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# 3D Anatomy Tutorial Template: A New Teaching Method Using Virtual Reality

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**Introduction:** The first two years of medical education is changing significantly at many institutions across the United States and the way information is presented to students is being modified. Computers have been increasingly utilized in many areas of medical school education, including teaching, review and in examinations. They are viewed as cost-effective means of extending the learning environment through their ability to deliver high quality color images within teaching laboratories as well as by remote access. In a recent survey of gross anatomy courses in the United States and Canada, 87 percent of participating institutions reported that computers are used to teach anatomy[1]. Most of the current methods of computer-aided teaching use static images or prerecorded 3D movies that do not involve the participation of the student in the learning process. Although 3D imaging of the human body is available from the NIH Visible Human Data Set, no known attempts have been successful in creating interactive 3D tutorials available over the Internet, which has forever changed the face of learning.

This project was designed to create a teaching tool available over the Internet. The tutorial aims to improve the understanding of spatial relationships between different organs and structures as well as following the progress of each student. The tutorial specifically traces the course of cranial nerve (CN) VI, abducens, from its origin in the midbrain to its innervation on the medial aspect of the lateral rectus muscle of the eye, constantly relating its course to the surrounding regional anatomy. This design serves as a prototype, allowing future users to create new educational objectives by adding additional 3D models, modifying the educational content, and creating a set of questions to test the student.

The 3D images used were extracted from the Visible Human Data Set. They were reduced in size, converted into VRML format and assembled in a VRML world through JAVA programming.

The educational content was designed to guide the student user along the course of CN VI. It provides information and directions that allows the student to identify important structures and guides the student to choose from a list of structures, change the transparency of these structures and observe the spatial relationships between these structures. Throughout the tutorial, the nerve remains opaque. The student, therefore, is able to understand the anatomic and topographical relationships between the nerve and various regions of the body through this 3D interaction.

The test component is based on a multiple choice methodology. The user's activity is recorded and stored in a database of the questions and answers used and the time taken to complete the test. This allows further analysis of the user's progress as well as a way to refine the teaching tool.

This tutorial teaches cranial nerve anatomy to first-year medical students in gross anatomy. Anesthesiologists currently using regional nerve blocks in the treatment of such disorders as trigeminal neuralgia may also find this tutorial useful in teaching the local head and neck anatomy needed to perform this procedure. By replacing the abducens nerve with the maxillary nerve, the regional anatomy and the course of the maxillary nerve through the head may be taught and provide key relationships that may enhance the efficacy of performing regional anesthesia.

This tutorial currently runs on PCs and SGI computers via Netscape and Internet Explorer. It serves as a model of an interactive 3D method of teaching accessible over the Internet, which has applications reaching far across disciplines.

## References:

1. Fitzharris T.: Survey of gross anatomy courses in the United States & Canada. ANAT REC 253 (6); 162-66. [PubMed: 9875985]

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# A Comparison of Computer-Assisted Instruction and a Traditional Lecture on Learning Vascular Anesthesia

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**Introduction:** Medical professionals hold a traditional view of the teaching and learning process, where the learner is viewed as a passive recipient of information. An alternative to traditional educational methods is the use of computer-assisted instruction (CAI) as a learning tool.1,2 As applications of interactive technology increase in number, their benefits are becoming better understood, as are the consequences associated with using the technology in education. We hypothesized that the use of CAI to teach anesthesia for major vascular surgery to a group of anesthesia residents would demonstrate statistically significantly higher test scores compared to a group learning through a traditional lecture format.

**Methods:** Twenty-five residents in training for anesthesiology were divided into two groups based on a randomization schedule and given similar content either in a standard lecture format or with CAI. The CAI format consisted of an interactive multimedia Microsoft Powerpoint application run from a CD-ROM within a Microsoft Windows NT environment. This file consisted of basic textual and graphic material, with hyperlinks to questions and answers based on the material. All residents were evaluated before their interventions with the same 47-item multiple-choice written examination and then re-evaluated approximately two weeks after their intervention. Scores were compared between intervention groups and between pre- and postintervention periods.

