

## **Part I: Background**

**Title:** Effectiveness of Applying Case Study Method of Instruction to Pathophysiology

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**Discipline:** Health Professions, Radiation Therapy, Nuclear Medicine, Pathophysiology, GI Disorders

**Submission Date:** June 15, 2012

**Course Name:** Pathophysiology

**Course Description:** This course is taught in the first semester of the Radiation Therapy and Nuclear Medicine Programs. It focuses on the pathophysiologic disorders that affect the human body throughout the life span. The theories of disease causation are introduced and discussed. The following areas are strongly emphasized during the course: cellular and systemic responses, clinical manifestations and the response of tissue to radiation damage; acquired, immune, infectious, carcinogenic and genetic alterations in the body systems are included. This is a 300 level course, taught in two sections. Section one (section 1) consisted of 20 first year radiation therapy students, while the section two (section 2) consisted of 25 first year Nuclear Medicine students and 25 first year Nursing students. The class time was approximately 90 minutes in the same classrooms in which class is normally taught.

## **Part II: The Lesson**

### **Learning Goals:**

Upon completion of the lesson study of GI disorders, we desired to see students retain information about the GI disorders on the unit exam. In addition, in section one, we hoped to see this same information retention on the final exam at the end of the semester. Secondly, we wanted to see the students apply the GI information learned in this unit. The lesson study was designed in a case study format. The students could apply the GI knowledge that they gained through the assigned reading and their existing pathophysiological knowledge, in order to solve the case. Along with application of knowledge, we wanted the students to exhibit critical thinking skills. By designing the lesson study in such a way that the students did not have all of the information that they needed, we hoped that it would encourage and engage them to think about the case in a critical way, using their basic knowledge of pathophysiology. Finally, the remaining goal of the lesson study was to encourage students to problem solve and collaborate. The case was designed to require the student to work in groups on a three-part progressive case study. It would require teamwork, collaboration, and critical thinking to solve the case. Developing teamwork and collaboration in a health professions program is very important. These students will become professionals who have to problem solve together and collaborate with each other in order to provide the safest and most effective patient care.

### **Lesson Plan:**

In order for students to prepare for the GI Disorders material, they were instructed to complete the assigned reading from their textbooks and understand instructor defined objectives prior to coming to class. For the lesson study, the students were assigned into groups of 4-7 at the beginning of class by the instructor. Individual informed consent was obtained by the instructor. The students were then instructed to spend 15-20 minutes in their groups discussing the defined objectives. After this discussion all students individually completed a pre-case assessment (see [Appendix 1](#)), consisting of multiple choice questions pertaining to GI disorders material.

Students then worked in assigned groups to complete a three-part, progressive case study on Crohn's Disease; a GI disorder. (See Appendix 2). In part one, students were given a patient history and asked to answer questions to identify potential organs of pathological concern, as well as to identify three

pathological disorders that the patient could be experiencing. In part two, students received laboratory values from a blood test and CT images of the patient's abdomen and pelvis. They were asked to identify abnormal blood values and record what abnormalities that they observed on the CT scan. In part three, the students were given a set of normal CT images in which they had to compare and contrast with the previously received abnormal scans of the patient. Finally, they were instructed to diagnose the patient with one of five potential GI disorders, along with reasoning why they would rule out the other disorders. The listing of the five potential disorders was given to the students by the instructor. The findings from each of the groups were recorded and a classroom discussion completed the lesson.

### **Part III: The Study**

#### **Approach**

While the students were completing the progressive case study, instructors and observers evaluated the students' interactions. The following four goals were observed and evaluated by recording evidence of various pre-defined behavior indicators: engagement, understanding, skilled action, critical reflection. See [Appendix 3](#) displaying the Lesson Study Observation sheet for behavior indicators used during the observation and evaluation.

Upon completion of the progressive case study, we conducted a class discussion of the five potential disorders and each group disclosed their patient diagnosis and reasoning with the rest of the class. This shared information was summarized on a chart on a white board by the instructor. Following this discussion, students individually participated in a post-case assessment (see [Appendix 4](#)), consisting of multiple choice questions pertaining to GI disorders material. In order to assess retention of this material, similar type questions were included on the unit exam in sections one and two, as well as the final exam in section one. The students were not aware that they would be given GI questions on the final, as it was not a cumulative exam (section 1 only). We wanted to see what the actual retention levels were without them reviewing the material. The additional GI disorders questions were given as bonus questions on the exam. Additionally, the Radiation Therapy students (section 1) were given a discussion evaluation form at the end of class on the day of the Lesson Study to qualitatively evaluate the case study pedagogical method.

