help one's fellow human beings in some constructive way.
6. What security and auxiliary benefits may one expect to receive, such as retirement pension, paid sick leave, life insurance, hospitalization insurance, unemployment insurance, and so on.
7. The extent to which the members of the occupation maintain professional exclusion by restricting entrance to those individuals qualified through education and experience and the ability to pass appropriate certification examinations.
8. How does the occupation rate in status and prestige in the community in comparison to other occupations?
9. What opportunities are provided to carry on research in the field?
10. What means are provided to help members of the profession to keep up with new developments as they occur?

If you were a high school graduate searching for an occupation in which you would be happy, how would you evaluate prosthetics-orthotics on each of these criteria if you knew as much about the field as you do now? How does it compare to other occupations you know about, such as medicine, engineering, accounting, physical therapy, sales, corporation vice-president, and the like? If you had possessed all this information at the time you went into prosthetics-orthotics would you have gone into it anyway, or tried some other field instead? This is the kind of mental gymnastics our prospective recruits go through in selecting an occupation, so let us consider each of the ten criteria and see if we can evaluate prosthetics-orthotics as a potential career in much the same way the prospective recruit might do it.

The educational program, to attract top-quality students, should be closely related to and under the supervision of a medical school with ample clinical rehabilitation facilities to provide the necessary teaching subjects. At present, the best the great majority of those wanting to enter the field of prosthetics-orthotics can expect is apprenticeship training without benefit of school classes in science and technology available even to apprentices in carpentry and plumbing. While a well-organized apprenticeship training program can turn out a competent journeyman craftsman, it cannot compete

against college programs in the fierce competition for the better young men who are looking for occupational opportunities on the professional level. The lack of adequate college level educational programs in prosthetics-orthotics would have a very adverse effect on many well-qualified young men, and would influence them to look elsewhere for a career.

The opportunities for advancement and professional growth are very good for the college-trained man in the field of prosthetics-orthotics, and should remain so for some time, as the likelihood of flooding the market with such men is not very great. Well-trained college men, if available, should be able to command starting salaries equal to or better than those of male physical therapists, teachers, and comparable professional groups, and the income possibilities in private practice are very attractive to the individual capable of and trained in the successful management of such an activity.

Prosthetics-orthotics offers better than average occupational stability, as there are thousands of amputees and paralytics in need of artificial limbs and braces. No satisfactory means for manufacturing prostheses and orthoses in various sizes, like shoes, has been devised. Custom fitting may be improved and made more efficient, as is being done now through research, but the elimination of the need for such fitting does not seem to be imminent. The discovery of means for transplanting nerves to revitalize paralyzed limbs, or of a serum for stimulating the amputee's body to grow new limbs would certainly change prosthetics-orthotics as we know it now, and it would be foolish to say that such developments are impossible in light of some of the recent research in the composition and function of the cell. On the whole, however, prosthetics-orthotics is probably no more subject to obsolescence than most professional fields, and perhaps less so than many.

There can be no question that prosthetics-orthotics rates high in its provision of opportunities for service to humanity. My twelve years of experience in prosthetics-orthotics at UCLA have convinced me that the opportunity for service to humanity has more appeal for the young man seeking a career than any other, even including money. Basically, this is the same motivation that has attracted some of our finest young college graduates into the Peace Corps, and with a good college level education program prosthetics-orthotics could use this appeal to attract recruits of equal ability.

In the area of security—retirement, sick leave, paid vacation, insurance, and so on, wide variations are to be expected. A prosthetist-orthotist working for the Veterans Administration, for example, will receive all the considerable benefits accruing to a civil servant of the United States Government, whereas one operating his own facility may have less opportunity to take advantage of such "fringe benefits."