**Results:** Twelve residents underwent the lecture whereas 13 were given the CAI CD to use. Demographics and test results are listed in *Table 1*. The mean score for the CAI group was statistically significantly higher after the intervention, but not statistically significantly higher after intervention when compared to the lecture group. In only one subject did the score drop from pre- to postintervention. This subject was in the CAI group. Although the CAI group demonstrated greater improvement in scores between testing periods, the mean change was not statistically significant ($p = 0.08$) (Table 1).

**Discussion:** In residents, structured tutoring with a CD-based CAI application provides short-term educational outcomes slightly (but not significantly) above those of a standard lecture. Future studies should examine the long-term effects of multimedia computer-assisted learning on information retention.

## References:

1. Platt MW, Anderson W, Obenshain SS.: Use of student-centred, computer-mediated communication to enhance the medical school curriculum. Med Educ 1999;33:757-61. [PubMed: 10583769]

2. Moberg TF, Whitcomb ME.: Educational technology to facilitate medical students' learning: background paper 2 of the medical school objectives project. Acad Med 1999:74:1146-50. [PubMed: 10536639]

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# Distance Education With a Human Patient Simulator - A Novel Method to Involve Remote Participants

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**Introduction:** Crisis resource management training in a realistic simulated environment using a human patient simulator[1] has become accepted practice.[2] To obtain maximum effectiveness, group size should be limited to two to four,[3] which becomes expensive and time consuming. Video projection of such a small group session to a larger remote group would increase the number of "trainees." We asked two questions: How do we involve the remote participants in decision making?. Would the remote participants feel

involved in the scenario?

**Methods:** We developed a scenario with five consecutive obstetric crises using a METI simulator (Medical Education Technologies, Inc., Sarasota, FL). With Institutional Review Board approval, two residents volunteered to manage the simulation while other residents viewed events via closed circuit video. The simulation was stopped at five predetermined points. The remote participants were then required to provide a diagnosis and treatment plan, which were then used by those in the "hot seats" to continue the simulation. All residents (CB-I through CA-III) completed a questionnaire exploring their perceptions of the session.

**Results:** All residents (n = 20, 100% return) completed the questionnaires. On a 5-point Likert scale, 18 residents marked the "usefulness of the session" in the highest two categories. The majority of residents (n = 18) indicated that they did "feel personal involvement in the outcome of this simulation." Only two residents said they did feel "out of the picture" because of the remote location.

**Conclusion:** Using this methodology, remote residents did participate in decision making. Based on the resident evaluations, residents did feel involved in the scenario. Therefore, we believe this to be a valuable method to increase the number of trainees participating in a simulation scenario.

## References:

1. Gaba DM, DeAnda A.: A comprehensive anesthesia simulation environment: recreating the operating room for research and training. Anesthesiology 1988;69:387-94. [PubMed: 3415018]

2. Good ML, Gravenstein JS.: Anesthesia simulators and training devices. Int Anesthesiol Clin 1989;27:161-8. [PubMed: 2670770]

3. Murray WB, Shelley KH, Schneider AJL.: Education for practical anesthesia. Curr Opin Anesthesiol 1994;7:471-2

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# The Integrated Clinical Base Year: Will it Produce Better-Prepared Graduates?

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**Introduction:** Traditionally anesthesia residents completed an internship in internal medicine before beginning their anesthesia training. We have developed an anesthesiology-focused integrated clinical base year that we hope will enable our residents to use these outside rotations to build on their growing anesthesiology knowledge in order have a better understanding and implementation of quality patient care.

**Methods:** Our residents in both the traditional and the integrated program will participate in this study. All

residents will provide evaluations annually of their perceived abilities and their academic abilities through departmental written and oral examinations and the annual in-service examination. A comparison between the traditional residents and the integrated program residents will be made.

**Results:** Preliminary results with the first three residents enrolled in the integrated program show that they score higher on oral and written examinations than their traditional year cohort at the PGY-2 level (departmental written exams: 64% vs. 58%; Departmental Oral Exams: 75% vs. 73%; in-service exam 61st percentile vs. 53rd).