In section two, we compared the test scores of the GI disorders with those of a similar disorder in the same unit to determine if the case study method of instruction would improve exam scores versus the standard lecture type of instruction, thus proving better retention through understanding of material. In section two, we compared the test scores of GI disorders with the test scores of the respiratory disorders unit. These questions were in similar format.

#### **Findings/Discussion**

For this research, 53 students in their first semester of professional program study in Nuclear Medicine Technology, Nursing, and Radiation Therapy were studied. The Radiation Therapy students were assigned to section one. The Nuclear Medicine Technology and Nursing students were assigned to section two.

The pre-case assessment and post-case assessment scores were evaluated, and average score was determined for each section, respectively. In section one, the pre- case assessment was 52% and the post- case assessment was 69%. In section two, the pre- case assessment, was 57% and the post- case assessment was 67%.

In section one, students scored an average of 90.1% on the unit exam given a week after this case study. Additionally, the average score for the 14 GI related questions was 90.6%. The average score of the GI disorders bonus questions on the non-cumulative final exam was 59.5%.

In section one, the behavior indicators as noted by the instructors and observers who evaluated the students were as follows;

1. Engagement: evidenced in most groups through discussions and comments regarding wanting more information to feed interest in topic. Students were persistent in trying to solve the case even when they expressed not having enough information.
2. Understanding: students explored many different ways to reach a diagnostic conclusion on the case. This was evidenced at the end of the class when we had the discussion regarding why they chose one particular disorder over another.
3. Skilled action: students worked very collaboratively towards the end of the case in an effort to diagnose the GI disorder. There was quite a bit of discussion regarding the ruling out of various factors, etc.
4. Critical Reflection: students made many statements during the case about feeling the need to have more information especially as it related to the CT scans. While they were initially quick to try to start diagnosing during part one, it was interesting to have stop, slow down and talk through the diagnosis as the case progressed.

In section two, the students scored an average of 83.5% on the unit exam, given a week after the case study. Additionally, the average score of the 14 GI related questions was 84.4%. The average score of the respiratory related questions was 69.9%.

In section two, the behavior indicators as noted by the instructors and observers who evaluated the students were as follows;

1. Engagement: evidenced in few of the groups, little expression of interest, more off-task discussion of weekend events, parties, etc.
2. Understanding: hunches were mostly observed, checking where pain was in relation to the GI quadrants, taking one of the symptoms and try to find a GI condition to match.
3. Skilled action: differentiation observed when prompted by objectives, students offered first hand and second hand experiences to assist in diagnosing condition.
4. Critical reflection: not evidenced.

The application of Lesson Study to our GI disorders material with the intention of studying how students process and retain information, their ability to think critically about material, and how they collaborate to solve problems will be discussed. This discussion is based on the evidence of our data.

Our attempt to study how our students process information was evidenced in the behavior indicators; Engagement and Understanding.

In section one, based on lesson study observation, it was obvious that students were challenged, worked collaboratively and had to apply knowledge, as well as use critical thinking skills to understand the new information. When unit exams scores on the GI material were compared to that of material taught by traditional lecture; the GI scores were higher demonstrating higher levels of retention of information.

The final goal of lesson study to encourage students to problem solve and collaborate was evidenced during Lesson Study observation of behavior indicators, skilled action and critical reflection. Lesson

study facilitators and observers reported students working collaboratively in an effort to diagnose the GI disorder. The facilitators and observers also reported the students making many comments during the Lesson Study that evidenced critical thinking. The students made comments about needing more information as it related to the CT scans and as the case study progressed, the students started to slow down and talk through the diagnosis. This was different from the beginning of the lesson study where they were quick to try to come up with the correct answer or diagnosis.

Also in section one, many themes were apparent in the open-ended questions regarding the lesson study discussion and instructor's effectiveness on the discussion evaluation form (see [Appendix 5](#)). In response to the question of what each individual student, as well as their group members could have done to make the discussion more effective, the majority of students reported being more prepared for class. Many of them associated being prepared with taking notes, reading the corresponding chapter in the textbook, and having a prior understanding of the material to be discussed and study in class.

