

MEDICAL SCHOOL AND RESIDENCY PROGRAM CURRICULUM RESOURCES ON DRUG ABUSE AND ADDICTION

Patient-Centered Learning: The Connor Johnson Case— Substance Abuse in a Physician

University of North Dakota

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November 8, 2009



<http://www.drugabuse.gov/coe>

These curriculum resources from the NIDA Centers of Excellence for Physician Information have been posted on the NIDA Web site as a service to academic medical centers seeking scientifically accurate instructional information on substance abuse. Questions about curriculum specifics can be sent to the Centers of Excellence directly.

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Introduction

General Case Information

The case presented herein is designed for three 2-hour meetings and emphasizes the importance of considering substance abuse in the differential diagnosis, even when not obvious, and highlights the issue of substance abuse among physicians.

Facilitator Activities and Responsibilities

Facilitators are to:

- Monitor the group process
- Keep the group on track
- Ask questions to explore depth of knowledge

To assist facilitators in these activities and ensure some uniformity between groups, the facilitator version of the case (included) provides key background information and identifies important issues for discussion. The Facilitator Guide, however, does not provide specific answers to the Educational Objectives because it is the facilitator's role to encourage students to formulate questions, pursue answers, and share their knowledge with fellow students, not to provide the "right answer" to the questions this case raises. In addition, the role of facilitator does not include the teaching of content; therefore, facilitators need not be experts in the areas covered in the case.

Note: *A PBL Primer for Students and Faculty* and *Skills to Enhance Problem-based Learning* are provided as reference articles for instruction in conducting a problem-based learning (PBL) group and essential group process skills.

Student Activities and Responsibilities

Students working in groups of six to eight are to:

- Review the case in detail one page at a time
- Identify the chief complaint
- Suggest hypotheses (which students are to review and refine as new information becomes available)
- Discuss what questions they would ask when taking the patient history
- Describe the physical examination
- Specify the diagnostic tests they would order
- Answer the embedded questions in the Facilitator Guide (in shaded boxes)

Meeting 1

- At the end of the first meeting, students are to review deficiencies in their knowledge and define learning objectives to research.

Meeting 2

- At the second meeting, students present learning objectives and research results, usually with a handout and educational aids (e.g., PowerPoint, video).
- At the end of the second meeting, students are given the Student Learning Objectives which they are to research prior to the final meeting.

Final Meeting

- At the final meeting, each student makes a short presentation (about 10 minutes) to the entire group that addresses a previously selected Student Learning Objective that the student has researched (students typically spend 2 to 4 hours in research between meetings). Presentations are to include a handout and visual aids (e.g., PowerPoint slides, video, computer images). Students then review the case and the group process.

Key words: drug abuse; drug addiction; impaired physicians; infective endocarditis; substance abuse

Educational Objectives

Educational Objectives are the overall objectives for the three-session experience and are as follows:

- Discuss major risk factors and differential diagnosis for infective endocarditis.
- Identify major causative agents and the pathophysiology of both acute and subacute endocarditis.
- Understand drug abuse in the physician population, including risks, types of drugs involved, treatment, monitoring, and risk of relapse.
- Know the effects of chronic opioid use on the central nervous system and other organs.
- Learn the characteristics of opioid withdrawal and how it is managed.

Facilitator Guide

This case is about an anesthesiologist who presents with fever, malaise, and several other somewhat nonspecific and vague findings, which turn out to be infective endocarditis caused by intravenous (IV) drug abuse.

Infective endocarditis is characterized by colonization or invasion of the heart valves, the mural endocardium, or other cardiovascular sites by a microbiologic agent, leading to the formation of vegetations composed of thrombotic debris and organisms, often associated with destruction of the underlying cardiac tissues.

The key to recovery is early diagnosis and appropriate therapy.

In this patient's (Dr. Johnson's) case, the students are given a little information at a time, which correlates with the evolution of the disease. In the early stage it would be difficult to make a specific diagnosis; but as time goes on, more and more of the clinical findings point toward endocarditis. In consideration of the patient's past history of trauma with chronic pain syndrome and treatment—and his job as an anesthesiologist—the suspicion of drug abuse arises early in the case as a diagnosis of endocarditis is being made.

Meeting 1

Note: The notes for the facilitator are provided as an aid in directing the students' discussion, if the students do not raise/address these questions on their own.

Case	Notes for the Facilitator
<p>Dr. Johnson is seen in the emergency room with a chief complaint of fever and sweats that have gotten worse the last 24 hours.</p> <p>Dr. Johnson is a 32-year-old anesthesiologist, working for the local hospital, who was well until about 4 weeks ago when he developed symptoms of fatigue, malaise, and poor appetite. Over the last 4 weeks he has developed feverishness, diaphoresis, myalgias, and arthralgias. He presents today having just administered anesthesia for the patient of a local surgeon.</p>	<p>Chief complaint: Fever and sweats—worse in the last 24 hours.</p> <p>Hypotheses:</p> <ul style="list-style-type: none">• Influenza• Anemia• Mononucleosis• Cytomegalovirus• Undifferentiated connective disease• HIV

Case	Notes for the Facilitator
<p>Physical Examination</p> <p>General: A slender, somewhat weak-appearing male with a nonproductive cough, slight tachycardia, and petechiae in the oropharynx.</p> <p>Vital signs: Temperature: 38° C Heart rate: 105 bpm Blood pressure: 120/80 mm Hg RR: 22/minute</p> <p>HEENT: Posterior pharynx is quite red with exudate.</p> <p>Heart: Normal sinus rhythm and grade I/VI systolic murmur noted at apex without radiation.</p> <p>Lungs: Clear to auscultation and percussion.</p> <p>Abdomen: No organomegaly or tenderness; normal bowel sounds.</p> <p>Neurological: Normal.</p>	<p>General: Rapid heart rate and red throat.</p> <p>Heart: Apex location suggests regurgitant lesion (rather than stenosis) at the mitral or tricuspid valve.</p> <p>Hypothesis list modified:</p> <ul style="list-style-type: none"> • Upper respiratory tract infection • Cardiac valvular disease • Strep throat • Mononucleosis • Anemia • Influenza

Case			Notes for the Facilitator
CBC	Result	Ref. Range	
WBC	13.0	5.0–10.0 x 10 ³ /:L	WBC: Elevated WBC and NEUT% indicate an infection.
RBC	4.8	4.5–6.0 x 10 ⁶ /:L	RBC: Anemia ruled out due to normal RBC values.
HGB	15.0	13.0–17.0 g/dL	
HCT	45.0	40.0–52.0%	
MCV	85	80–100 fL	
MCH	30	27.0–33.0 pg	
MCHC	35	32.0–36.0%	
RDW-CV	12.0	11.5 –14.5%	
PLT count	300	150–400 x 10 ³ /:L	
NEUT %	76	50–70%	
Lymph %	22	20–40%	
Mono %	1	2–8%	
EOS %	1	1–4%	
BASO %	0	0– 2%	
Lab: Hematology			
Rapid strep test and mono test were negative.			
A diagnosis of upper respiratory tract infection, possibly viral, was made and the patient was empirically treated and sent home on azithromycin 500 mg today and 250 mg/day for the next 4 days.			
			The rest of the labs are within normal range.
			Strep throat and mononucleosis no longer likely.
			Why use a macrolide antibiotic at this point to treat this patient?
			Azithromycin: A macrolide antibiotic used in adult patients; semisynthetic derivative of erythromycin; bacteriostatic agent that inhibits protein synthesis by binding reversibly to the 50 S ribosomal subunits of sensitive microorganisms.

Case	Notes for the Facilitator
<p>One week later, Dr. Johnson returned to the emergency room with his wife. His symptoms had not improved since being placed on antibiotics and, in fact, he states he is feeling worse.</p> <p>Upon further questioning, it is found that he has been experiencing a tender right knee joint. On exam he had a warm swelling of his right knee joint, an erythematous nodule on his right index finger, and a grade II/VI systolic ejection murmur at apex radiating to the axilla. Dr. Johnson is admitted to the hospital for further workup and treatment.</p>	<p>Tender right knee joint: The tender and swollen joint suggests septic emboli originating from bacterial vegetations on the heart valves.</p>

Case	Notes for the Facilitator
<p>Dr. Johnson is examined by the attending physician upon arrival on the medical floor. Dr. Johnson describes his health as excellent, has no active medical problems, is taking no medications, and has no known medical allergies.</p> <p>Past medical history: Five years ago, Dr. Johnson was in an auto accident with multiple traumatic injuries, including compound fracture of his left femur and lacerations of the bladder and urethra. He was treated with morphine and other oral narcotics for pain control for 3 months.</p> <p>Family history: Father and mother in good health; two siblings in good health.</p> <p>Social: Patient says that he does not smoke, uses alcoholic beverages socially, and does not use illicit drugs. He works as an anesthesiologist at the local hospital. He has been married for 8 years and has a 4-year-old son. He denies any extramarital sexual contact.</p> <p>Physical exam: He appears unkempt, obviously ill-appearing, and anxious. He continues to complain of continuous nagging muscle aches and feverishness.</p> <p>Vital signs: Temperature: 101 °F (38.3 °C) Heart rate: 105 bpm Blood pressure: 130/45 mm Hg</p> <p>Eyes: PERRLA; small conjunctival petechiae; small oval hemorrhage with pale center noted in the left retina.</p> <p>Throat: Posterior pharynx is mildly erythematous; no exudate seen.</p> <p>Neck: No adenopathy.</p>	<p>Past medical history: Trauma and implanted devices sometimes become colonized by organisms that may later become a source of septicemia and endocarditis.</p> <ul style="list-style-type: none"> • Morphine: An opioid drug; a high-efficacy receptor antagonist (mu-receptor) that binds to receptor on neurons involved in pain transmission in the spinal cord and higher CNS centers. <div data-bbox="824 1073 1430 1192" style="border: 1px solid black; background-color: #e0e0e0; padding: 5px; margin: 10px 0;"> <p>Why are answers to questions about past medical history, family history, and social activities important at this time?</p> </div> <p>Vital signs: Fever may be a clue to sepsis.</p> <p>Eyes: Small conjunctival petechiae are Roth spots, which are characteristic of endocarditis.</p>