Professional exclusion, or means for preventing unqualified persons from entering the profession, is probably the weakest aspect of the occupational facade displayed by prosthetics-orthotics. That this should be true has been an unending source of amazement to me ever since I started the prosthetics education program at UCLA twelve years ago, and became acquainted with conditions in the field. As I have stated many times at various meetings, my garbage man here in Pacific Palisades where I live could start a prosthetics-orthotics "facility" for the price of a month's rent on a store, a business license, and a few dollars worth of tools and supplies, and there is no way to stop him from inserting his advertisement in the "yellow pages" of the telephone book and inflicting his ministrations on any hapless amputee who comes to him for his "professional" services. My garbage man could

not practice medicine, law, engineering, physical therapy, barbering, beauty culture, embalming, or any of a score of occupations, without risking being fined and imprisoned for practicing without a license. It is indeed ironic that he would not be allowed to embalm a dead body, but would be perfectly free to maim a live one. This makes a sorry picture to paint for the bright young man who is able to qualify for enrollment in college. There is not much incentive to put in four years of hard work at great expense and perhaps personal sacrifice to enter a profession which can be readily entered by a third grade graduate whose experience is limited to shoeing horses. Some will say I am exaggerating, but we have facts that will prove otherwise. One of the most disturbing experiences I ever had was taking care of the case of an employed "prosthetist" who traveled a considerable distance to enroll in one of our classes in prosthetics. After he arrived, we found to our dismay, that he could neither read nor write.

I fail to understand why the American Board for Certification in Prosthetics and Orthotics does not develop model legislation and exert leadership in obtaining its passage by each state legislature, making A.B.C. certification mandatory to be licensed to practice prosthetics and orthotics in the state. A national testing agency like the A.B.C. makes sense, but professional exclusion can only be accomplished through the police power vested by our Constitution in the several states. Admittedly, getting uniform legislation passed by fifty state legislatures is a long and arduous task, but this is the price that must be paid to achieve true professionalism. If this could be accomplished, being a "Certifee" would command real respect. Those who have invested much time and money in establishing and training themselves in the field of prosthetics-orthotics would have protection from the unfair competition of untrained "garbage men," the handicapped person would be protected from injury by unqualified "fitters," and the prosthetics-orthotics profession could more readily attract top quality young men.

The occupational prestige accorded to prosthetists-orthotists in the community is not great in relation to its potential, which is very great. In general, an occupation is prestigious in proportion to its exclusiveness, the magnitude of income of its members, and the contribution it makes to the welfare of humanity. For example, medicine for years has been a high prestige occupation. More years of college and graduate work are required for entry than any other profession, and strong state licensing laws make it impossible for anyone to practice who does not meet the requirements of professional standards, thus making it one of the most exclusive of all occupations. Financial rewards are ample, and medicine ranks amongst the highest in its contribution to the welfare of humanity. In prosthetics-orthotics, financial rewards can be quite ample, and the element of service to humanity is present to a large degree, but as discussed earlier, the lack of high educational and professional requirements for entry practically eliminates the element of exclusiveness. As a result, the status and prestige of those in the field of prosthetics-orthotics do not measure up to their potential.

Opportunities for research in prosthetics-orthotics are much greater than in many occupations. Congress has authorized more than one million dollars annually to the Veterans Administration for such work, and additional amounts are available through the Vocational Rehabilitation Administration and the National Institutes of Health. Some work is sponsored by private agencies such as the National Foundation and the Easter Seal Foundation. Better means are provided for keeping up to date on new developments in prosthetics-orthotics than for preparing to enter the field in the first place. Numerous articles are published in technical journals, extension classes are

offered by the universities, and presentations on prosthetics and orthotics topics are made at regional and national meetings.

From this discussion it is clear that the picture is not all black, and prosthetics-orthotics does have some strong assets in bidding for new talent in competition with engineering, physical therapy, optometry, drafting, and other professional fields. On the other hand some of the weaknesses mentioned are a real handicap, and of these one of the most serious is the lack of sufficient well-organized educational programs designed to prepare the student for entry into the field of prosthetics-orthotics. There are five levels of educational programs commonly identified with occupational preparation:

1. University graduate school. Bachelor's degree is required for entry; graduate schools usually give advanced degrees, such as the M.D. and LL.D. The better medical schools in the United States are always graduate schools, as are most law schools.
2. Four-year college. The four-year college grants the bachelor's degree, either in the liberal arts or general education curriculum, or some professional field, such as engineering.
3. Two-year college. Formerly called "junior colleges," California has almost 100 of these schools, and they are becoming more numerous in other states as well. They now grant the Associate of Arts degree, and most of them have dropped the "junior" from their names. In California they serve two purposes, to provide two-year terminal programs for training technicians, and to provide the first two years of the regular four-year college program, on completion of which the student transfers to a four-year institution.
4. Apprenticeship training. Apprenticeship is a combination of training on-the-job while working for an employer for pay, and classroom training in the technical aspects of the occupation, usually (but not necessarily) in evening classes.
5. On-the-job training. Similar to apprenticeship, but without the classroom technical training.

