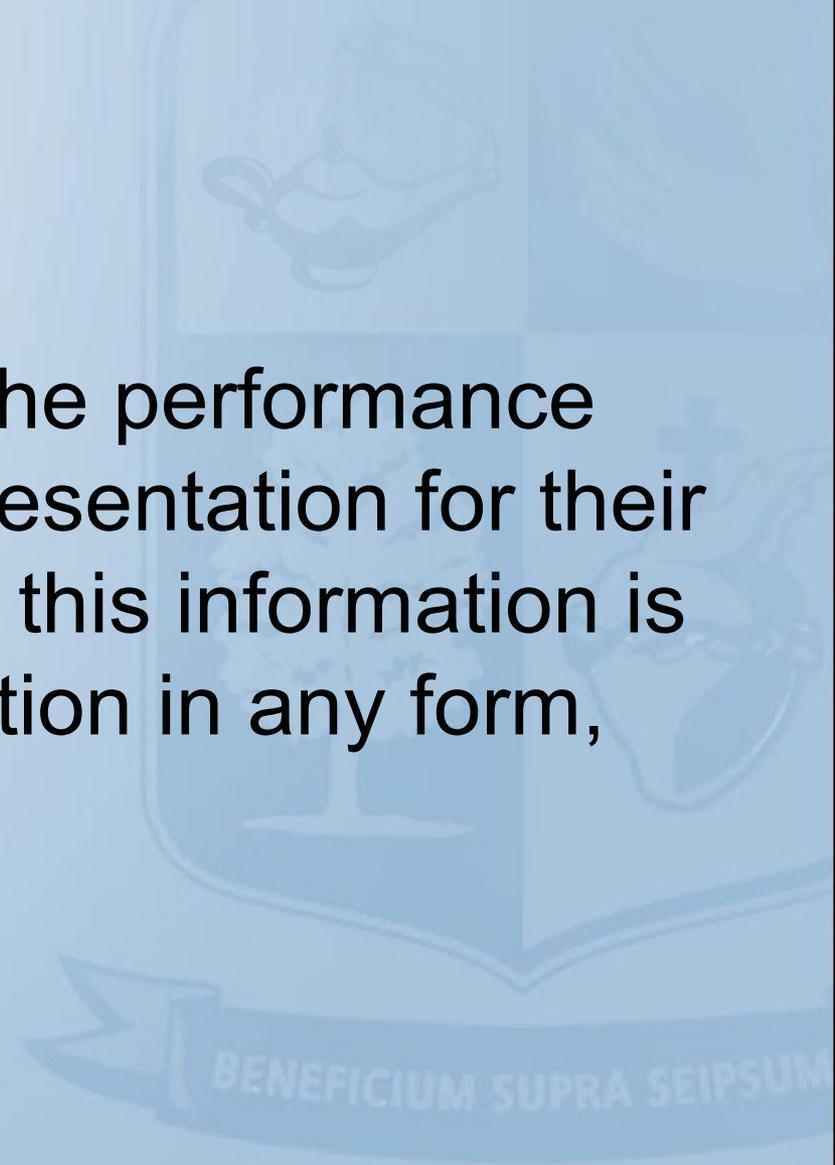


CI 30 - Using Performance-Based Assessments to Promote Critical Thinking in First-Year Students

Kimberly L. Boyd, Ph.D.

Associate Professor of Biology and
Coordinator of First-Year Advising

- Faculty are free to use the performance task described in this presentation for their own classroom use, but this information is not for public dissemination in any form, including the web.



- This roundtable will discuss the use of performance-based assessment tools at individual course, program, and institutional levels. Discussions will revolve around current research in the benefits and limitations of performance-based assessments, training faculty to design appropriate assessment tasks for their courses, and using such tasks as part of integrated general education curriculum initiatives or in conjunction with institution-wide assessments of student learning (i.e., NSSE, CLA).