Case	Notes for the Facilitator
<p>Chest: Normal excursion, decreased breath sounds bilaterally.</p> <p>Heart:</p> <ul style="list-style-type: none"> • Soft S₁, S₂. • Grade II/VI holosystolic murmur heard at the apex and conducted to the axilla. • Grade I/VI systolic ejection murmur heard at the aortic area and not conducted to the carotids. <p>Abdomen: No organomegaly; no tenderness.</p> <p>Extremities: Slightly erythematous pea-sized nodules noted in thenar and hypothenar eminences, similar to the one on the right hand. Several red-brown linear streaks beneath the fingernails of the left hand. Right knee is warm, dusky red, and swollen. The patella is ballotable. There are multiple small puncture wounds in a linear pattern on the lower extremities.</p> <p>Neurological: No nuchal rigidity; Cr II-XII intact; sensory exam intact. Patient performed finger to nose movements very slowly but without apraxia; both sides were performed equally. He exhibited a fine tremor of his hands.</p> <p>Motor exam: Intact strength; muscle tone normal; DTRs brisk and symmetric gait; station and Rhomberg not performed.</p>	<p>Heart: Older murmur is louder and a new murmur has developed, indicating significant pathology in the mitral or tricuspid valve.</p> <p>Extremities: Nodules on extremities are Osler’s nodes, also characteristic of endocarditis.</p> <p>Splinter hemorrhages are small embolic lesions in the nailbed.</p> <div style="border: 1px solid black; background-color: #e0e0e0; padding: 5px; margin: 10px 0;"> <p>Students should discuss the significance of “multiple small puncture wounds,” which are suggestive of IV drug use.</p> </div>

Case			Notes for the Facilitator
CBC	Result	Ref Range Male	
WBC	14.5	5.0–10.0 x 10 ³ /L	<p>WBC: WBC has increased from previous labs, indicating infectious process.</p> <p>PLT: PLT has dropped from previous labs, indicating possible systemic involvement/bone marrow toxicity due to sepsis.</p> <p>NEUT: NEUT % has increased from previous labs, indicating acute bacterial infection.</p>
RBC	4.8	4.5–6.0 x 10 ⁶ /L	
HGB	14.6	13.0–17.0 g/dL	
HCT	44.2	40.0–52.0 %	
MCV	84	80–100 fL	
MCH	31	27.0–33.0 pg	
MCHC	33	32.0–36.0 g/dL	
RDW-CV	12	11.5–14.5 %	
PLT Count	54.0	150–400 x 10 ³ /L	
NEUT %	90	50–70 %	
Lymph %	3	20–40 %	
Mono %	2	2–8 %	
EOS %	5	1–4 %	
Lab: Hematology			
Morphology:			
<p>RBC: Normocytic, normochromic WBC: Neutrophilic left shift with toxic granules and Dohle bodies present.</p>			

Case			Notes for the Facilitator
Metabolic Panel	Result	Normal Values	<p>Students should discuss or make a learning issue of the class of antibiotics that are prescribed to the patient.</p> <p>Nafcillin: Antistaphylococcal penicillin active against staphylococci and streptococci; resistant to staphylococcal beta-lactamases; inhibits bacterial cell wall synthesis.</p> <p>Gentamicin: Aminoglycoside antibiotic effective against both gram-positive and gram-negative organisms. It irreversibly inhibits protein synthesis.</p> <p>Pharmacodynamics of gentamicin (aminoglycosides) must be considered to achieve efficacy without inducing unwanted toxicity.</p> <p>(MEETING 1 - STOP HERE)</p>
BUN	28	7–22 mg/dL	
Sodium	131	135–145 mmol/L	
Potassium	5.0	3.6–5.5 mmol/L	
Chloride	100	98–108 mmol/L	
Glucose	225	Fasting: 70–99 mg/dL	
Creatinine	1.2	0.5–1.2 mg/dL	
Phosphorus	4.0	2.6–4.9 mg/dL	
Calcium	10.0	8.7–10.7 mg/dL	
Magnesium	2.0	1.6–2.4 mEq/L	
Albumin	3.2	3.5–4.8 gm/dL	
Alkaline Phosphatase	72	71–213 IU	
Total Bilirubin	2.7	0.3–1.2 mg/dL	
LDH	175	94–172 IU	
SGOT/AST	40	8–42 IU	
Total Protein	6.0	6.0–8.0 gm/dL	
Uric Acid	4.0	3.9–7.8 mg/dL	
Cholesterol	180	120–200 mg/dL	
Triglycerides	280	20–200 mg/dL	
HDL Cholesterol	28	29–83 mg/dL	
<p>Hepatitis B and C and HIV tests were negative.</p> <p>Blood cultures were drawn from each arm.</p> <p>An echocardiogram was done. The mitral valve showed small, rounded irregularities on the atrial side of the leaflets. Antibiotic treatment was started and included nafcillin (2 grams intravenous every 4 hours) and gentamicin (based on pharmacodynamics).</p>			

Meeting 2

Case	Notes for the Facilitator
<p>Over the course of the next week, Dr. Johnson experienced tachycardia, diarrhea, hypertension, and diffuse pain. He was treated with clonidine 0.3 mg twice a day and with loperamide 2 mg after each loose stool. NSAIDs were administered for pain. On day three, a few more linear streaks appeared under his nails and fingertips. A urine sample was obtained, which was positive for opiates.</p> <p>Blood cultures were positive for <i>Staphylococcus aureus</i>. Gentamicin was discontinued, and Nafcillin was continued for 6 weeks. With this treatment, his condition improved.</p> <p>His attending physician questioned his colleagues who reported that the patient's performance had decreased over the last few months. A check of the narcotics register looked good, but records showed much higher doses of fentanyl used on patients recently. The patient's wife reports increased emotional lability and agitation at home during this same time.</p> <p>Upon sensitive questioning by the attending physician, the patient admitted to a problem with prescription opioid abuse since his accident and subsequent opioid treatment 5 years ago. He started stealing fentanyl from the operating room 2 years ago and has been increasing his use over the last 4 months.</p> <p>Students should discuss these symptoms and identify that these may be caused by opioid withdrawal. Treatment is directed toward this diagnosis.</p>	<p>Clonidine: Alpha 2 agonist that decreases sympathetic nervous system over-reactivity and suppresses anxiety in the management of withdrawal symptoms.</p> <p>Loperamide: Opioid phenylpiperidine derivative used to control diarrhea by slowing down gastrointestinal motility. Potential for abuse is low due to its limited ability to gain access to the brain.</p> <p>Students are encouraged to be open to the fact that physicians (Dr. Johnson in this case) can be under much stress, which can lead to various abnormal responses and behaviors. Students should discuss what ethical issues are involved in obtaining this kind of information about any patient, especially a physician-colleague, and the ethical and professional issues in dealing with a physician-patient, especially with a sensitive problem such as substance abuse. They should discuss how to approach discussion with a patient about a sensitive topic such as substance abuse. They should also discuss how IV substance use places a person at risk for endocarditis.</p> <p>Students should discuss how to talk to patients to encourage them to enter substance abuse treatment and how to facilitate this referral.</p> <p>Dr. Johnson will need to get into an addiction treatment program. His returning to the practice of anesthesiology (with an opioid abuse history) raises several issues, especially when he is re-exposed to the availability of opioids. He will need drug monitoring and close followup with a sponsor physician.</p>

Case	Notes for the Facilitator
<p data-bbox="186 304 324 346">Epilogue</p> <p data-bbox="186 378 771 661">Dr. Johnson's condition improved with treatment, and he had no serious cardiac sequelae. He went back to work with provisional privileges and with regular physician followup and random drug screens. After 1 year, he remains at work and continues to test negative for illicit substances.</p>	<p data-bbox="795 777 1201 819">(MEETING 2 - STOP HERE)</p>

Final Meeting

Case	Notes for the Facilitator
	<p>At the final meeting each student makes a short presentation (about 10 minutes) to the entire group that addresses a previously selected Student Learning Objective that the student has researched (students typically spend two to four hours in research between meetings). Presentations are to include a handout and visual aids (e.g., PowerPoint slides, video, computer images). Students then review the case and the group process.</p>

Student Learning Objectives

Student Learning Objectives are specific issues arising from the case that the students must be sure to address and are as follows:

1. Describe the indications for, the proper procedure and timing of, and the expected results of blood culture in patients suspected of having infective endocarditis and other types of sepsis.
2. Discuss the major risk factors for developing infective endocarditis.
3. Identify the major causative agents of infective endocarditis, their pathogenesis, diagnosis, and antibiotic therapy.
4. Discuss the pathophysiology of endocarditis and differentiate between acute and subacute.
5. Discuss the topic of drug abuse in the physician population in terms of risk, types of drugs involved, treatment, monitoring, and risk of relapse. What are Dr. Johnson's risk factors?
6. Discuss the treating physician's responsibility to the State Board of Medical Examiners regarding Dr. Johnson's substance abuse.
7. What treatment is recommended for Dr. Johnson's substance abuse? What characteristics of treatment programs are associated with success?
8. What are the important effects of chronic opioid use on the CNS and other organs? Discuss the biochemical mechanisms involved.
9. What are the characteristics of opioid withdrawal? How are they managed?

Pilot Information

This case was piloted in October 2008 in the University of North Dakota School of Medicine & Health Sciences' second-year class, comprising approximately 63 students in eight small groups.

At the end of the week the faculty member directing this block and one of the Center of Excellence (CoE) faculty members met with the student leaders for the week and separately with the faculty facilitators to discuss the case and the week's activity in the small groups. Satisfaction with the case was high among both students and faculty facilitators; there were no consistent concerns requiring revision. CoE faculty also accessed the student case presentations, which were generally of good quality and addressed the issues raised in the case.

Further Reading

Drugs of abuse: Fentanyl. National Institute on Drug Abuse Web site.
<http://www.drugabuse.gov/druggpages/fentanyl.html>. Accessed August 26, 2009.
(A summary of the structure, pharmacology, and use of fentanyl.)

Gold MS, Byars JA, Frost-Pineda K. Occupational exposure and addictions for physicians: Case studies and theoretical implications. (2004). *Psych Clin N Amer*, 27, 745–753.

(This paper presents an overview of epidemiologic data concerning physicians and substance use disorders and reviews the neurobiology of opiate exposure.)

Gold MS, Melker RJ, Dennis DM, Morey TE, Bajpai LK, Pomm R, Frost-Pineda K. Fentanyl abuse and dependence: Further evidence for second-hand exposure hypothesis. (2006). *J Addict Dis*, 25, 15–21.

(This article presents epidemiologic data concerning substance use disorders in physicians. Anesthesiologists are much more at risk than other specialties, and fentanyl is the drug of choice in this group. The paper presents a hypothesis that this risk is in part due to airborne exposure in the operating room.)

National Institute on Drug Abuse Research Report Series: *Prescription Drugs: Abuse and Addiction*. National Institute on Drug Abuse Web site.
<http://www.drugabuse.gov/ResearchReports/Prescription/Prescription.html>. Accessed August 26, 2009.

(This report reviews prescription drug abuse generally in the U.S. population.)

State of Minnesota Health Professionals Services Programs Web site.
<http://www.hpsp.state.mn.us>. Accessed August 26, 2009.