It was pointed out earlier that an ideal educational program in prosthetics-orthotics would be one in which the student would enroll in a two-year college where he would take a course of fundamentals that would qualify him and place him in a job as an orthopedic technician, with the A.A. degree. If the quality of his work in the two-year college was high and he showed adequate ability to handle more advanced work, he could transfer to a four-year college for more advanced work in prosthetics-orthotics, engineering, psychology, and other subjects leading to the Bachelor of Science degree, and ability to function as a professional prosthetist-orthotist. In both programs the students would serve a year of internship under supervision in an approved facility or facilities.

I have been asked many times why apprenticeship would not serve our purpose just as well as the college program described above, and at far less cost. I have had considerable experience with apprenticeship training, having served an apprenticeship as a machinist myself, taught evening apprentice technical classes, organized the California Apprentice Instructional Materials Laboratory, and published a book on problems of apprentice instruction (*Teaching Apprentices*, Chicago: American Technical Society, 1949). Apprenticeship has always functioned better in Europe than here, and many of our best skilled craftsmen having been trained there, particularly in Germany and Denmark. The reason it works better in Europe is the fact that they have strict laws that enforce the rules of the program on all

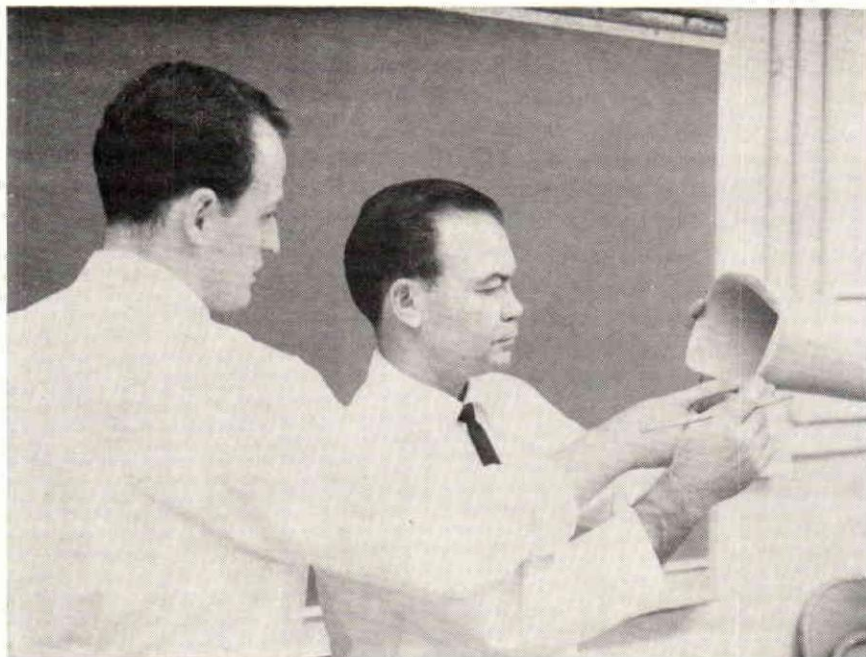


Fig. I—On-the-job instruction: the teacher demonstrates and explains the operation to the student, one step at a time.