**Discussion:** Although these preliminary data are small in number, the results are encouraging. Not only are the integrated residents able to advance through the clinical base rotations at appropriate times in their training but also they are able to participate in four years departmental didactics (rather than only three for the traditional residents). What is hoped is that by integrating outside rotations of increasing complexity that are specific to anesthesiology training the resident will be able to internalize the applications easier than by having a concentrated traditional year. What is yet to be ascertained is whether the 'head start' these integrated residents have over their traditional cohort can be maintained throughout the four years of training.

## References:

1. The 1999 ABA-ASA Joint Council Reports to Program Directors. September 1999

2. ACGME. Program Requirements for Resident Education in Anesthesiology. July 1996.

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# Managing and Designing Research Projects in a Time-Restricted Academic Environment

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**Introduction:** Our study focused on locating physicians with innovative ideas and on the methods of working with them to plan and design their projects, taking into consideration that physicians have clinical obligations that leave little time for research. The objective was to establish whether someone with no formal medical training could assist the physicians by utilizing the extra person's larger amount of time available for research.

The research associate began with no contacts and no established projects. The first part of the study was to create a list of physicians who had previously shown interest in starting research projects or had contributed project ideas. This was accomplished by interviewing lab technicians and secretaries and using this data to contact the prospective physicians with an initial offer of assistance.

Upon receiving a reply, the associate arranged to meet with the physician to discuss and document the

proposal. After the first meeting, the associate investigated the subject matter to acquire a thorough understanding of all topics discussed, and used this and the information gathered during the meeting to compose an initial summary of the project. This summary included the objective and supporting background materials, but at this point contained no discussion of methods.

The purpose of the summary was to help both the associate and the physician. The associate was able to comprehend the project ideas and have a written document that could be used to expedite later research. The physician could see another perspective of the project and ensure that the associate and physician both had a similar understanding of the project. The summary was also beneficial in helping both people consider improvements to the current design. Methods were deliberately excluded in this part of the study, since we wanted to create a summary of the project goals that was independent of the available resources.

Once the associate and physician had resolved and summarized the goals, the focus was turned to the methods and design of the project. Factors such as feasibility, time, equipment, and resources were added to the previous considerations of originality and applicability. To verify that the final method chosen was truly the most accurate and most efficient, we created several designs for each project and analyzed them to find the method that in our minds best met the objectives.

The final stage of each project was to condense all of the materials produced thus far into drafts for grant application. The associate created the documents with the physician's comments and help in revising each successive draft. To search for potential financial support, the associate used several grant searches to compile lists of applicable sources such as foundations and endowments. After the design, documentation, and support for a project had been completed, the associate's involvement was considered to be concluded.

The first benefit of this study was that each participating physician, without utilizing an excessive amount their time, was able to plan their idea into a project that was ready to be initiated. The second outcome was the development of a method that can be used to locate and design research experiments in a time-restricted academic environment.

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## A Proposed Novel Classification of Teaching Strategies Using a Full Human Simulator

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Similar to the flight simulators used in the aviation industry, full human simulators[1,2] have become available to medical educators. A full human simulator is a computerized, life size mannequin with a simulated cardiovascular system (pulses, heart sounds, ECG, etc.), a respiratory system (chest wall movement, lung sounds, realistic upper airway, etc.) as well as computer models that produce realistic physiologic responses to trainee interventions and to more than 50 medications. Although these simulators

have been in use for several years, there are very few guidelines for teachers proposing to use simulators in a comprehensive educational environment.

We propose a novel classification of teaching strategies using a full human simulator that also incorporates Bloom's Educational Objectives.[3]

**Observation:** This is similar to a teaching ward round where the diagnosis is known using a "look here, see this" teaching mode. Bloom's "facts" and "understanding" objectives are addressed.

**Diagnosis:** The trainees are presented with a "diagnostic challenge" as the diagnosis is not known. An advantage of the full human simulator is that trainees can perform a diagnostic test or therapeutic maneuver (administer fluids or drugs) and use the response of the system as a diagnostic aid ("ping the system".) The diagnostic mode can be used in slow time (step by step), or in real time (with or without videotaped debriefing). In addition to the previous, Bloom's objectives of "application", "analysis", and "synthesis" are addressed.