(This Web site presents a model program for monitoring of physicians impaired by substance use disorders or mental illness as an alternative to discipline by State medical boards.)

A PBL PRIMER FOR STUDENTS AND FACULTY

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BASIC POINTS ABOUT STUDENT-CENTERED, PROBLEM-BASED LEARNING

What is “Student-Centered” Learning?

Almost all teachers desire similar outcomes for their students. For example, students should be:

- Interested in learning more about the subject.
- Enthusiastic about the subject.
- Able to use information in practical settings.
- Able to communicate ideas to others.
- Having a fund of basic knowledge.
- Aware of their limits (strengths and weaknesses).
- Able to identify problems and solve or manage them.

Unfortunately, not all educational methods help students become proficient in all these desired outcomes.

Teaching-Learning methods can be conveniently categorized in two ways.

The first is based on the person responsible for making the decisions of what the student is to learn. *Is it the teacher (teacher-centered) or the learner (student-centered)?*

The second category is based on how the body of knowledge and skills to be learned is organized. *Does it center on subject areas (subject-based) or problem areas (problem-based)?*

These are often viewed as being at opposite poles of a spectrum:

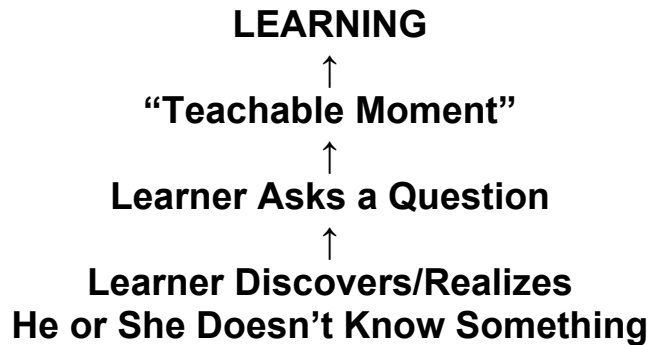
Teacher-Centered _____ Student-Centered
Subject-Based _____ Problem-Based

In practice, many teachers use a combination of techniques. However, most faculty are much more familiar with teacher-centered, subject-based approaches. This results primarily from their own past experience and from the lack of opportunities to participate in, and learn the techniques of, student-centered and problem-based methods during their training.

In the **teacher-centered** approach, the teacher chooses the sequence, the time students have to consider topics, etc. (i.e., teachers make almost all choices for students). Students tend to become passive and spend time trying to devine the structure of the material and what you want them to do to succeed.

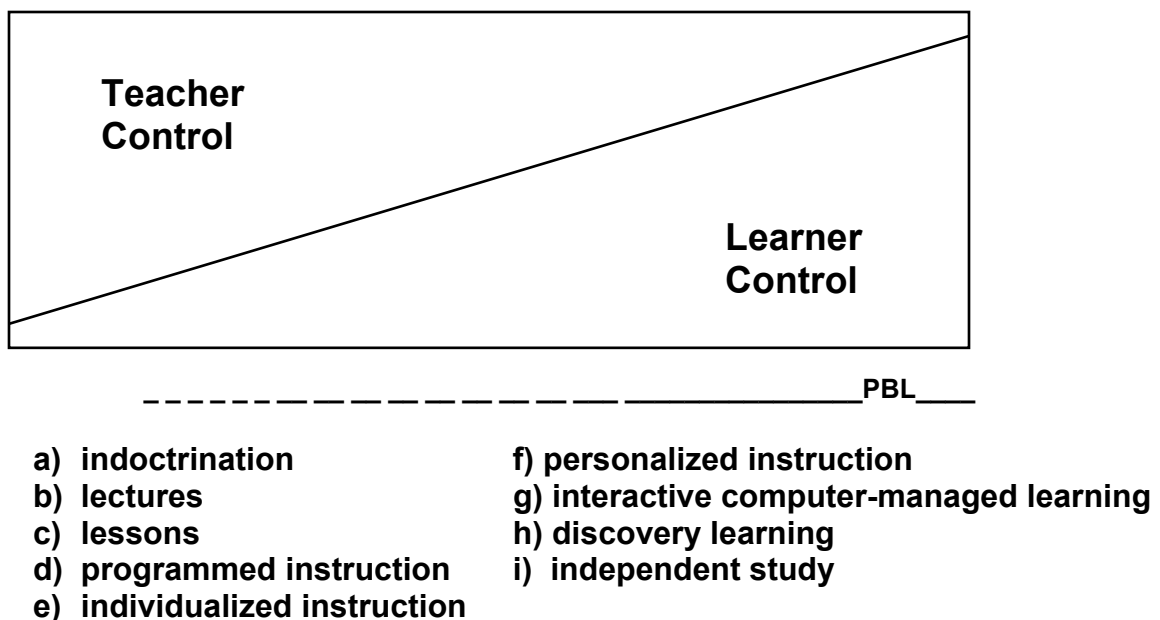
In **small group, student-centered learning**, students must take responsibility for decisions and their consequences (i.e., closer to real life). They must learn to find what they need in a timely way. Their success is a direct function of the questions they ask.

Learning is most efficient if learner has a need or desire to know something.



PBL provides a method which helps learners discover “teachable moments” for themselves.

Educational methods fall along a spectrum depending on who controls the learning activities.

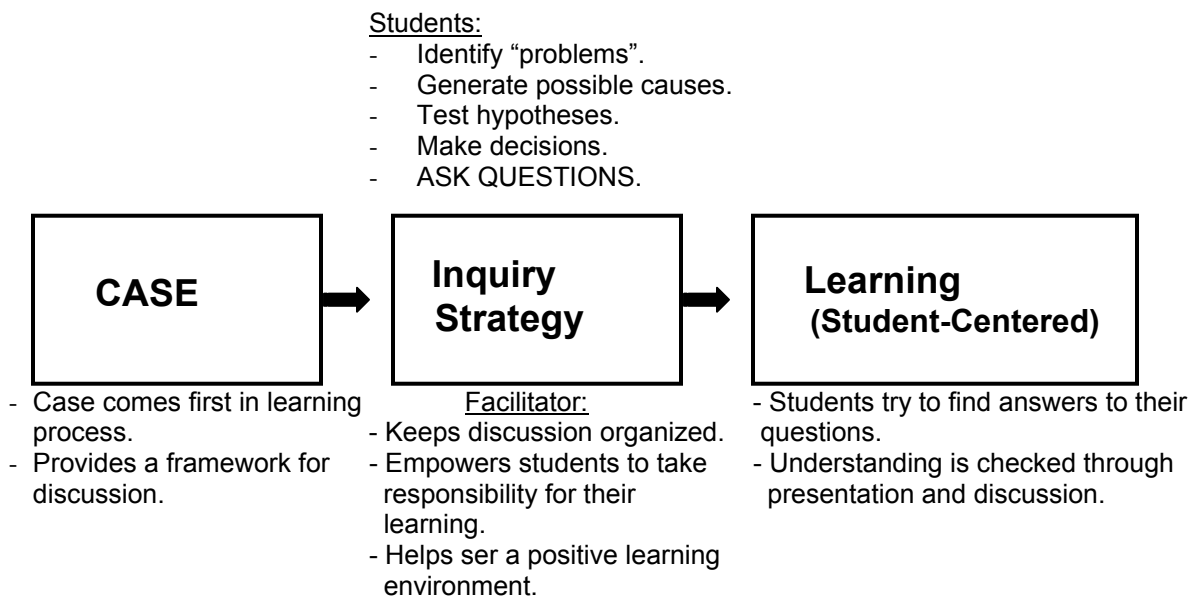


Adapted from Millar, Morphet, and Saddington, 1986.

What is PBL?

PBL is a method of learning which begins by encountering a problem and following a systematic reasoning and inquiry strategy in the process of working toward the resolution or understanding of a problem. The encounter with the problem is the initial step in the learning process. (Barrows and Tamblyn, 1980).

Problem-Based Learning



This is the reverse of typical problem-solving exercises in which students are given a “problem” to solve by applying material which they should have mastered.

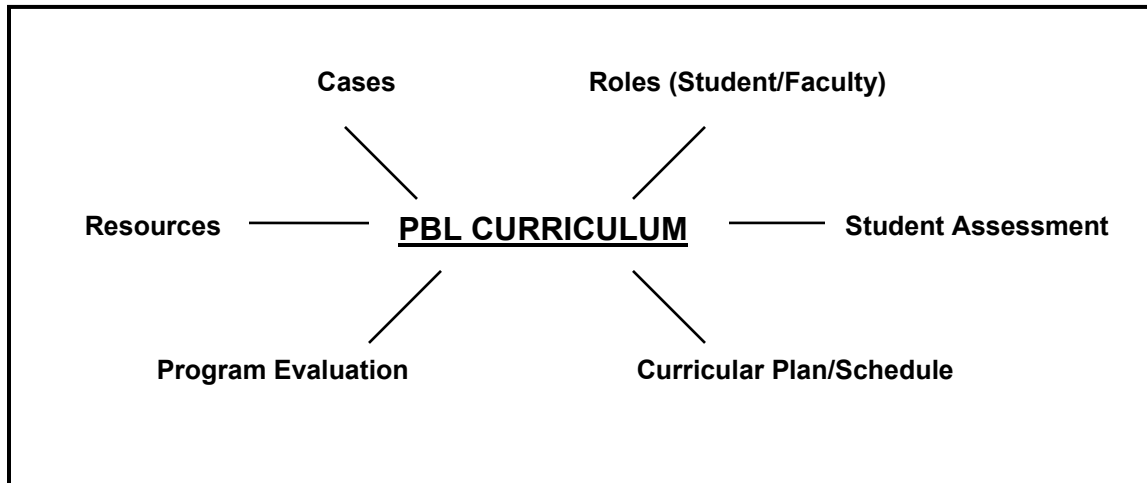
Problem-based learning (PBL) as a well-defined curricular strategy was first established at McMaster University School of Medicine in the mid 1960’s (Barrows and Tamblyn, 1980). This pioneering approach was followed by other medical schools in Europe and North America, and variations of PBL now appear in a wide variety of health sciences and non-health science institutions and programs including human medicine, veterinary medicine, architecture, economics, engineering, nursing, law, mathematics, social work, computer science, dentistry, and pharmacy.

A common misconception is that simply because patient cases or clinical scenarios are scattered throughout the curriculum, the curriculum is “problem-based”.

What are the Components of a Successful PBL Curriculum?

Several key elements must be considered and tightly integrated in designing an optimal PBL curriculum. All these elements must be highly integrated and complimentary if the PBL method is to operate most effectively.