The increase in retention of information by using the progressive case study pedagogical method instead of the traditional lecture method of instruction was also evidenced in section two. Our attempt to assess retention of information was evidenced by the unit test. In comparing the GI disorders test questions with the respiratory test questions, section two tests scores seem to indicate that their retention for GI disorders was greater than their retention for the respiratory disorders. The respiratory disorders class was delivered in classic lecture style. On the unit test, the average scores of the GI disorders was 14.5% more than the average scores of the respiratory questions. Therefore, although modest, there seems to be evidence that retention was improved by case study understanding.

In section two, there was little evidence of the behavior indicators, skilled action and critical reflection. There was remedial understanding being undertaken when the students utilized a symptom to diagnose the GI condition. Although very little processing of the information was observed in section two, there was a modest improvement of their post-assessment scores as compared to their pre-assessment scores, which illustrates some improvement in student understanding of the material.

In conclusion, observations gleaned from the Lesson Study of GI Disorders were useful in making thinking visible. Our main goal to see information retention was attained as evidenced by the exam scores. The goal of student application of content was also met. Lastly, the Lesson Study goal of observing collaboration and critical thinking skills was achieved by section two and useful information regarding the lack of achievement in section one was attained by the Lesson Study observation. Lesson Study was able to provide us with a useful template with which to assess the benefit of case study pedagogical method of instruction. We look forward to another iteration in the next semester of instruction of pathophysiology.

## **References**

none

## **Appendices**

### **Lesson Materials**

Appendix 1: Pre-Case Assessment

Appendix 2: Case Study

Appendix 5: Post-Case Assessment

### **Study Materials**

Appendix 3: Lesson Study Observation Sheets

Appendix 4: Discussion Evaluation

## Appendix 1

NAME: \_\_\_\_\_

### Pre-Case Study Assessment - GI Disorders

#### 10 Questions

1. Diverticulitis is a condition involving which of the following?
  - A. small bowel
  - B. colon
  - C. stomach
  - D. anus
2. What type of disorder is celiac disease?
  - a. Intussuception
  - b. Malabsorption
  - c. Hernia
  - d. Peptic ulcer disease
3. What would a perforated gastric ulcer cause?
  - A. severe anemia
  - B. obstruction
  - C. gastric hemorrhage
  - D. peritonitis
4. Diverticulitis is;
  - A. an outpouching of all 5 layers of the intestine
  - B. an inflammation of a diverticulum
  - C. usually asymptomatic
  - D. usually acquired due to a low fiber diet and low fluid intake
5. Crohn's disease is;
  - A. an inflammation in a diverticulum
  - B. an outpouching of all 5 layers of the intesting
  - C. an inflammation of all 5 layers of the bowel
  - D. a diffuse disease of the colon which results in mucosal disorders
6. Diverticulosis is;
  - A. An outpouching of all 5 layers of the intestine
  - B. An inflammation in a diverticulum
  - C. Recurrent, episodic inflammation leading to fibrosis and obstruction
  - D. Usually is caused by retained stool
7. Infectious (non-erosive) gastritis can potentially result in;
  - A. GERD
  - B. Peptic Ulcer Disease
  - C. Diverticulitis
  - D. Crohn's Disease

8. Autoimmune gastritis results in our bodies being unable to;
  - A. Absorb B-12 which can result in dementia
  - B. Absorb water which results in severe dehydration
  - C. Absorb nutrients which results in severe fatigue
  - D. Fight the ulceration of the stomach lining
  
9. Barrett's esophagitis is caused by;
  - A. Peptic Ulcer Disease
  - B. Hiatal hernia
  - C. Esophageal diverticulum
  - D. Chronic GERD
  
10. Which of the following is a condition involving the small intestine?
  - A. Peptic Ulcer Disease
  - B. Crohn's disease
  - C. Barrett's esophagitis
  - D. Malabsorption syndrome