**Treatment:** In this mode, diagnosis may be a preliminary step, but the emphasis is on treatment of the problem. The treatment strategy can also be in slow time or in real time. Real-time teaching includes Crisis Management, also called Critical Event Management, in which video debriefing is commonly used. Bloom's objectives addressed include all of the previously mentioned objectives as well as "evaluation/ comparison" of different therapies.

**Crisis Resource Management (CRM):** In this mode, the actual problem or crisis is not the issue, but team work and leadership are emphasized as well as using all the resources, calling for help and avoiding fixation errors.[4] Bloom's objectives addressed include the previous as well as "attitudes."

**Credentialing:** A natural progression is to use the full human simulator as an examination tool to test the trainees' expertise in a simulated practical environment. This intuitively seems to be a better method than a pencil and paper test. However, we believe that until the fidelity of the simulators have improved, using the simulator as a "pass-fail" mechanism should be approached with caution (or preferably avoided.) Similarly, although the simulators are excellent tools to teach cognitive processes and decision making, the realism of psychomotor tasks needs improvement before valid credentialing can be assured.

In conclusion, we believe using such a classification enables teachers to follow a natural progression and to develop and use increasingly complex teaching strategies.

## References:

1. Good ML, Gravenstein JS.: Anesthesia simulators and training devices. Int Anesthesiol Clin 1989;27:161-8. [PubMed: 2670770]

2. Murray WB, Shelley KH, Schneider AJL.: Education for practical anesthesia. Curr Opin Anesthesiol 1994;7:471-2.

3. Bloom BS., et al. : (1956) Taxonomy of Educational Objectives. Handbook I: Cognitive Domain. New York, NY: David McKay.

4. Gaba DM, DeAnda A.: A comprehensive anesthesia simulation environment: recreating the operating

room for research and training. Anesthesiology 1988;69: 387-94. [PubMed: 3415018]

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# Integration of Simulation-Based Anesthesia Education With a Web-Based Resource

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**Introduction:** Full-scale anesthesia patient simulation is thought to be useful for enhancing anesthesia trainee learning by using an experiential approach. However, it is a very time- and labor-intensive teaching tool. Using a web-based resource to allow trainees to prepare and review simulation sessions, may encourage them to use collaborative learning and "deeper" learning strategies, thus 1) maximizing learning, and 2) allowing more of the teaching sessions to be used for higher-order cognitive skills.

**Methods:** All senior anesthesia residents at Cleveland Clinic have attended a monthly simulation session for the last year. In addition, our anesthesia interns have been attending a different monthly simulation session over the last four months. An online resource was created, to provide a curriculum and a study plan for these sessions. The online resource provides: 1) a case stem, 2) questions regarding perioperative anesthesia management, 3) a list of references (short reading assignments from texts, key journal articles, and online "links" to internal and external sites).

**Results:** For personnel at the same training level, it was recognized that our trainees have 1) different learning preferences, and 2) different levels of knowledge and comprehension of the topics that would be relevant to each simulation session. Some participants are enthusiastic about using the online-resources. In a three-week period in March, 30 trainees accessed the website. The trainees are increasingly reading, printing out, "reading around," and discussing the topics posted on the web-based resource. An additional benefit of the site has been to simplify logistics of running the simulation center. The online resource serves as a centralized scheduling area, streamlining the workload of secretaries, engineers, and clinicians involved in supporting education in our simulation center.

**Discussion:** A web-based resource can provide a unique supplement to a simulation center by 1) coordinating operational issues in running the center, and 2) possibly enhancing the educational value of the experience. Further study may help to determine the ultimate impact of this intervention.