Key Elements of a Successful PBL Curriculum



Although PBL was clearly defined by the McMaster group, the increasing number of institutions which have adopted and modified portions of the original concept has led to the existence of a wide variety of educational activities included under the term of “PBL”. This makes providing a simple definition difficult.

Thus, a spectrum from “Classic PBL” (as originally defined by McMaster) to integrated curricula currently exists.

Spectrum of “PBL” Curricula	
<u>“Classic” PBL</u>	<u>”Integrated” PBL</u>
Small group tutorial discussions as the primary mode of learning, supported by other methods (i.e., lectures, labs), and sufficient self-study plus evaluations which match the teaching style.	Small number of tutorial case discussions inserted into a milieu of traditional approaches. (i.e., labs, lectures, etc.)

What are the basic elements of the PBL approach?

Students work cooperatively in small groups, assisted (facilitated) by a faculty member who is often not expert in the detail of all issues raised by the “problem”.

PBL is best accomplished in small groups because they:

- Foster more active involvement of learners.
- Provide a context for learning and practicing social and communication skills.
- Offer the possibility of peer support in the learning process.

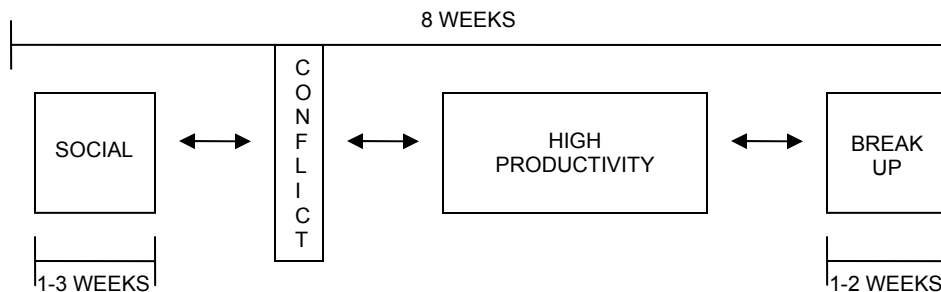
- Offer the possibility to develop teamwork skills.
- Offer opportunities to make decisions about your learning (i.e., adult learning theory).

Disadvantages of small groups include:

- Practical logistics (e.g., faculty/student ratio)
Many PBL facilitators feel that the ideal group size is 5-7 students, although larger groups have been used by some programs. Group size greater than 6-7 makes regular participation by all members difficult, and it is more difficult for the tutor to adequately monitor each student in order to provide useful feedback on an individual basis.
- Assessments, both written and oral, take more time the larger the group.
- There is increased vulnerability in a small group
No one can hide. Both students and facilitator are constantly visible. This may favor those comfortable in taking risks. Demonstrative students may receive disproportionate attention. This raises issues of gender or cultural differences, background differences, and issues of confidentiality.
- Faculty must clearly understand their role as a student-centered facilitator or a small group discussion can easily become a small group lecture.

The length of time a group remains together varies from program to program. Some change the composition of groups every 6-10 weeks. Newly constituted groups also are joined by a new faculty facilitator. This provides practice in forming new groups quickly.

Members of working groups pass through several dynamic stages as they develop.



The role of the facilitator changes and evolves during the life of the group.

The role of the facilitator also changes as group members become more experienced.

A “progressive disclosure”, or “discovery learning”, case format as the framework for the tutorial discussions.

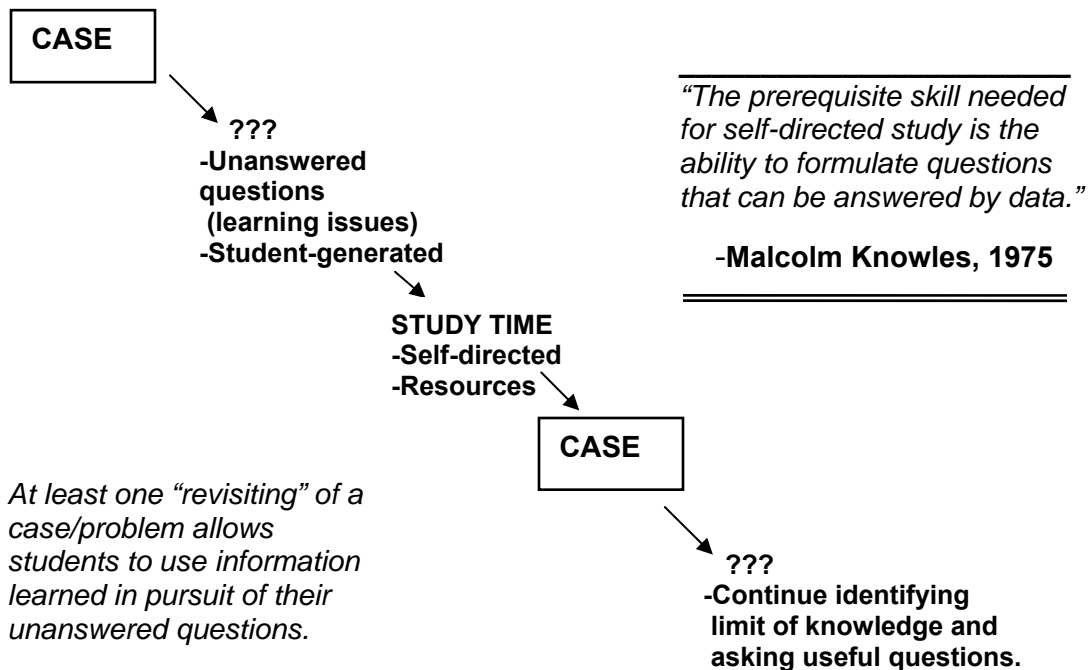
Cases provide a structure for a discussion which allows you to discover:

- What you already know.
- What you don’t know.
- What you need to learn next.

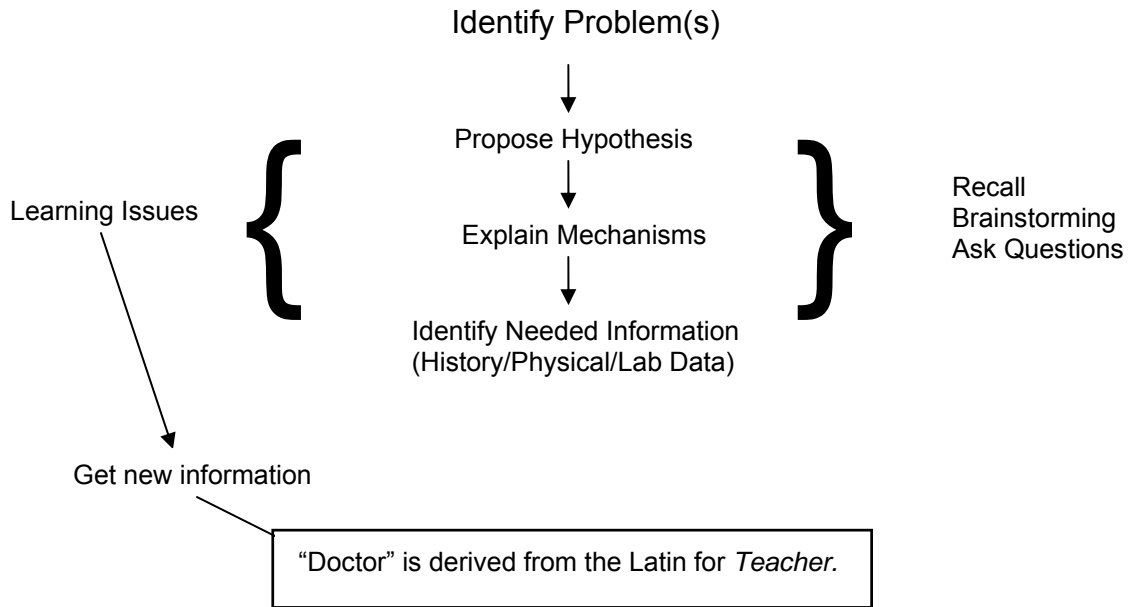
Everyone is encouraged to define the limits of their knowledge and ask pertinent questions.

Becoming comfortable in quickly identifying the limit of one's knowledge, developing the skill to ask a specific next question, and learning how to find the answer to the question utilizing a variety of resources and other disciplines is also an essential skill for continued ("lifelong") learning.

Flow of Case (Problem)-Stimulated Learning



During discussion of the case, students identify problems, suggest possible causes, recall their prior knowledge, explain their reasoning in terms of basic mechanisms, explore the limits of their understanding and ask specific questions, incorporate new information and revise their thinking.



Group members teach each other.

Explaining so others understand, responding to questions, and checking out communication is new to many students.

The ability to concisely and accurately explain information to others is an important skill to master for future teaching in an academic setting as well as for patient education.

Evidence-based reasoning

Providing evidence and explaining your thought processes is not only an excellent learning tool, but is a skill that is important to any interdisciplinary problem-solving situation or shared discussion.

Students and faculty practice ongoing reflection and evaluation.

Ongoing, useful feedback should be practiced as an important mechanism for continued improvement.

Feedback should be viewed as a conversation or dialogue between a giver and receiver.

To be most successful, both parties must share a common set of goals, ground rules and expectations. These form the basis for what is to be commented upon and may be periodically reevaluated and changed based on experience.

Resources are made available to students, but students are not told how to “tackle” the problem.

Students learn to assess the usefulness of resources by comparing information gleaned from a variety of sources.

Students are encouraged to *Learn for Understanding*, rather than for recall of isolated facts, through appropriate opportunities to reflect on their educational experiences, and through frequent feedback, linked with opportunities to practice the application of what has been learned.

PBL fosters *Integrated Learning*, (i.e., learning in a variety of subjects or disciplines concurrently in the context in which the learning is to be applied in real-life situations).

PBL allows *Cumulative Learning*, (i.e., to achieve growing familiarity through a sequence of learning experiences that are relevant to the student’s goals, experiences that become progressively less straightforward and more complex and challenging).

No subject or topic should be studied in finite depth at any one time, rather it should be reintroduced repeatedly and with increasing sophistication whenever it contributes legitimately to reasoned decision making in a problematic situation. As the students mature so should the various aspects of the curriculum.

What are the Educational Principles upon which PBL is based?

The PBL approach is based largely on principles of adult education.

<p>Principles of Adult Learning</p> <p><u>Learners:</u></p> <ul style="list-style-type: none">• Want to use what they learn soon after learning it.• Like to solve problems, not just learn facts.• Learn best when they set their own pace.• Have increased motivation when they set their own objectives.• Like to know how they are doing. <p style="text-align: right;"><i>-Kevin Bunnell, 1980</i></p>

I hear and I forget.

I see and I remember.

I do and I understand.

(Chinese Proverb)

Barrows (Barrows, H.S. 1986 Med. Ed. 20:481-486) suggested the PBL approach is based on the following educational objectives:

Knowledge should be structured to be recalled in practice contexts.