Presentation Summary

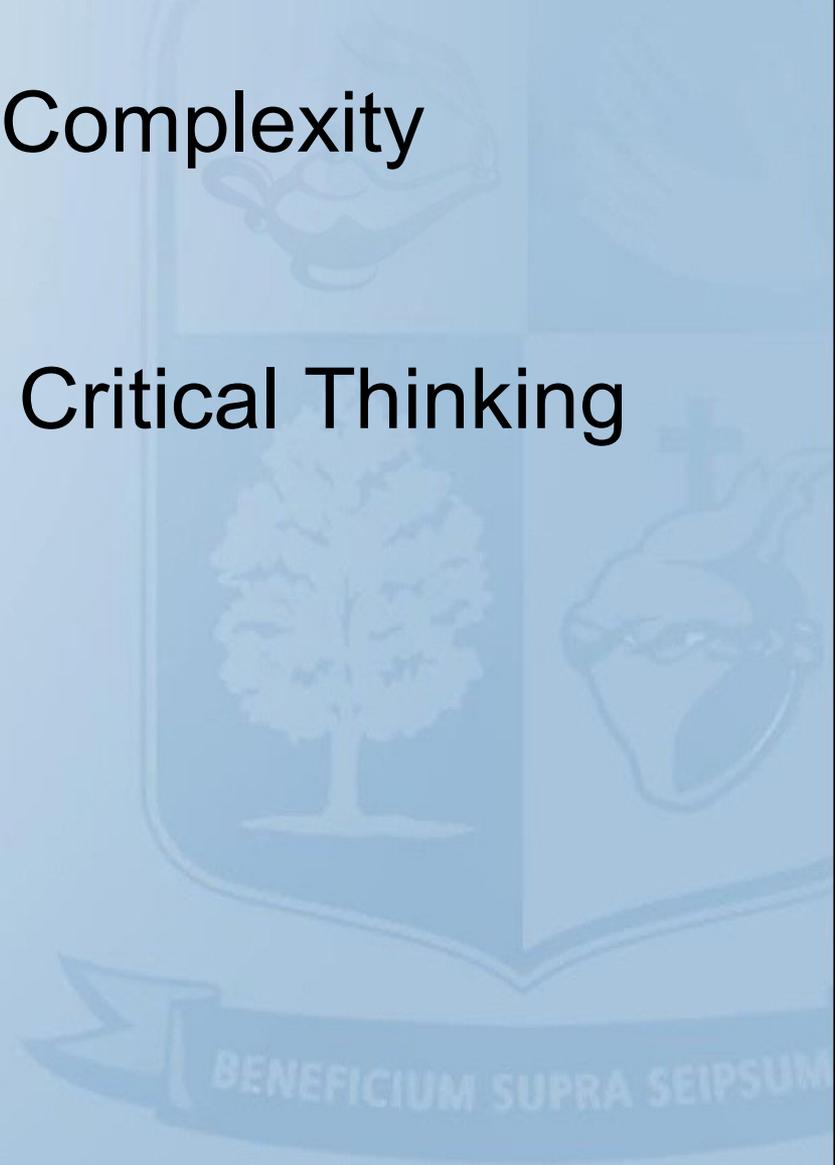
1. What do we really want our students to know and do when they leave college?
2. What is performance-based assessment?
3. Using performance tasks for course-embedded assessment.
 - A specific example
 - Research on critical thinking development in freshman.
4. Beyond coursework – Performance tasks for program and institution-wide assessment.

1. What do we really want our students to know and do when they leave college?

- Cabrini College's QLEP's – Qualities of a Liberally Educated Person
 - Cognitive Complexity
 - Effective Communication
 - Understanding of Self and Beliefs as a Global Citizen
 - Propensity for Engaging in Life-Long Learning
 - Responsibility for Social Justice
 - Expertise in a Specific Area

Cognitive Complexity

- Analytic Reasoning and Critical Thinking
- Creative Thinking
- Scientific Reasoning
- Quantitative Reasoning



Critical Thinking

- Possible Indicators
 - Student gathers and **assesses relevant information** to understand and evaluate a position besides his or her own.
 - Student clearly and precisely **formulates questions** about his or her own or another's position.
 - Student **understands the underlying assumptions** behind his or her own or another's position.
 - Student **contextualizes a position** historically and culturally.
 - Student **tests** his or her own or another's **conclusions** against relevant criteria and standards.
 - Student **understands the implications and consequences** of his or her own or another's position.

