The Development of a Perfusion Educational Program

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Abstract

(J. Extra-Corp. Technol. 19[2] p. 216-220 Summer 1987). The development of a School of Perfusion Technology starts with a purpose statement that defines the need for such a program and the role of the school within the professional community.

After defining the purpose for such an educational program, a task analysis provides the program description of a perfusionist, which later is used to develop the curriculum. A goal analysis details what the student and program will achieve at completion. A statement of the professional and educational philosophy along with the program objective complete the basic foundation.

Level of sponsorship of the program determines the duration of education, physical resources, budgetary support, clinical availability and instructional faculty. A target population study forms the basis to define the applicant traits desirable for the program. All of the above data are combined to generate an application process and to begin to create the curriculum.

Specific subject matter is listed to include all pertinent and ancillary topics along with the approximate time required to cover each topic. Classes are developed from the topic list, with material coordinated to provide an overlap of knowledge between classes. Statement of course goals and objectives defines the learning expectation while the examination evaluates student knowledge.

Clinical rotations provide the opportunity for practical application of the scientific principles learned in the didactic portion of the education. Pre and post clinical evaluations are essential toward determining student’s strengths and weaknesses, in order to validate his or her knowledge in the clinical practice. This form of education mandates a single instructor per student and continual vigilance.

An outcome analysis is generated after graduation with employer feedback and peer review of the graduate perfusionist. From this analysis the program goals and objectives are tested, and program re-evaluation begins.

Introduction

Perfusion education began through the efforts of several people who had been trained on the job to perform cardiopulmonary bypass. From this foundation, the profession has developed structured education programs, offering students in perfusion a strong didactic background with supervised clinical activity. By continuing to refine the educational process, the profession will be assured of individuals who can fill the expanding role of the perfusion technologist.

The acquisition of an organized body of knowledge, together with a clinical practicum, is the cornerstone of a program. Knowledge organized into a structured curriculum that coordinates class time with progressive clinical experience is the mainstay of perfusion education.

Several collaborating organizations (Table 1) made

Table 1
Collaborating Organizations of the “Essentials and Guidelines” for an Accredited Educational Program for the Perfusionist

The American Association for Thoracic Surgery
American Board of Cardiovascular Perfusion
American Medical Association
American Society of Extracorporeal Technology
Society of Thoracic Surgeons
Perfusion Program Directors Council

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possible the adoption of essentials and guidelines for an accredited educational program for the perfusionist which were adopted in 1980. Essentials are the minimum standards for which an educational program is held accountable, including knowledge, skills, and program organization; the guidelines offer examples toward interpreting each essential. This document of essentials and guidelines will provide a consistency of education mandated by the profession, and will provide invaluable assistance when developing a perfusion educational program.

Research and Development

The initial program research and development will rely on a core of individuals dedicated to educating perfusionists. It will be necessary to research and define the need for such a program. This group must also decide at what educational level the program will be based—undergraduate, post-baccalaureate, or certificate. The sponsor of a program, a college, university, hospital, or other suitable institution, should also be considered.

After deciding to establish a program in perfusion education, a program philosophy must be written. This will outline the theoretical base for the program’s purpose, its relationship to the allied health team, and its role within the perfusion profession. The philosophy will describe the program as well as the program interaction with the student. It will also include a statement of principles of the program conduct and ethics.

Following the documentation of the program philosophy, a task analysis is conducted to detail the program’s definition of a perfusionist. A list of the specific tasks that the program requires a graduate perfusionist to perform can be placed in one of the categories found in Table 2. Ability to set up and prime an extracorporeal circuit, ability to set up and operate an intra-aortic balloon pump, and ability to provide support to a patient with failing lungs are but a few examples of perfusion tasks. Completion of the task analysis will assist to define the admission criteria, course selection, and subject matter.

Next is a goal analysis, to define the capabilities that the program plans for the student to achieve. With the use of items the program has listed in the task analysis, the goal will relate items to student accomplishment. Each goal uses behavioral objective language, such as “will perform...” and “upon completion, the student will...” Documenting the program goals will enable the student and staff to understand what the student is to accomplish by the end of the educational process.

Objectives then must be expressed. They are the working definition of what the program will accomplish in each phase of the learning environment. Each program objective will describe one of the following items: performance—what the learner is able to do; condition—under which the performance is expected to occur; criterion—quality or level of performance acceptable. An example of an objective would be: The student will be able to set up an extracorporeal circuit in the operating room without error and within 30 minutes. Each item expressed in an objective will satisfy the program goal, and the student will have an exact understanding of these expectations.

Once these steps have been completed, the program foundation has been established and will be governed by the documented goals and objectives. Then a target population study should be performed to define the group for which the program is intended. This study will also describe characteristics of the prospective students and thus define the applicant pool.