*“Education is most effective when undertaken in the context of future tasks”
(Glasser, 1982).*

Cognitive psychology suggests “problem-solving” is context specific. It is becoming increasingly apparent that learning takes place most effectively when students are actively involved and learn in the context in which knowledge is to be used (contextual learning).

Students should develop an effective reasoning process.

PBL provides opportunities to practice developing an approach to dealing with problems. “(These) skills must be shaped and perfected through repeated practice and feedback...” (Barrows, 1986)

Students should develop effective self-directed learning skills.

*“These are essential skills (for health care professionals) as knowledge (increases) and problems and concepts never envisioned or predicted by...teachers have to be understood and applied in the case of patients.”
(Barrows, 1986)*

It is more important for students to be able to learn quickly, effectively and independently when they need it, than it is for them to have assimilated (at graduation) all the information which their teachers believe is desirable.

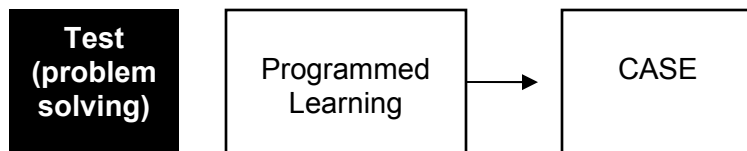
The educational format should increase motivation for learning.

“The perceived relevance of working with (practical) problems and the challenge of solving problems provide strong motivation for learning.” (Kantonia, 1940)

The expanding knowledge base of most professions means that it is impossible to include all the knowledge that is required for the beginning practitioner in the pre-service curriculum. Abstract information alone probably has little meaning for students.

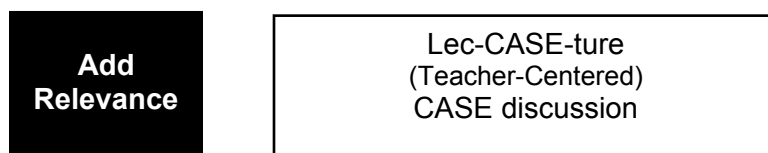
A key distinction between a “problem-based” approach and other uses of problems is the placement of the problem in the learning process.

For example, cases (problems) are commonly used as tests (i.e., “problem-solving” exercises). A case is usually presented at the completion of a portion of the curriculum, the goal being to assess whether the student has mastered a body of information and can apply it in a “problem-solving” way.



- Apply learned information to get the right answer.
- Information given and students respond to prompting questions.

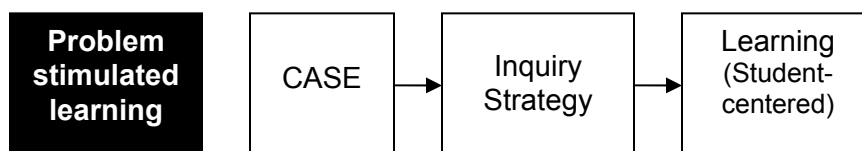
Another common use of “problems” is a case study approach, where the details of a selected clinical case are use as the framework for discussion. Presentation of patient problems or clinical cases during lectures is also often used in basic science courses, the main goal being to indicate relevance of material being presented to future application.



- Illustrate usefulness of information.
- Maintain interest.
- Teacher-centered.
- Usually used in single session.

These are valid educational uses of problems, but they are not “problem-based learning”

Problem-based learning differs in that the problem is presented at the beginning of a learning process, with no expectation of prior knowledge on the part of the learner. For this reason it is sometimes referred to as “problem-stimulated learning”.



- Develop an effective reasoning process.
- Develop effective self-directed learning skills.
- Increase motivation for further learning.
- Develop interpersonal and communication skills.
- Tie new information to previous knowledge.

Tip for facilitators:

Try to have a clear idea of your main priorities at each stage of group development. For example: for the first few sessions, you might focus on:

- Building the sense of group identity and respect for each other.
- Empowering the students to assume ownership of the group and their learning.

- Modeling expectations and behavior (Asking questions. Saying “I don’t know.” Using the board. Asking for and providing self- and group assessment, etc.).
- Valuing the feedback process by doing it and providing time to do it.
- Encourage the members of the group to define acceptable levels of depth and breadth for their discussions.
- Give praise and positive feedback (legitimately) for specific behaviors.
- Be inclusive. Keep reaching out to each member of the group. Be even handed.
- Be genuinely interested in the students, the process of learning, and in helping them to find what they need.
- Insist on evidence for statements (self-assessment, use of resources, use of evidence).
- Provide timely and useful feedback to students.

Changes in Facilitator’s Role Over Time in a PBL Curriculum

- At the beginning of a PBL curriculum – Facilitator is more active in modeling desired behaviors and empowering learners to become proficient at self-directed learning. Students focus on learning about the process of PBL and generating learning issues to learn basic material.
- Year 2 – Group members tend to facilitate themselves. Facilitator focuses on depth, breadth, accuracy and integration of information. Students increase recall of basic information and apply it to new situations.
- “Clinical years” – Group focuses more on diagnosis and patient management learning issues. Facilitator serves as “local expert” as well as facilitating efficient use of time.

What are the roles for students and faculty in problem-based, student-centered learning?

Students

- To be “student-centered” is a difficult concept to define precisely, but refers to a set of behaviors which reflect a way of teaching and learning based on principles of adult learning. It places more responsibility on the learner to determine what should be learned and how learning will be pursued and evaluated.
- Student-centered learning is directed toward allowing students to develop the skills required to direct their own learning. It allows students to be active participants in their

education by fostering and rewarding them for formulating questions and deciding for themselves the nature and extent of what they want to learn. This allows considerable individual flexibility for each student depending on his or her own background, interest and learning style, within a framework provided by the curriculum.

- Student-centered, problem-based learning requires students to become more active in decision making, finding resources, managing their time, analyzing information, explaining, and defending ideas with evidence. This is usually a new way of learning and a new set of responsibilities for students who have experienced, and been successful in, many years of more traditional, teacher-centered methodology.

Faculty

- The role of faculty is to help students formulate questions, encourage the pursuit of ideas and answers to these questions, and to establish a safe, comfortable environment in which learning from each other can occur.
- Faculty play many different roles in a problem-based curriculum. However, perhaps the role which is most different for most faculty is that of serving as a student-centered tutor or facilitator of small group discussions.
- While development of new skills is often required, the change usually reflects a shift in emphasis of the major roles required of all excellent teachers, i.e., evaluator, resource person, and facilitator.

Teachers play three general roles in the learning process:

- Resource person
- Evaluator
- Facilitator

Different teaching styles reflect a balance of these roles:

Resource > Facilitator = Teacher-Centered

Facilitator > Resource = Student-Centered

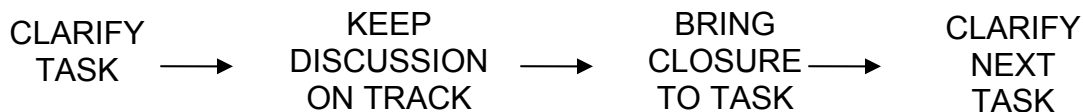
- The switch from perceiving the role of “teacher” as a content expert whose job it is to “cover” information for students, to that of a “facilitator” or “tutor” who facilitates the learning of students by empowering them to assume a greater responsibility for their own learning, can be frightening to many faculty. Faculty must accept that they do not need to be a content expert in order to teach in this manner.

What Skills Are Necessary for Successful Facilitation?

A strong interest in promoting a basic level of understanding in a diverse group of students is particularly important for success as a facilitator/tutor. Conflict resolution, communication, and group dynamics are prerequisites in the process, and evaluation skills are essential to the short and long term outcome adjustments of the program.

Student-centered teachers:

- Recognize the value of interpersonal interaction as the prime teaching modality and view students as responsible for their own learning.
- Monitor and maintain the flow of discussion.
 - A discussion may be viewed as a series of tasks. A major part of facilitation is keeping the discussion focused on one task at a time.



- Make sure the specific task, goal or question is clearly understood by all members before beginning the discussion.
- Keep discussion on track.
 - Don't allow the group to veer off on tangents.
 - *(Is this where we were going? How does this relate to the task at hand?)*
 - Tangents are good indicators that someone has reached the limit of their knowledge and is less confident of information. This is often a good time to identify learning issues.
 - Help the group focus.
 - *(e.g., "I think we're floundering here", or "Where do we go from here?" or "What do we need to know to proceed?")*.
 - Allow sufficient time for discussion (but do not let the group "spin their wheels").
 - Facilitate and help manage the discussion, but do not provide information too soon [i.e., before the students ask for it (i.e., the "teachable moment")].
 - Sometimes play a stronger facilitative role in asking questions that clarify issues and guide discussion when it gets off track
 - Finish each task before moving on to the next task. (Bring the task to closure by summarizing, clarifying learning issues; ask the group "Are we finished with this task?").

- Develop a sense of when and how to use and respond to questions.

Stock facilitating questions:

- "Can you sketch that for us?"

- “What is the evidence for that?” (“Can you tell us why you think that?”)
- “Are you sure?”
- “What exactly is your question?” (“What do you need to know next?”)

“Where might you find that information?”

- Don’t respond immediately to questions.
- First ask if the questioner can answer his/her own question.
- If not, ask if anyone else in the vicinity can answer the question.
- If not, ask permission to answer (or ask the group if they would like to try and find the answer first).
- Then decide whether to provide the answer, or suggest it as a learning issue.

Asking Questions – A Checklist

Do I:

- Ask rather than tell whenever possible.
- Ask one question at a time as concisely as possible.
- Adjust the difficulty of the questions to the learners’ abilities.
- Avoid playing the “Guess what I’m thinking” game.
- Provide adequate “wait time” for learners to respond to my questions.

Play a facilitative role.

To begin with, teachers listen and encourage students to listen to each other. They observe. They use questions to clarify and raise issues for the group to decide (“Does anyone have anything to say?” “Is there agreement or disagreement?” “Are you confused and in need of clarification?” “Are we ready to move on?”) By paying attention to what is said and not said, the teacher gains a sense of student needs.

Tolerate silence. (Give students time to think, ask questions and answer questions).

Encourage students to participate.

- Remember, there are many ways to participate in a group discussion (e.g., presenting, asking facilitating or clarifying questions, etc.)
- It is the quality of the contribution, and not merely the frequency or duration of the contribution, that is most important.

Help students to uncover what they know and do not know.

- Ask, “What specifically would you need to know next?”

Guide them to the resources that will help them learn what they do not know.

- What students do not know is used as a stimulus for self-study and for future group discussions.

Do tutors have to be content experts?