## Appendix 2

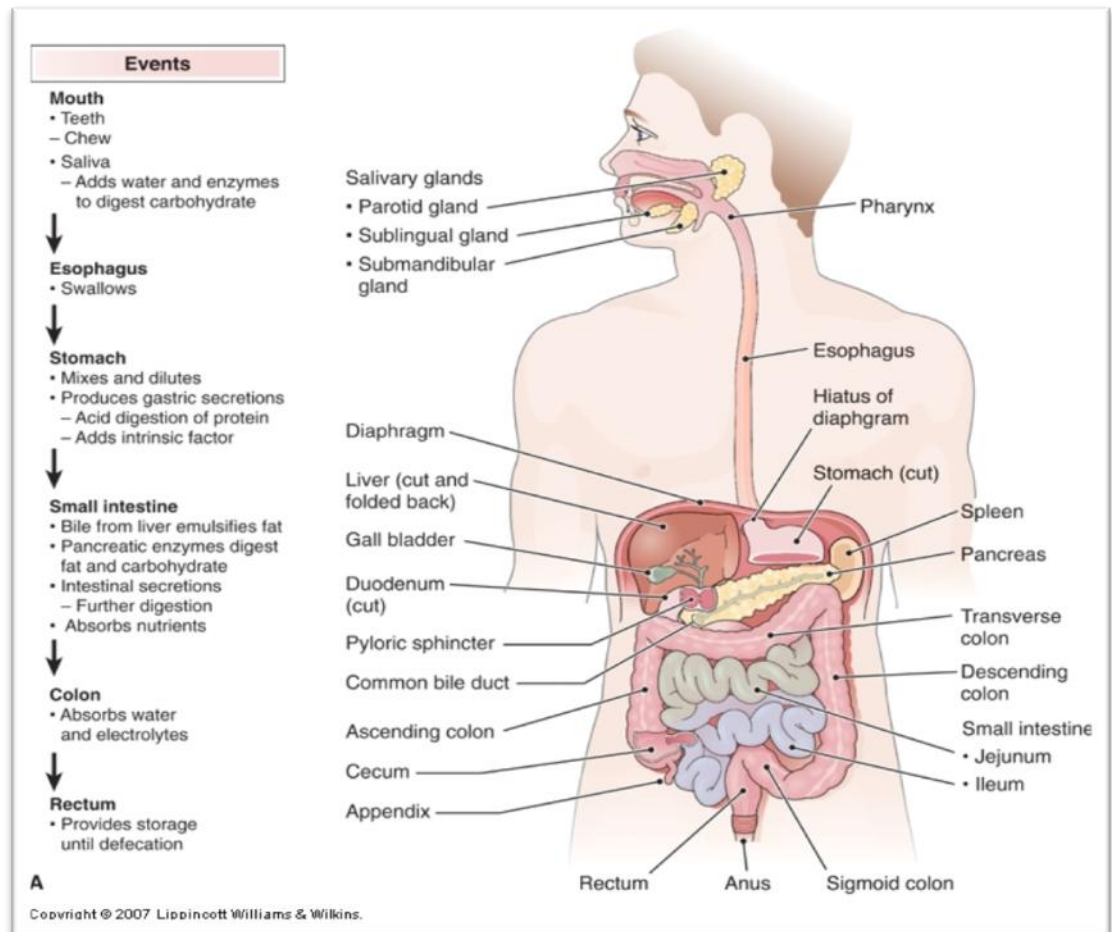
### Part 1:

Read the following patient history and based on this information, answer the questions below.

#### PATIENT HISTORY:

The patient is a 32 year old female who presented to the emergency department complaining of progressive fatigue, rectal bleeding and pain in the left lower quadrant and right lower quadrant (a table for areas affected shown below) without relief for a number of days. She denied any infection, bruising or “heartburn”. She reported constipation for the past couple of days. She also reported consumption of one bottle of wine per day for ten years, but in the last four years had reduced her intake to two glasses of wine per day. Past medical history was significant for surgery requiring resection or parts of the colon (she can’t remember what areas). No outpatient medications and no known drug allergies. Physical exam showed mild scleral icterus (yellowing), lungs clear to auscultation, heart regular rate and rhythm without murmurs, rubs, or gallops, abdomen with midline scar, liver palpable 2 cm below the left costal margin, and spleen not enlarged.