## References:

1. http://home.earthlink.net/~stecknk/

2. Spencer JA, Jordan RK.: Learner centred approaches in medical education. BMJ 1999;318:1280-3. [PMCID: PMC1115656] [PubMed: 10231266]

3. Candler CS, Andrews MD.: Avoiding the great train wreck: standardizing the architecture for online

curricula. Acad Med 1999;74:1091-5. [PubMed: 10536630]

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# The Teaching Faculty Position-A New Approach to Educational Accountability and Satisfaction

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**Purpose:** The role of educator always has been understood to be a component of an academic career. As academic centers become more accountable for federal dollars spent on postgraduate education, it will be incumbent on departments to be able to account for time devoted to educational endeavors. One such way of not only demonstrating accountability but also providing excellent teaching sessions is the establishment of a rotating Teaching Faculty Position.

**Description:** Our Teaching Faculty Position is a two-week rotating nonclinical assignment on Monday, Wednesday, and Friday. Assignment is contingent upon application to the departmental Education Committee. This application must contain a description of an educational project that is either novel or previously started by another faculty member. Duties include medical student lectures, resident teaching, and work on the educational project described in the application. Resident teaching occurs away from clinical duties, individually with 1 to 2 residents, and involves topics selected by the participating faculty. Educational projects may include curriculum development, simulator scenarios, fiberoptic intubation or difficult airway modules, or educational research projects.

**Value:** Medical students, residents, faculty, departments, and the academic center all benefit from this assignment. The medical students rotating in our department received well-organized lectures and simulator experiences from the teaching faculty. The residents receive individualized instruction away from clinical duties over topics such as anatomy of regional techniques, fiberoptic intubations in the simulation lab, and others at a pace best suited for the learner. The faculty members are able to easily document educational activities for their teaching portfolios, as well as having the satisfaction of a teaching job well done. The department benefits by the ease of documentation of the use of faculty nonclinical time toward worthwhile projects, as well as by having motivated residents and faculty.

## References:

1. Levinson W, Rubenstein A.: Mission critical-Integrating clinician-educators into academic medical centers. N Engl J Med 1999;341:11:840-3. [PubMed: 10477784]

2. Waisel D.: Nonpatient care obligations of anesthesiologists. Anesthesiology 1999;94:4: 1152-8. [PubMed: 10519515]

3. Evans C.: Faculty development in a changing academic environment. Acad Med 1995:70:1:14-20. [PubMed: 7826435]

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# Video Technique in Teaching Intubation

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**Introduction:** Among the airway management skills every anesthesiologist must master is direct laryngoscopy. Teaching has always been a challenge because the teacher and pupil do not have identical views of the structures.

Even for the accomplished anesthesiologist there are patients in whom intubation will be difficult. It is helpful to have an assistant who can manipulate the larynx or perform maneuvers to assist the intubator in better visualization.

The authors have employed a standard Mcintosh blade, which accepts a small flexible bundle, and image bundle. The blade, which is interchangeable with others, fits on a laryngoscope handle which contains a small video camera.

Cables connect the handle to a camera control and light source. The image is displayed on a television monitor, which can be positioned over the patient on an articulated arm, or on any other monitor in the operating room. The use of the video monitor has gained wide use in endoscopic surgery and is now the accepted standard.

The magnified image makes it possible for assistants or observers to see precisely what the anesthesiologist sees and what anesthesiologist is doing in real time. As in surgery, in the case of tracheal intubation the video monitor with the superb image allows an assistant to visualize the effect of manipulations designed to help in the placement of the tracheal tube.

In the teaching arena, the video laryngoscope permits the instructor and pupil to have identical, simultaneous views of the anatomy. The instructor can make appropriate suggestions or corrections. The fact that these efforts can be coordinated is a notable improvement over standard techniques. The video laryngoscope has been used by a number of intubators in more than 50 cases with differing levels of experience from medical students to experienced practitioners. On several occasions external manipulation of the larynx by an assistant was helpful in achieving intubation. Even nonexperts were impressed by the image and recognized it as a valuable asset.

The video laryngoscope is a relatively simple system and has the great advantage of using the standard laryngoscope handle and blade. It represents an important and valuable teaching adjunct and can be employed in every day practice in the emergency room, in the operating room, or in the intensive care unit under any condition which requires patient intubation.