There is a considerable debate among educators regarding whether facilitators/tutors must be content experts in the area of the cases they tutor. There is a hierarchy of possibilities:

While there is no “right answer”, a consensus seems to be that a well-trained, effective tutor who is also expert in the topic being discussed is probably ideal. However, since it is difficult to find tutors who are expert at a detailed level in all topics raised by a case (especially if the case is designed to integrate a wide variety of topics), the best compromise is to have a tutor who is very skilled as a facilitator and who is generally knowledgeable about the main objectives of a case.

Conflict Resolution

MANAGING INTERPERSONAL CONFLICT

To resolve interpersonal conflicts, you need to find effective ways of communicating during a conflict, and of course, you want to create an outcome satisfying for everyone concerned.

<i>Mode</i>	<i>Similar Terms</i>	<i>Description</i>
Imposition	Win/lose, forcing, contending	One party is forced to accept the other party's position.
Withdrawal	Escape, retreat	One party leaves the group.
Inaction	Avoidance, wait-and-see	One or both parties do as little as possible.
Yielding	Smoothing, lose/win, conceding	One party withdraws his or her demands.
Compromise	Lose/lose, mutual concessions	Parties locate an alternative that stands somewhere between their positions.
Problem Solving	Win/win, confrontation, integrative bargaining	Parties identify the source of the conflict and agree on a solution.

“Group Dynamics” – Donelson R. Forsyth

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January 1996

Skills to Enhance Problem-based Learning

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Abstract: Problem-based Learning (PBL) has become a popular method of instruction among educators in the health professions. Central to the effectiveness of PBL is the ability of students to work together to solve problems. When these abilities are lacking, PBL outcomes can be compromised. Since these skills have not been emphasized in public school or higher education, students are often forced to muddle through group processes in the effort to learn. The purpose of this paper is to discuss the interpersonal skills necessary to enhance PBL, and suggest how these skills can be improved and incorporated into the curriculum.

Problem-based learning (PBL) has gained acceptance and has been found effective within a variety of disciplines in higher education.^{1,2} PBL satisfies three important criteria that promote optimal learning.³ First, it provides an environment where the student is immersed in a practical, on-going activity in which he/she receives feedback from other students and the instructor. Second, the student receives guidance and support from his/her friends and peers. Learning is not unidirectional (teacher to student), but multi-directional, including other students, tutors, and professors.⁴ As Savery and Duffy state, learning occurs through the multiple interactions within the learning environment.⁵ Third, the learning is functional — based on solving a real problem. According to Camp, PBL is based on a foundation of collaboration and integration within a small group context.⁶ Simply stated, PBL depends upon the ability of students to work together to identify and analyze problems, and/or generate solutions.

PBL's dependence upon group effectiveness may lay at the heart of the difficulty for researchers to definitively say that PBL improves learning.^{7,8} Kalaian and Mullen reported that although tutor effectiveness was the crucial item in learning at the start of the curriculum, by the end, learning was more a function of the effectiveness of the small group process.⁹ The assumption that students can work together effectively is a misguided one. Few employed health professionals, much less students, have the skills needed to work in groups competently or effectively.^{10,11} This should come as no surprise since traditional lecture or textbook generated learning is at the core of education from elementary school through many graduate level programs. Subsequently, students are forced to learn by trial and error how they personally work best in a group setting. Their communication and group interaction habits are developed over two decades of formal education. These habits, however, differ from student to student. Some may try to take control of the group, others will become passive, still others will become overly verbose, while others will shy away from commenting.¹² Observers of student group interaction often find that students don't work productively, waste time, repeat old information, or become confrontational.⁷ Regardless of the problem posed to a group of students, learning is proportional to the ability of that group to work effectively together.¹²⁻¹⁴ Faculty, too, may lack the ability to utilize problem-based learning effectively because of a lack of training in small-group management.¹⁵ In some instances they may find themselves in small groups that actually harm individuals and the learning climate.¹⁵

Medical and health professionals who have used PBL in the classroom have reported symptoms of weak group process and interaction skills among the students.^{7,9,15} These problems compromise the learning process. Hitchcock and Anderson identified five different small group dysfunctions:¹⁵

Apathy, or lack of meaningful interaction.

- Limited or focused discussion that ignores other aspects of an issue.
- Dysfunctional group member who does not participate or perform work equally with others in the group.
- Scapegoated student, who becomes ignored by other group members.
- Domineering student who disrupts, or prevents others to learn through the process.

For faculty, poor interpersonal skills (as determined through informal interviews) can lead to:

- A class becoming hostile towards the instructor due to frustration over learning.
- An over-reliance on tutors and/or professor in solving problems and completing tasks.

Peter Senge stated that "a group of talented individual learners will not necessarily produce a learning team, any more than a group of talented athletes will produce a great sports team."¹⁶ [As a point of clarification and for the purposes of this article, group and team will be used synonymously] To be a learning team, the learners need to have the interpersonal skills that will help them become an effective team. For example, in a course designed to teach students how to work together as a group to solve problems, lack of interpersonal skills and over-reliance on previously formed bad habits of group process created a decline in learning.¹⁷ In this course, students were randomly divided into two groups of six students each. However, randomness created one group comprised of all the "leaders" in the class, and one group with "no leaders." All students had been instructed in the skills of team dynamics, and were required to utilize these skills to solve a problem posed to them by the instructor. Based on instructor observations, and qualitative data obtained from students in the course, the "no leader" group utilized the skills, followed the process, and worked effectively and efficiently during the class. Their level of interaction and the depth of analysis was good. The "leader" group started out fine, but over the course of time began to break apart as individuals began to try to gain dominance of the group and to formulate a process to their individual preferences. Eventually, the group was pulled in six different directions, communication broke down, and motivation declined. Individually, the students were good, but together they were not successful. Frustrating the situation even more for the "leaders" was the fact that the other group was functioning effectively, having fun, and learning. It became abundantly apparent to the "leaders" that they needed to follow a process, and practice the skills taught to them in order to learn and function effectively. This experience impressed upon the students that interpersonal skills relating to group process were essential for effective problem solving and learning, and that sheer force

of will does not breed success. Katzenbach and Smith have expounded on the need for teams to have problem solving and interpersonal skills.¹³ Without these skills being adequately developed, student learning can be frustrated.

What Interpersonal Skills are Necessary?

The skills necessary for successful teaming include: consensual decision making skills, dialogue and discussion skills, team maintenance skills, conflict management skills, and team leadership skills. Students who have these skills have a better opportunity to learn more than students who do not have these skills.^{12,17-19}

Consensual Decision Making Skills

The first skill team members need before they join a team is consensus decision making.¹⁹ Consensus is based on the term "to consent" as in "to grant permission." When a team arrives at consensus, each team member permits the decision to occur and agrees to support the decision. Consensus means that every member of the team participates in the decision, and everyone agrees with the decision. The decision, however, may not be the decision everyone prefers, but it is one that everyone can live with. In PBL, reaching consensus requires that every student participates, has equal opportunity to be heard, and for their ideas to become part of the team's database.^{20,21} Consensual decision making, by definition, involves the contributions of all members, not only a select few. In this environment, the likelihood of an outcome acceptable to all is high.²⁰

Consensus occurs at various levels. Sheive and Metivier have outlined five levels of consensus.²¹ The first level is where all team members agree that no more information is needed. The second level is where everyone understands what each team member means. It involves clarifying the information. The third level of consensus occurs when all members agree on the relationship between a set of items (differentiating between main and supporting ideas). The fourth level of consensus occurs when all agree on the hierarchy within a set of ideas. Lastly, the fifth level of consensus is achieved when all agree on the activities needed to solve a problem. Adopting consensus as an operating style requires patience, the ability to listen and learn from others, and a willingness to adjust one's own needs with those of the team's. While consensus is time consuming, it inevitably leads to well thought out and implementable solutions.²⁰ Consensus is predicated on the need for individual's to understand each other. Therefore to reach consensus students need to have the ability to effectively engage in dialogue and discussion.

Dialogue and Discussion Skills

Dialogue

Dialogue is a process by which students seek to understand one another. Dialogue is not just a technique, but a principle that is founded on the belief that problem identification and resolution are intimately linked with a core of common meaning.¹⁶ Before a solution can be determined, common definitions of the problem must be identified.¹⁴

Dialogue is a process that builds shared meanings and definitions of the problem between students within a group. When the meanings are shared and understood the ability of the students to resolve the problem is enhanced.

For dialogue to be effective it must be nurtured not forced. It requires true facilitation, not manipulation, where value judgements are not allowed. At most, students in a dialogue ask questions to clarify meaning for the purpose of accurately understanding another's viewpoint and passion about an issue or problem.²⁰ The issue is *not* whether you agree or disagree with another, the issue is whether you understand the other person's view. Consequently, effective listening and critical thinking skills are crucial.²²

Dialogue is not used for the purpose of making a decision. According to Senge et al., it will backfire if channeled toward closure.¹⁴ This can be a problem with student learning and is often exemplified when students go directly to solutions rather than developing a shared meaning of the problem. Through dialogue students learn how to think together. Students learn when individual contributions lead to greater understanding of the problem and how to resolve it.

Two effective procedures that enhance dialogue are brainstorming, and clarification.^{17,18,21} Brainstorming, as opposed to brainstorming, is a procedure that sequentially solicits ideas pertaining to a problem from group members. Whereas brainstorming involves a random solicitation of information that tends to favor the more verbose and quick thinking individuals, brainstorming allows all group members equal opportunity to participate in idea generation. The ability for each student to participate equally provides a potential solution to problems with domineering, shy, or less cerebrally agile students. By providing equal opportunity, all students develop a sense of ownership and reduce the tendency to think unidirectionally. Following brainstorming, clarification is utilized to provide depth of meaning of the brainstormed items, and to promote understanding between students about each item. Essential to dialogue is asking questions that clarify, not challenge or place a value judgement on the item. Value-laden questions breed interpersonal conflict which compromises the team's effectiveness.

For example, a student who feels threatened by another student's questioning may be less likely to provide information in the future. The net result is a group with fewer actively participating members, and less "brain power" to engage the problem. Therefore, clarification is a skill that utilizes effective questioning to promote understanding — not agreement. Questions are posed in a manner such as "Help me understand what you mean by this statement?" "Please explain to me how your item relates to the problem we are addressing?" Clarification also requires that the student, whose brainstormed item it is, clearly articulate what they mean. This promotes critical thinking, for to be clear a student must present information that is not ambiguous. All students in a group must be allowed to ask for clarification of an item. When all students understand, essentially they have consented to the meaning of that item.