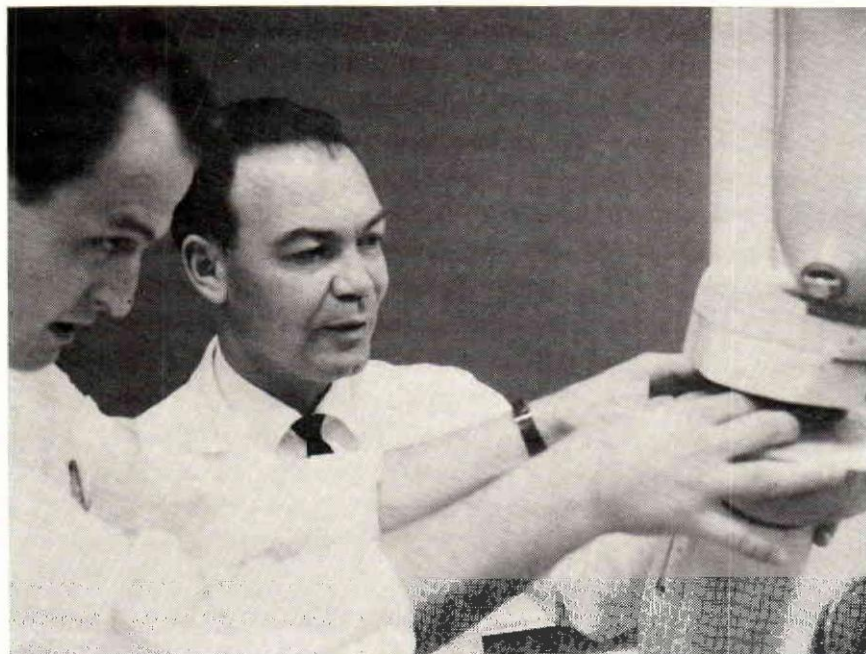


Fig. II—Immediately following the demonstration, the teacher has the student perform the operation under his supervision.

employers alike. There are five pitfalls that plague apprenticeship in this country, that the laws do much to prevent in Europe.

1. Production vs. training. The atmosphere in the average shop tends to emphasize production at the expense of training. Under these conditions the apprentice tends to deteriorate into a helper rather than a trainee, and learning decreases as this deterioration increases.
2. Poor work sequence. The apprentice learns best when he progresses from the simple to the complex in a planned, organized way. In the natural course of events in the average production shop the apprentice works on whatever comes in, or helps with bits and pieces of jobs already in progress.
3. Failure to rotate from one work process to another. When the apprentice learns one work process, he is supposed to be shifted to another so he can learn it, and so on until he has learned them all. The temptation to keep him on a process he has mastered long after he should have been shifted is very great, as the employer is then getting journeyman's production for apprentice wages.
4. Lack of teaching skill on the part of those responsible for teaching the apprentice. To be able to teach well one must possess some knowledge and skill in the art of teaching, and very few of those responsible for teaching apprentices on the job take the trouble to acquire this ability. The result is often a low order of efficiency in apprentice teaching.
5. Lack of training in the scientific and technical aspects of the work. Anatomy, physiology, kinesiology, mechanics, biomechanics, and the like are not readily taught on the job, yet are needed by the apprentice if he is to have well-rounded training. It is very difficult to organize classes for the small numbers of apprentices to be expected in prosthetics-orthotics in any locality.

A well-organized college program can overcome most of these difficulties encountered in operating apprenticeship training programs, and in addition it lends an aura of status and prestige that cannot be found in most apprenticeship programs. Prosthetics-orthotics is an auxiliary medical service, and as such it should be on a professional level, whereas in this country apprenticeship has become associated in many people's minds with labor unions, management associations, and the like. On the other hand, it must be admitted that apprenticeship offers a real-life educational environment, complete with pressure to produce and a weekly pay check. Many of the European apprenticeship programs are successful because they send the apprentice to college or technical institute several full days each week, and he learns on the job the other days. Work sequence and rotation on work processes are regulated by law, which keeps exploitation of the apprentice to a minimum. The college-oriented program we have in mind would actually function to accomplish almost exactly the same goals as the best European type apprenticeship training programs, as we would combine practical laboratory experience in the hospital and rehabilitation center with technical and scientific instruction in our educational program, followed by an internship on the job, and this very closely parallels what the European apprentice does on the job and in his technical institute classes.

To summarize our discussion to this point, the field of prosthetics-orthotics has strong appeal for the young prospective recruit, particularly in the areas of service to humanity, occupational stability, and income possibilities. Much of the luster of these attractive aspects of the occupation is

dimmed by the lack of adequate opportunities for college level education for entry into the field, and the almost complete absence of any form of professional exclusion to protect the qualified prosthetist-orthotist from the unfair competition of those who have not gone to the expense in time and money of obtaining proper education and training to do the work properly. With good college level education programs available, and a state by state requirement of certification to practice, prosthetics-orthotics would acquire real professional status and would attract its fair share of the cream of each annual crop of bright young men looking for career opportunities.