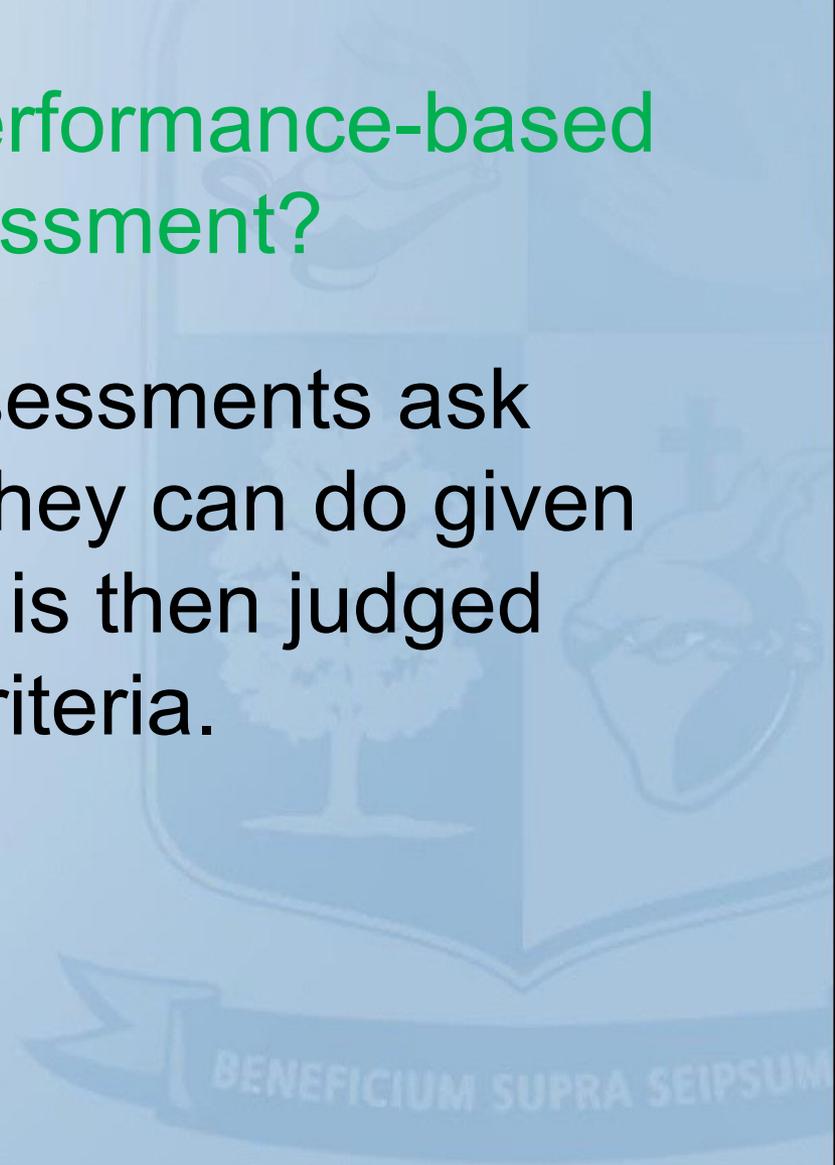
When do we introduce this to students?

- We expect these skills to be fully developed by the time students graduate.
-But when do we begin to develop these skills?