Discussion

In contrast, discussion is used for the purpose of making a decision or reaching closure on an issue or problem. For discussion to be effective it should follow dialogue. When there is no common understanding of the problems and concerns, or shared vision of what needs to be done, effective decision making is compromised.²³ Discussion is not a debate, and it is not for the purpose of winning. Discussion is a skill that makes thought processes visible, allows assumptions to surface and be challenged, and exposes the sources of disagreement. Effective discussion focuses on issues, not personalities.²² Discussion, mindfully done, allows ideas to be challenged in a meaningful way, and focuses on making a decision so a problem can be addressed and remediated. The role of the facilitator is essential in effective discussion, for discussion can become unfocused and purposeless if not done properly. The facilitator must focus predominantly on the process, not the content of discussion. The facilitator must monitor discussion so that it allows students to reach a decision, challenge assumptions and involve all group members. Facilitators should provide opportunity for all to participate in the discussion. Discussion is useful in clustering items together into categories, prioritizing items as to their relevance to the problem, or selecting a solution to the problem. Facilitators must be careful not to interject their ideas, but rather, focus on promoting student interaction and discussion toward a decision. Tutors, for example, must be careful not to practice facilitation by manipulation. That is, move the team to their view or solution. If this occurs, students may learn to be dependent upon the tutor, rather than becoming independent learners and decision makers. Although, tutors may help teams where they lack information, during discussion, they should take caution in moving the team to their viewpoint.

Maintenance Skills

All teams have two fundamental tasks: to accomplish a task, and to develop and maintain the team. Tipping, Freeman and Rachlis reported that faculty and students had a low awareness of effective group dynamics and the absence of mechanism for reflection that could help groups analyze and learn from their behaviors.⁷ For teams to improve, and therefore learn, all members must contribute to the on-going evaluation of the team's process and development. This requires group members to provide feedback and evaluation on: 1) each member's commitment to the project, task, and team; 2) the level of affective development including feelings of trust, belonging, and work relationships; 3) the team's efficacy — ability to get the job done; and, 4) their ability to resolve conflict. Therefore, team members must have and follow methods and procedures that allow feedback.²¹ Feedback from others is essential for both personal and team growth, and students should learn to self manage their own groups by conducting on-going process evaluations.¹⁹ When students do not receive on-going feedback about their own performance, problems fester, resentments rise, and frustrations increase. Feedback should not only occur from the instructor, via a grade, but should also be on-going from both the instructor and other group members so that students have opportunity to improve throughout the PBL process. Another technique that serves to promote team maintenance is debriefing. Debriefing is a technique of

discussing how the team and/or the work of the team is progressing. It serves to engage the group in self-assessment, and enables the group to determine how it needs to change and to be self-correcting. For example, during debriefing students may address what went well, what has been accomplished, what were some difficult moments, what they need to work on, and what has been learned. Debriefing should be done at the end of every other class period, as a minimum, to be effective.^{17,18,21}

Conflict Resolution Skills

Conflict is healthy, common, and necessary for team growth.¹⁵ However, conflict can become destructive to student learning when it is personal or becomes an obstacle to task completion. Conflict can occur when students lack the skills necessary for team function. For example, a lack of dialogue skills will result in misunderstandings, a lack of shared meaning, and confusion. This can result in conflict and create resentment.¹³

Another source of conflict is the difference in thinking styles between students. Teams are usually composed of 5 to 10 students, each with a different background, a unique view of the world, and a variety of thinking styles. This diversity provides rich resources for problem solving.²⁰ Thinking styles determine how a student gathers information and how the student utilizes information to solve problems. Not understanding or appreciating the value of other students' thinking styles creates conflict. For example, a more intuitive student is more likely to consider several options simultaneously when analyzing information, or jump from one step of analysis to another. In contrast, a systematic thinker is more likely to make a plan for problem solving, and complete one analysis before jumping to the next step. If these students don't understand the value of each others' style and their respective manner for analyzing data, the systematic thinker may view the intuitive thinker as flighty and impulsive, while the intuitive thinker may view the systematic thinker as slow and ignorant. Many potential conflicts are minimized when students are aware of the various cognitive styles represented by individuals within the group.²⁰

According to leaders in team process conflict can be managed and minimized by:^{10,13,14,19}

- Focusing on the process and not the people as the source of conflict.
- Providing a safe, non-threatening environment that allows conflict to surface and be resolved.
- Developing common team purposes and goals.
- Building shared meanings and perspectives.
- Instituting a common approach to solving problems and accomplishing team tasks.
- Emphasizing collaboration.
- Understanding differences in how individuals gather and analyze data (i.e. thinking styles).

Hitchcock and Anderson also recommend that ground rules be established to govern student interaction, and to promote the above objectives.¹⁵ Ground rules serve to prevent crises from occurring by establishing clear expectations, and serve to establish norms of behavior which act as references for process diagnosis when problems do occur.²⁴ Ground rules should be elicited from the group members,²⁵ with certain ground rules deemed mandatory.¹⁵ For example, students should be punctual and attend class, no value judgements during brainstorming/storming and clarification, come to each group session prepared. Peterson utilized a structured team problem solving approach that provided a systematic method for problem solving and group interaction.^{17,18} The structured system prevented behaviors and communication patterns that create conflict. Student qualitative responses, and outside observations from the Center for Teaching Effectiveness indicated that conflict was significantly reduced, and students stayed on task during the team interaction. By defining roles, space, and behaviors through a structured process, conflict was minimized because students learned how to act and function together to solve a problem.

Team Leadership Skills

In early teaming, every individual should be given the opportunity to be assertive and to learn the value of his/her thoughts and actions.¹⁹ This necessitates that traditional views of a leader's role be modified.²⁶ Teams need and seek participation and input from all members. Traditionally, the leader of a group is seen as the authority, the one who makes the final decision, generates member interaction, sets the agenda, and provides direction.⁷ As a consequence, team members may become reliant upon the group leader, and may not function well without his/her presence. A student team which operates this way usually can not be productive when a "student leader" (or tutor) is absent. This approach is very much like traditional education modalities which have been reported to contribute to a "learned helplessness" among students.^{27,28} Therefore, it becomes necessary for all team members to be able to lead the team. This can occur when responsibility for the operation of the team is shared. The technique is called role-sharing. Shared leadership leads to shared accountability and competencies. The leader of a team should focus on the process rather than the content of the problem solving process. The leader performs more of a facilitatory role, working to encourage and manage communication, participation, and consensus.²⁶ The leader functions to manage and implement dialogue and discussion appropriately, as well as resolve conflict judiciously as it arises. Most importantly, the leader keeps the team functioning within a problem solving process. When students overtly share the leadership or facilitator role, they are more attentive to team maintenance issues when they reassume a team member status because they can empathize with the team leader's responsibilities.²⁰ In addition, effective leadership skills allow students to become more self managed, which may allow for fewer tutors, thereby reducing the cost of a PBL curriculum — a common obstacle to PBL implementation.⁴

The Importance of Structure

Teams need a common approach to problem solving, and members need a safe, secure environment in which to function, share ideas without being judged, interact, and to keep them on task.^{12,16} Team process breaks down when there is a lack of direction, purpose, and open communication between team members. Although students have developed individual strategies for problem solving, these strategies often do not mesh with the strategies of others, or work well in a team setting. According to Shieve and Metivier, to promote effective team interaction the team must have structure to:²¹

- Provide an overall process for problem solving.
- Provide procedures to govern the problem solving process.
- Govern and regulate team member behaviors, roles, and space.

When people feel that their ideas do not matter, or feel vulnerable to ridicule, learning is hampered, and a feeling of helplessness can develop.²⁸ Student frustration also results when team members pull the group in different directions, or follow a process of problem solving that has not been agreed upon by the entire team. Conflict occurs when student interaction is not regulated such that unequal participation, workload, and

learning occurs.¹⁵ Students may regress into conflict when there is an absence of rules and thereby compromise learning.

Student groups that learn and follow a structured problem solving process, utilizing a common set of procedures, governed by techniques which regulate team behavior, have shown through self-reported and outside observer data improvements in critical thinking, interpersonal skills, problem solving, and learning.^{17,18} Czikszenmihalyi has long advocated the need for rules and structure for obtaining an optimal psychological experience.²⁹ Structure in terms of behaviors, roles, and space may help students function more competently and obtain a positive educational experience in PBL.

When Should Interpersonal Skills Be Learned?

Ideally, it would be advantageous if all students had these skills prior to the implementation of PBL. The reality is that not all students have adequately developed these skills. There are three possible mechanisms for teaching students these skills. The first is to create a skills course as a prerequisite to PBL based courses or curriculums. The advantage to this approach is that subsequent instructors do not have to concern themselves as intensely with the process of learning, thereby freeing them to deal more directly with the content to be learned. A second strategy is to train students in interpersonal skills while they work on a problem in a specific course already existing within a curriculum. This option has the advantage of not having to create a new course, but it will compromise the learning of content because the instructor will have to divide his/her attention between the learning of teaming skills and the course content. This strategy, however has been limited to smaller class sizes of 30 or less.¹⁸ Finally, tutors and faculty members could be trained to be team trainers, and teach students teaming skills while they work on problems. This spreads out the training and frees the instructor from having to spend time on interpersonal skill development.

It is also important for faculty to be competent in interpersonal skills before they can be expected to train students. For PBL to be improved, the development of interpersonal skills is a necessity. Continual reliance on the belief that students will somehow be able to work out a problem will continue to compromise PBL and student learning outcomes. PBL's effectiveness is impacted by how well students work together. Therefore, enhancing Problem-based Learning will require the development of the interpersonal skills upon which PBL is built. Since PBL has not been the educational method of choice in the majority of pre-medical education systems, suffice it to say that many students will lack these skills upon entering the medical school curriculum. By training students (as well as faculty) in these skills prior to, or within existing medical courses which utilize PBL, learning can be enhanced.

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Skills to Enhance Problem-based Learning Med Educ Online [serial online] 1997;2,3.
Available from: URL <http://www.Med-Ed-Online.net>.