Right Upper Quadrant	Mid Upper Quadrant	LT Upper Quadrant
Right Middle Quadrant	Middle Quadrant	Left Middle Quadrant
Lower Right Quadrant	Mid Lower Quadrant	Left Lower Quadrant



1. Based on patient symptoms, identify potential organs of pathological concern?
2. Given the information discussed in the patient physical exam notes; identify three potential pathological disorders from your reading that this patient could be experiencing.

Part 2: The attending physician in the ER orders a blood test and a CT scan of the abdomen to begin the diagnostic process.

The laboratory values from the blood test included the following:

	Patient Value	Normal Range (female)
WBC	2.6 x 10 <sup>9</sup> /L	4.5 - 10.5
Hemoglobin	2.7 g/dL	12.1 -15.1
Hematocrit	7.7%	33.0 – 43.0
MCV	129.7 fL	76-100
RDW	46.7%	11.8 - 15.2
PLT	48 x 10 <sup>9</sup> /L	150-350
Reticulocytes	9.2%	0.5 – 2.0
Abs Retic	0.052 x 10 <sup>12</sup> /L	0.018 – 0.158
LDH	6338 IU/L	<170
TBILI	8.8 mg/dL	0.3 – 1.5
DBILI	<0.1	
Iron	159 µg/dL	65 – 165
Saturation	64%	25 – 50%
TIBC	247 µg/dL	250 – 420
Ferritin	135 ng/mL	10 – 282
B12	63 pg/mL	211 – 911
Folate	13.2 ng/mL	>5.4
RBC Folate	805 ng/mL	293 – 809

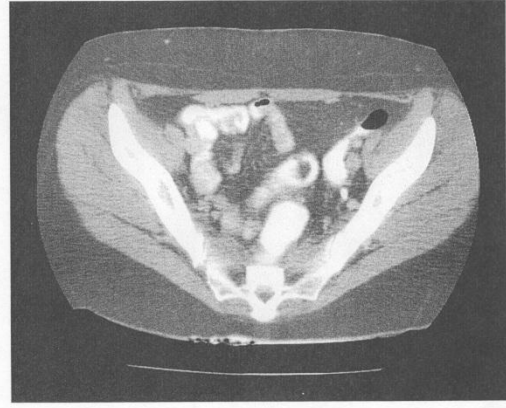
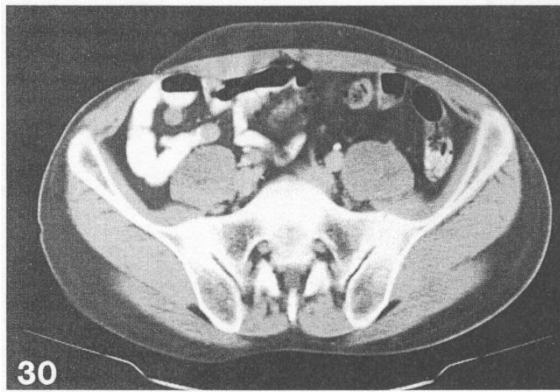
1. What lab values are abnormal? What does this indicate?

Part 3:

CT scan images were taken and found to be abnormal, showing the following results:



Below are normal CT scans of the same anatomical area.



Determine the anatomical area scanned in the above images. Compare the normal scan to the abnormal scan of the patient, note any differences that you can see between the normal scan and the scan of the patient.

With the information provided, try to diagnose the patient above. Please provide information on those gastrointestinal disorders that you will rule out and for what reason.

The following are the different possibilities:

- 1) GERD(w/Barrett's)
- 2) Gastritis
- 3) Crohn's Disease
- 4) Peptic Ulcer Disease
- 5) Diverticulitis

Photos courtesy of Siemens, Fleckenstein, & Madden

Appendix 3

Lesson Study Observation Sheets- GI Disorders

Goal or Outcome	Behavior Indicators or Evidence of Goal
Engagement	Expressions of curiosity or interest Requests to know more about the subject Continues effort in face of difficulty
Understanding	Makes appropriate connections between new ideas Quality of students' explanations of a concept
Skilled Action	The quality of collaboration exhibited by students
Critical Reflection	Reflective comments made in group discussion Makes metacognitive statements (wanting more information, commenting on how things do not fit together, gathering more information before making conclusions)

Comments:

## Appendix 4

NAME: \_\_\_\_\_

### Post- Case Study Assessment- GI Disorders 10 Questions

1. The reason why peptic ulcer disease is such a problem is because it can result in so many complications that;
  - A. Have a lot of symptoms that are difficult to treat
  - B. Can be fatal
  - C. Can cause cancer
  - D. Cause infection
  
2. Chronic pain, burning of the upper abdomen and general discomfort, usually after a meal are symptoms of;
  - A. Esophageal varices
  - B. Esophageal diverticulum
  - C. GERD
  - D. Crohn's Disease
  
3. What can involve any of the GI tract?
  - A. Peptic Ulcer Disease
  - B. Crohn's Disease
  - C. Diverticulosis
  - D. Chronic Ulcerative Colitis
  
4. What can result in toxic megacolon?
  - A. Peptic Ulcer Disease
  - B. Crohn's Disease
  - C. Diverticulosis
  - D. Chronic Ulcerative Colitis
  
5. Diverticulosis is when a diverticuli becomes inflamed;
  - A. True
  - B. False
  
6. Which of the following is a condition almost always involving the sigmoid?
  - A. Peptic Ulcer Disease
  - B. Crohn's disease
  - C. Barrett's esophagitis
  - D. Diverticulosis
  
7. Which of the following is a condition involving the stomach?
  - A. Peptic Ulcer Disease
  - B. Crohn's disease
  - C. Barrett's esophagitis
  - D. Diverticulosis

8. Barrett metaplasia is a pathology of which one of the following?
- A. Stomach
  - B. Small bowel
  - C. Esophagus
  - D. Colon
9. Why may a fistula form with Crohn's disease?
- A. lack of peristalsis leading to dilated areas of intestine
  - B. fibrosis and thickening of the wall causing obstruction
  - C. erosion of the mucosa causing bleeding
  - D. recurrent inflammation, necrosis and fibrosis forming a connection between intestinal loops
10. What pain is typical of diverticulitis?
- A. lower left quadrant
  - B. lower right quadrant
  - C. sharp, around the umbilicus
  - D. lower abdominal pain radiating into the groin

Appendix 5

Name:

Date:

How much did you

- learn from the group discussion A. a lot B. a little C. nothing  
participate in the discussion A. a lot B. a little C. not at all  
enjoy the discussion A. a lot B. a little C. not at all

How effective was the group in allocating time and getting work accomplished:

- A. very B. somewhat C. barely D. not at all

Incidence of Productive and Counterproductive Discussion Behavior- Check any you engaged in and circle any you observed in others.

- |   |   |
|---|---|
| <input type="checkbox"/> asked, gave information                      | <input type="checkbox"/> monopolized discussion         |
| <input type="checkbox"/> asked, gave reactions                        | <input type="checkbox"/> called attention to self       |
| <input type="checkbox"/> asked, answered questions                    | <input type="checkbox"/> chronic interruptions          |
| <input type="checkbox"/> restated ideas/points in articles            | <input type="checkbox"/> criticized others (put down)   |
| <input type="checkbox"/> restated ideas/points of discussants         | <input type="checkbox"/> changed subject often          |
| <input type="checkbox"/> asked for/gave examples                      | <input type="checkbox"/> frequent irrelevant comments   |
| <input type="checkbox"/> asked for/gave summary                       | <input type="checkbox"/> withdrawn, did not participate |
| <input type="checkbox"/> asked for/gave evidence or support for ideas | <input type="checkbox"/> apologetic                     |
| <input type="checkbox"/> redirected group to return to task           | <input type="checkbox"/> OTHER-please specify:          |
| <input type="checkbox"/> monitored time                               |   |
| <input type="checkbox"/> encouraged, supported other ideas            |   |
| <input type="checkbox"/> elaborated on others' ideas                  |   |
| <input type="checkbox"/> OTHER-please specify                         |   |

As a learning experience I would evaluate the discussion as

- A. poor B. fair C. average D. good E. excellent

Give reasons for your rating. Be specific, give examples.

What, if any, aspects of your own behavior do you need to change to be a more effective group member?

What, if any, aspects of other group members' behavior need to change to enhance the group's learning?

What, if anything, did the instructor do that facilitated effective, whole-class discussion?

What, if anything, did the instructor do that inhibited effective, whole-class discussion?

What, if anything, should the instructor do or not do that would improve the quality of whole-class discussion?