For example, the applicant pool might consist of all undergraduates of universities, or all individuals with Bachelor of Science degrees. The desired information about the applicant traits—such as previous degree, hospital experience, employment record—will be used to develop an application form. The educational level of the applicant pool will dictate the courses required in the perfusion program itself, in contrast to those courses required before entry into the program. Research into the education methodology to be used, such as lectures, self-study modules, computer simulations, and laboratory models, will better define the mechanics of the education.

Curriculum Design

Perfusion education can be divided into two categories: 1) a didactic portion to include coursework, exams and laboratories, and 2) a clinical practicum where the student applies the knowledge learned in the didactic portion.

Each lecture topic within the program should be listed together with the approximate time required for instruction. The topics are placed in groups of similar subjects, and then each topic group constitutes a course. The development of a course in this fashion will provide a slight overlap of lecture material, to
ensure an orderly transition of information from one class to another. A logical progression of information will allow the student to draw upon the knowledge learned in one class, to enhance learning in other classes.

Typical courses might include perfusion technology, cardiovascular dynamics, acid-base physiology, pharmacology, and in vivo laboratories. For each course, the student must receive a syllabus in which the course goal states the expected outcome at completion and the course objectives provide details on what is to be learned in that course. Each topic to be taught includes the dates of discussion and assignments that the student must complete prior to each class. From such a clearly written syllabus, the student will understand what is expected during the course. Also, examination questions are designed around the objectives to evaluate the students' level of achievement.

Evaluation of the student's knowledge and the application of the learned material is important. Administration of a criterion referenced exam will test the student against the course objectives, not against each other as in a norm referenced exam. Analysis of the student's exam for correct and incorrect answers may also reveal strengths and weaknesses in the exam process, or in the teaching process. If each student has the same wrong answer on a question, then the instructor must evaluate the way the subject item was presented in the classroom, as well as the way it was formulated as an examination question.

A grading system for the examination will identify the student's competency, and the instructors can identify what the student knows. Grading an exam will also provide a measurement of the student's progression in learning the material. By setting a minimal acceptable grade, e.g. 70%, the student and staff have a guide as to the student's level of achievement compared to the course objectives.

Clinical Rotation

Student clinical exposure to perfusion should be instituted after the basic perfusion course has been taught. Student responsibility for cardiopulmonary bypass should follow the didactic phase of their education. Clinical education of a student requires a single instructor per student—providing maximum patient safety in this critical learning environment.

Skills that the program desires students to achieve should be listed, including a time frame for mastering the task. By listing the skills in an organized progression of tasks, the student will know what is to be learned next. This then provides a sequenced learning environment for the clinical practicum.

During a clinical case an instructor should immediately point out errors in technique or thought process, as well as provide positive reinforcement and praise for correct actions. An explanation of how to correct or improve techniques should always be provided for the student. At the conclusion of each clinical experience, student and instructor should review the performance in detail. A written critique of the student's performance, expressing both positive and negative aspects of the case, is groundwork for student improvement in subsequent cases.

A grading system is used to rate the student's achievement and skills in the clinical setting. Competency may be defined as possession of suitable knowledge, skill, or experience toward some task to meet a minimum level of understanding, but not necessarily exceptional. It is necessary for each program to define its own measure of achievement as well as the grading tools to define competency. If the student can set up an extracorporeal circuit for three consecutive weeks without error and in a reasonable time frame, then the student may be considered competent for that task, and graded accordingly. Ultimately, the student is found to be competent or incompetent based upon his or her performance of that task.

The clinical education of a student is not limited to cardiopulmonary bypass. Related clinical areas, such as intra-aortic balloon counterpulsation, autologous blood recovery systems, and others, must be included. Each student receives adequate exposure to every clinical task that is listed in the program goals. Table 3 provides an example of the knowledge, and skills to be attained prior to graduation.

Resources and Program Maintenance

The location itself must have classrooms, study areas, library facilities, student health care availability, audio-visual equipment, and sufficient number and variety of clinical equipment. Financial support for the program must be forthcoming annually.

Regarding program faculty, its members must be available for student guidance and assistance for any difficulty encountered. Program faculty must be knowledgeable and qualified in an appropriate area such as perfusion technology or a related profession, and must have the necessary teaching skills. Sufficient time must be allocated for each faculty member to prepare subject matter, and to lecture, proctor and grade exams, counsel students, and maintain his or her clinical expertise.