While the kind of program described above is desirable, it will probably not be achieved in the immediate future, and apprenticeship and one-the-job training will continue to be necessary for some time to come. In fact, it is not likely that there will ever be a time when a significant amount of such training will not be necessary, which means that all of you in the field of prosthetics-orthotics will at one time or another be called on to do some instructing on the job. In discussing the weak points in apprenticeship training you will recall I pointed out that one such point was the lack of understanding of how to teach on the part of those responsible for teaching the apprentice, so let's consider some of the basic principles and techniques you might use to make your teaching easier and more effective.

First, let's consider some basic ideas or principles of instruction.

1. Learning is developing in ourselves knowledge, skill, attitudes, and appreciations, and the ability to use these assets in the solution of our problems.
2. Teaching is getting others to learn.
3. We can learn without anyone teaching us.
4. We learn more in less time when:
 - a. Someone teaches us.
 - b. We have a strong desire to learn.
 - c. When the material to be learned is organized.
5. There is no learning without activity; either physical, or mental, or both.
6. Good teaching induces more learning in less time by:
 - a. Motivating students to want to learn.
 - b. Stimulating student activity.
 - c. Organizing material to be learned.

What are some ways the teacher might motivate the student to want to learn?

1. Appeal to his emotions, such as desire for prestige and status, competition, job satisfaction, monetary reward, promotion, and so on.
2. Relate the material to be learned to his past experiences and future needs.
3. Be enthusiastic about prosthetics-orthotics, and remember, enthusiasm is caught, not taught.

How can the teacher stimulate student activity?

1. Know prosthetics-orthotics thoroughly and in detail, both theory and practice.
2. Use exactly the right words to express your meaning. For example, avoid use of the word "thing" as a substitute for precise nomenclature. Remember, the only word that correctly identifies that vertical groove on the median line of the upper lip is PHILTRUM.
3. Explain new words to the student, and write them out if possible so that he can see how they are spelled.

4. Explain complex ideas in terms of simple ones. The complex idea of centrifugal force can be made more understandable by relating it to the force you feel when turning a corner in an automobile.
5. Explain one idea at a time, in logical steps.
6. Explain the relation of one idea to another.
7. Ask questions, encourage students to ask questions, stimulate discussion, but avoid "bull sessions" by confining the discussion to the problem at hand.
8. Maintain strict discipline; students really like it better that way. We all tend to work a little harder when we know we are expected to.
9. Have the students put into practice what they see demonstrated. There is no substitute for learning by doing.
10. Encourage students to be education minded by stimulating their interest in professional literature, meetings, extension courses, and exhibits.

What can the instructor do to organize the course material for the student?

1. Arrange the topics in the course in a logical sequence, starting with the simple and proceeding to the more complex, or, if more appropriate, in chronological order.
2. Give the student the over-all picture at the start, explaining what he is to learn, the procedures that will be followed, and what he is responsible for.
3. Keep the student informed on how well he is doing, where he is in the program, and how far he has yet to go.
4. As each new topic is taken up, explain the relation between it and the one that preceded it, and point to the one that will be taken up next.
5. Review each step with the student until he has mastered it.
6. Students learn more from success than they do from failure, so try to insure initial success. Satisfaction from learning creates the desire for more learning.

The good instructor applies all these principles and many more in teaching on the job. When a learner is to be taught a new operation, the instructor first analyzes it to determine the steps that must be mastered and the key points or information that must be learned to do the steps properly. He then demonstrates it for the student, showing and explaining each step slowly and carefully. Next, he has the student do the operation under his supervision so he can correct any errors and get him off to a good start, followed by repetition of the operation until the student has the desired degree of skill. At first this may seem like a time-consuming method, but it actually gets the job done correctly in a minimum of time.

The ability to plan and carry out on-the-job instruction should be cultivated by every prosthetist-orthotist as he can use this skill constantly in his daily work where communicating instructions quickly and efficiently will save much waste of materials and lost time. The development of universally accepted terminology is necessary for successful communications, so remember, that vertical groove on the median line of the upper lip is never called "thing," it is the **PHILTRUM**!