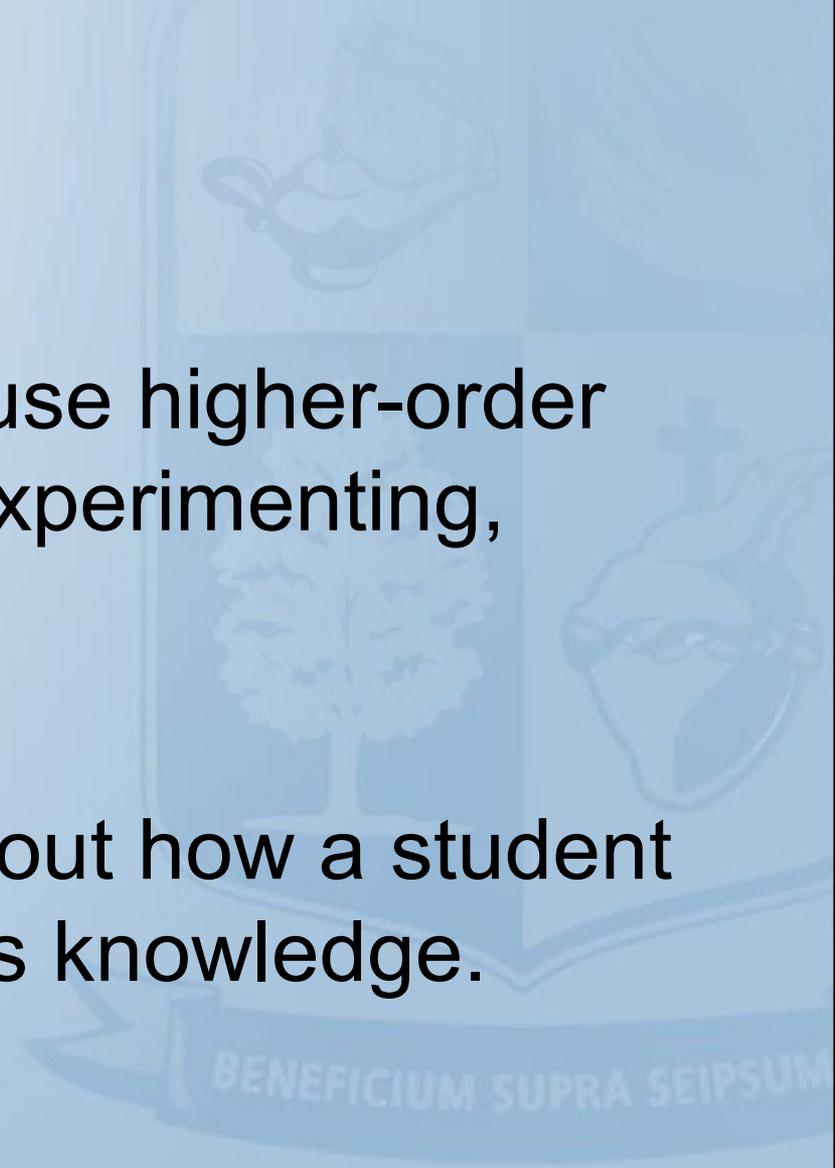
**→ THE MINUTE STUDENTS
WALK IN THE DOOR**

2. What is performance-based assessment?

- Performance-based assessments ask students to show what they can do given an authentic **task** which is then judged using a specific set of criteria.