Student records and documentation should be centrally located for easy accessibility. Records to be kept include: admission, attendance, health, exam scores, student guidance, disciplinary action, and clinical evalu-
Table 3
Identification of Skills and Competencies of a Perfusion Technologist

<table>
<thead>
<tr>
<th>Scientific Foundation</th>
<th>Personal Competence</th>
<th>Preparation for Extracorporeal Procedures</th>
<th>Execution of Extracorporeal Procedures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anatomy</td>
<td>Perform under stress</td>
<td>Assess Patient</td>
<td>ICB/TCB</td>
</tr>
<tr>
<td>Embryology</td>
<td>Maintain emotional stability</td>
<td>Collect/Interpret Data</td>
<td>Continuous scan of environment</td>
</tr>
<tr>
<td>Pathology</td>
<td>Maintain positive professional image</td>
<td>Perform Calculations</td>
<td>High level of attentiveness</td>
</tr>
<tr>
<td>Pharmacology</td>
<td>Chemistry</td>
<td>Review current literature</td>
<td>Physics</td>
</tr>
<tr>
<td>Chemistry</td>
<td>Physics</td>
<td>Select appropriate circuit design, equipment and supplies</td>
<td>Mathematics</td>
</tr>
<tr>
<td>Physics</td>
<td>Mathematics</td>
<td>Participate in continuing education</td>
<td>Mathematics</td>
</tr>
<tr>
<td>Chemistry</td>
<td>Sterilization Techniques</td>
<td>Establish and maintain acceptable extracorporeal physiology</td>
<td>Mathematics</td>
</tr>
<tr>
<td>Physics</td>
<td>Laboratory Procedures</td>
<td>Maintain Records</td>
<td>Hemodynamics</td>
</tr>
<tr>
<td>Anatomy</td>
<td>Medical Terminology</td>
<td>Maintain Records</td>
<td>Emergency Responses</td>
</tr>
<tr>
<td>Embryology</td>
<td>Principles of Extracorporeal Technology</td>
<td>Interpreting hemodynamic data</td>
<td>Continual patient assessment</td>
</tr>
<tr>
<td>Pathology</td>
<td>Product Design and Function</td>
<td>Maintain Membrane Oxygenation</td>
<td>Communication Skills</td>
</tr>
<tr>
<td>Pharmacology</td>
<td>Patient Monitoring</td>
<td>Maintain Records</td>
<td>Myocardial Preservation</td>
</tr>
<tr>
<td>Chemistry</td>
<td>Types of Extracorporeal Procedures</td>
<td>Maintain Membrane Oxygenation</td>
<td>Myocardial Preservation</td>
</tr>
<tr>
<td>Physics</td>
<td>Mechanical Procedures</td>
<td>Autotransfusion</td>
<td>Manage Personnel</td>
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<tr>
<td>Mathematics</td>
<td>Assist Procedures</td>
<td>Blood Flow Studies</td>
<td>Conduct in-services</td>
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<tr>
<td>Sterilization</td>
<td>Intra-Aortic Balloon Pump</td>
<td>Hemoconcentration</td>
<td>Maintain Inventory</td>
</tr>
<tr>
<td>Techniques</td>
<td>Operate</td>
<td>Product Evaluation</td>
<td>Intermediary with other Depts. and Administration</td>
</tr>
<tr>
<td>Laboratory Procedures</td>
<td>Criteria for use optimal performance weaning criteria</td>
<td>Maintain Membrane Oxygenation</td>
<td>Prepare Budget</td>
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<tr>
<td>Medical Terminology</td>
<td>Left Ventricular Assist Devices</td>
<td>Maintain Membrane Oxygenation</td>
<td>Maintain Membrane Oxygenation</td>
</tr>
<tr>
<td>Principles of</td>
<td>Artificial Heart</td>
<td>Maintain Membrane Oxygenation</td>
<td>Maintain Membrane Oxygenation</td>
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<tr>
<td>Extracorporeal</td>
<td></td>
<td>Maintain Membrane Oxygenation</td>
<td>Maintain Membrane Oxygenation</td>
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<td>Corporeal Technology</td>
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<td>Product Design and</td>
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<td>Function</td>
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<td>Maintain Membrane Oxygenation</td>
<td>Maintain Membrane Oxygenation</td>
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<tr>
<td>Patient Monitoring</td>
<td></td>
<td>Maintain Membrane Oxygenation</td>
<td>Maintain Membrane Oxygenation</td>
</tr>
</tbody>
</table>

Table 4
Policies Required by the Perfusion Education Program, in Conjunction with the Sponsoring Institution

- Operational Rules and Regulations
- Admission Criteria
- Interview Criteria
- Student Program Cost
- Vacation and Sick Time
- Graduation Criterion
- Failed Courses
- Readmission of Students
- Clinical Competency Committee
- Advisory Board

Program review and evaluation is an ongoing project. Input into the effectiveness of the program is gathered from faculty, students, peers and employers. Outcome analysis performed by the program officials is used to test the program compliance with its own goal. Areas of demonstrated weakness in either the didactic or clinical phase should be improved.

Conclusion

Developing an educational program in perfusion...
technology is no simple task. It begins with a dedicated group of individuals, no matter how small, who perceive the need for the program. The organizational process is long and difficult. Each step is time consuming, tedious and subject to many changes. There are multiple revisions, reviews and interactions with institutions and administrators, before a program can accept its first class.

The rewards for years of planning and implementation are seen at graduation—when persons accepted as students are now perfusion technologists, qualified and competent to the best of your ability and theirs.

Acknowledgment

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