STUDENT HANDOUT: MEETING 1

Case	Student Notes
<p>Dr. Johnson is seen in the emergency room with a chief complaint of fever and sweats that have gotten worse the last 24 hours.</p> <p>Dr. Johnson is a 32-year-old anesthesiologist, working for the local hospital, who was well until about 4 weeks ago when he developed symptoms of fatigue, malaise, and poor appetite. Over the last 4 weeks he has developed feverishness, diaphoresis, myalgias, and arthralgias. He presents today having just administered anesthesia for the patient of a local surgeon.</p> <p>Physical Examination</p> <p>General: A slender, somewhat weak-appearing male with a nonproductive cough, slight tachycardia, and petechiae in the oropharynx.</p> <p>Vital signs:</p> <p>Temperature: 38° C</p> <p>Heart rate: 105 bpm</p> <p>Blood pressure: 120/80 mm Hg</p> <p>RR: 22/minute</p> <p>HEENT: Posterior pharynx is quite red with exudate.</p> <p>Heart: Normal sinus rhythm and grade I/VI systolic murmur noted at apex without radiation.</p> <p>Lungs: Clear to auscultation and percussion.</p> <p>Abdomen: No organomegaly or tenderness; normal bowel sounds.</p> <p>Neurological: Normal.</p>	

STUDENT HANDOUT: MEETING 1

Case			Student Notes
Lab: Hematology			
CBC	Result	Ref. Range	
WBC	13.0	5.0–10.0 x 10 ³ /L	
RBC	4.8	4.5–6.0 x 10 ⁶ /L	
HGB	15.0	13.0–17.0 g/dL	
HCT	45.0	40.0–52.0%	
MCV	85	80–100 fL	
MCH	30	27.0–33.0 pg	
MCHC	35	32.0–36.0%	
RDW-CV	12.0	11.5 –14.5%	
PLT count	300	150–400 x 10 ³ /L	
NEUT %	76	50–70%	
Lymph %	22	20–40%	
Mono %	1	2–8%	
EOS %	1	1–4%	
BASO %	0	0– 2%	
<p>Rapid strep test and mono test were negative.</p> <p>A diagnosis of upper respiratory tract infection, possibly viral, was made and the patient was empirically treated and sent home on azithromycin 500 mg today and 250 mg/day for the next 4 days.</p>			

STUDENT HANDOUT: MEETING 1

Case	Student Notes
<p>One week later, Dr. Johnson returned to the emergency room with his wife. His symptoms had not improved since he was placed on antibiotics and, in fact, he states he is feeling worse.</p> <p>Upon further questioning, it is found that he has been experiencing a tender right knee joint. On exam he had a warm swelling of his right knee joint, an erythematous nodule on his right index finger, and a grade II/VI systolic ejection murmur at apex radiating to the axilla. Dr. Johnson is admitted to the hospital for further workup and treatment.</p> <p>Dr. Johnson is examined by the attending physician upon arrival on the medical floor. Dr. Johnson describes his health as excellent, has no active medical problems, is taking no medications, and has no known medical allergies.</p> <p>Past medical history: Five years ago, Dr. Johnson was in an auto accident with multiple traumatic injuries, including compound fracture of his left femur and lacerations of the bladder and urethra. He was treated with morphine and other oral narcotics for pain control for 3 months.</p> <p>Family history: Father and mother in good health; two siblings in good health.</p> <p>Social: Patient does not smoke, uses alcoholic beverages socially, and denies illicit drug use. He works as an anesthesiologist at the local hospital. He has been married for 8 years and has a 4-year-old son. He denies any extramarital sexual contact.</p> <p>Physical exam: He appears unkempt, obviously ill-appearing, and anxious. He continues to complain of continuous nagging muscle aches and feverishness.</p>	

STUDENT HANDOUT: MEETING 1

Case	Student Notes
<p>Vital signs:</p> <p>Temperature: 101°F (38.3°C)</p> <p>Heart rate: 105 bpm</p> <p>Blood pressure: 130/45 mm Hg</p> <p>Eyes: PERRLA; small conjunctival petechiae; small oval hemorrhage with pale center noted in the left retina.</p> <p>Throat: Posterior pharynx is mildly erythematous; no exudate seen.</p> <p>Neck: No adenopathy.</p> <p>Chest: Normal excursion, decreased breath sounds bilaterally.</p> <p>Heart:</p> <ul style="list-style-type: none">• Soft S₁, S₂.• Grade II/VI holosystolic murmur heard at the apex and conducted to the axilla.• Grade I/VI systolic ejection murmur heard at the aortic area and not conducted to the carotids. <p>Abdomen: No organomegaly; no tenderness</p> <p>Extremities: Slightly erythematous pea-sized nodules noted in the thenar and hypothenar eminences, similar to the one on the right hand. Several red-brown linear streaks beneath the fingernails of the left hand. Right knee is warm, dusky red, and swollen. The patella is ballotable. There are multiple small puncture wounds in a linear pattern on the lower extremities.</p> <p>Neurological: No nuchal rigidity; Cr II-XII intact; sensory exam intact. Patient performed finger to nose movements very slowly but without apraxia; both sides were performed equally. He exhibited a fine tremor of his hands.</p>	

STUDENT HANDOUT: MEETING 1

Case	Student Notes																																										
<p>Motor exam: Intact strength; muscle tone normal; DTRs brisk and symmetric gait; station and Rhomberg not performed.</p> <p>Lab: Hematology</p> <table border="1" data-bbox="191 485 786 1461"><thead><tr><th>CBC</th><th>Result</th><th>Ref Range Male</th></tr></thead><tbody><tr><td>WBC</td><td>14.5</td><td>5.0–10.0 x 10³/L</td></tr><tr><td>RBC</td><td>4.8</td><td>4.5–6.0 x 10⁶/L</td></tr><tr><td>HGB</td><td>14.6</td><td>13.0–17.0 g/dL</td></tr><tr><td>HCT</td><td>44.2</td><td>40.0–52.0 %</td></tr><tr><td>MCV</td><td>84</td><td>80–100 fL</td></tr><tr><td>MCH</td><td>31</td><td>27.0–33.0 pg</td></tr><tr><td>MCHC</td><td>33</td><td>32.0–36.0 g/dL</td></tr><tr><td>RDW-CV</td><td>12</td><td>11.5–14.5 %</td></tr><tr><td>PLT Count</td><td>54.0</td><td>150–400 x 10³/L</td></tr><tr><td>NEUT %</td><td>90</td><td>50–70 %</td></tr><tr><td>Lymph %</td><td>3</td><td>20–40 %</td></tr><tr><td>Mono %</td><td>2</td><td>2–8 %</td></tr><tr><td>EOS %</td><td>5</td><td>1–4 %</td></tr></tbody></table> <p>Morphology:</p> <p>RBC: Normocytic, normochromic</p> <p>WBC: Neutrophilic left shift with toxic granules and Dohle bodies present.</p>	CBC	Result	Ref Range Male	WBC	14.5	5.0–10.0 x 10 ³ /L	RBC	4.8	4.5–6.0 x 10 ⁶ /L	HGB	14.6	13.0–17.0 g/dL	HCT	44.2	40.0–52.0 %	MCV	84	80–100 fL	MCH	31	27.0–33.0 pg	MCHC	33	32.0–36.0 g/dL	RDW-CV	12	11.5–14.5 %	PLT Count	54.0	150–400 x 10 ³ /L	NEUT %	90	50–70 %	Lymph %	3	20–40 %	Mono %	2	2–8 %	EOS %	5	1–4 %	
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STUDENT HANDOUT: MEETING 1

Case			Student Notes
Metabolic Panel	Result	Normal Values	
BUN	28	7–22 mg/dL	
Sodium	131	135–145 mmol/L	
Potassium	5.0	3.6–5.5 mmol/L	
Chloride	100	98–108 mmol/L	
Glucose	225	Fasting: 70–99 mg/dL	
Creatinine	1.2	0.5–1.2 mg/dL	
Phosphorus	4.0	2.6–4.9 mg/dL	
Calcium	10.0	8.7–10.7 mg/dL	
Magnesium	2.0	1.6–2.4 mEq/L	
Albumin	3.2	3.5–4.8 gm/dL	
Alkaline Phosphatase	72	71–213 IU	
Total Bilirubin	2.7	0.3–1.2 mg/dL	
LDH	175	94–172 IU	
SGOT/AST	40	8–42 IU	
Total Protein	6.0	6.0–8.0 gm/dL	
Uric Acid	4.0	3.9–7.8 mg/dL	
Cholesterol	180	120–200 mg/dL	
Triglycerides	280	20–200 mg/dL	
HDL Cholesterol	28	29–83 mg/dL	

STUDENT HANDOUT: MEETING 1

Hepatitis B and C and HIV tests were negative.

Blood cultures were drawn from each arm.

An echocardiogram was done. The mitral valve showed small, rounded irregularities on the atrial side of the leaflets. Antibiotic treatment was started and included nafcillin (2 grams intravenous every 4 hours) and gentamicin (based on pharmacodynamics).

STUDENT HANDOUT: MEETING 2

Case	Notes
<p>Over the course of the next week, Dr. Johnson experienced tachycardia, diarrhea, hypertension, and diffuse pain. He was treated with clonidine 0.3 mg twice a day and with loperamide 2 mg after each loose stool. NSAIDs were administered for pain. On day 3, a few more linear streaks appeared under his nails and fingertips. A urine sample was obtained, which was positive for opiates.</p> <p>Blood cultures were positive for <i>Staphylococcus aureus</i>. Gentamicin was discontinued, and Nafcillin was continued for 6 weeks. With this treatment, his condition improved.</p> <p>His attending physician questioned his colleagues who reported that the patient's performance had decreased over the last few months. A check of the narcotics register looked good, but records showed much higher doses of fentanyl used on patients recently. The patient's wife reports increased emotional lability and agitation at home during this same time.</p> <p>Upon sensitive questioning by the attending physician, the patient admitted to a problem with prescription narcotic abuse since his accident and subsequent narcotic treatment 5 years ago. He started stealing fentanyl from the operating room 2 years ago and has been increasing his use over the last 4 months.</p> <p>Students should discuss these symptoms and identify that these may be caused by narcotic withdrawal. Treatment is directed toward this diagnosis.</p> <p>Epilogue</p> <p>Dr. Johnson's condition improved with treatment, and he had no serious cardiac sequelae. He went back to work with provisional privileges and with regular physician followup and random drug screens. After 1 year, he remains at work and continues to test negative for illicit substances.</p>	

Student Learning Objectives

Student Learning Objectives are specific issues arising from the case which the students must be sure to address and are as follows:

1. Describe the indications for, the proper procedure and timing of, and the expected results of blood culture in patients suspected of having infective endocarditis and other types of sepsis.
2. Discuss the major risk factors for developing infective endocarditis.
3. Identify the major causative agents of infective endocarditis, their pathogenesis, diagnosis, and antibiotic therapy.
4. Discuss the pathophysiology of endocarditis and differentiate between acute and subacute.
5. Discuss the topic of drug abuse in the physician population in terms of risk, types of drugs involved, treatment, monitoring, and risk of recidivism. What are Dr. Johnson's risk factors?
6. Discuss the treating physician's responsibility to the State Board of Medical Examiners regarding Dr. Johnson's substance abuse.
7. What treatment is recommended for Dr. Johnson's substance abuse? What characteristics of treatment programs are associated with success?
8. What are the important effects of chronic opioid use on the CNS and other organs? Discuss the biochemical mechanisms involved.
9. What are the characteristics of opioid withdrawal? How are they managed?