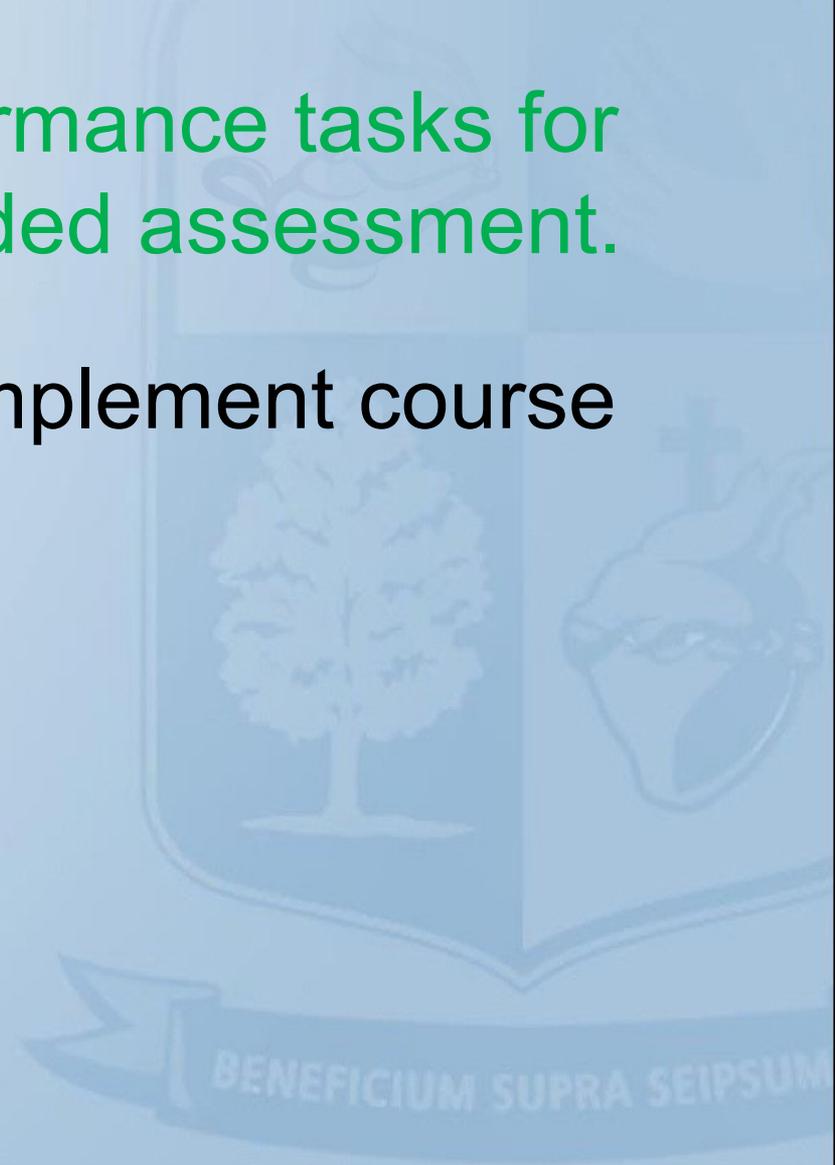


- Calls for the student to use higher-order thinking skills such as experimenting, analyzing or reasoning.
- Provides information about how a student understands and applies knowledge.



3. Using performance tasks for course-embedded assessment.

- Developing tasks to complement course learning outcomes

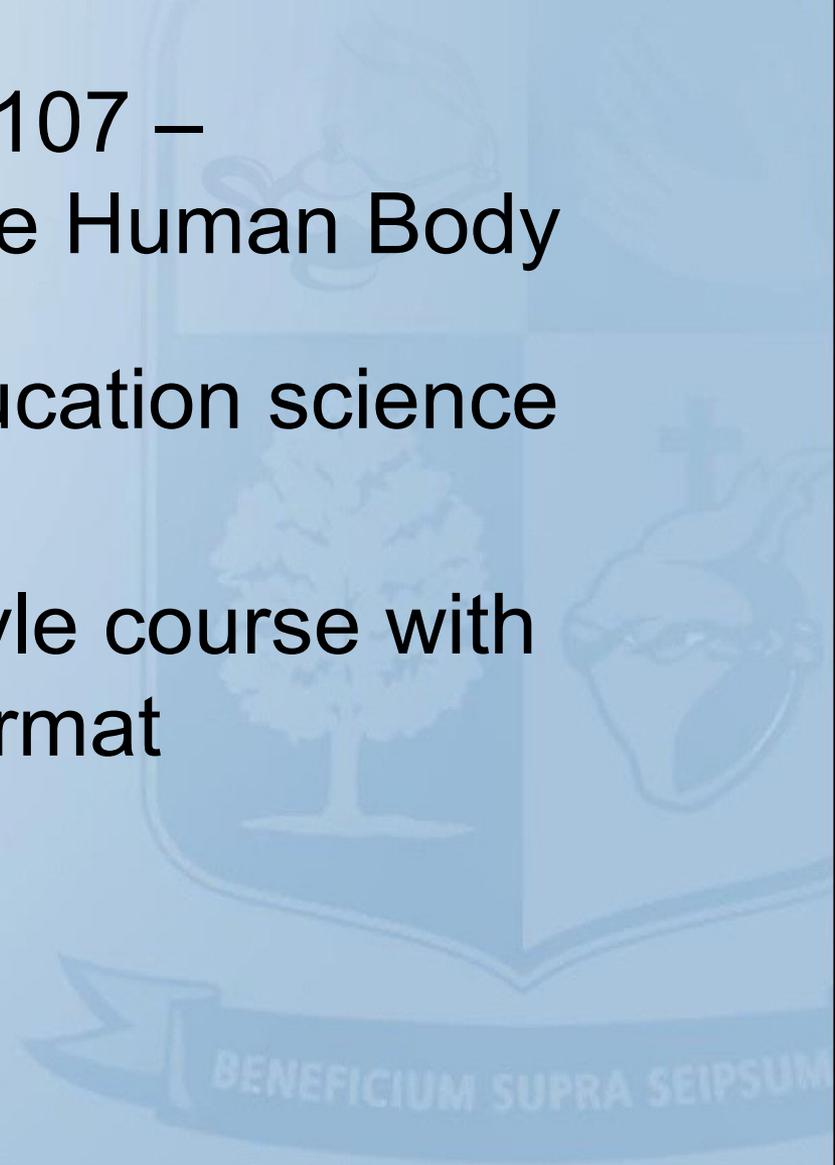


- Using the CLA Performance Task model

**collegiate
learning
assessment**

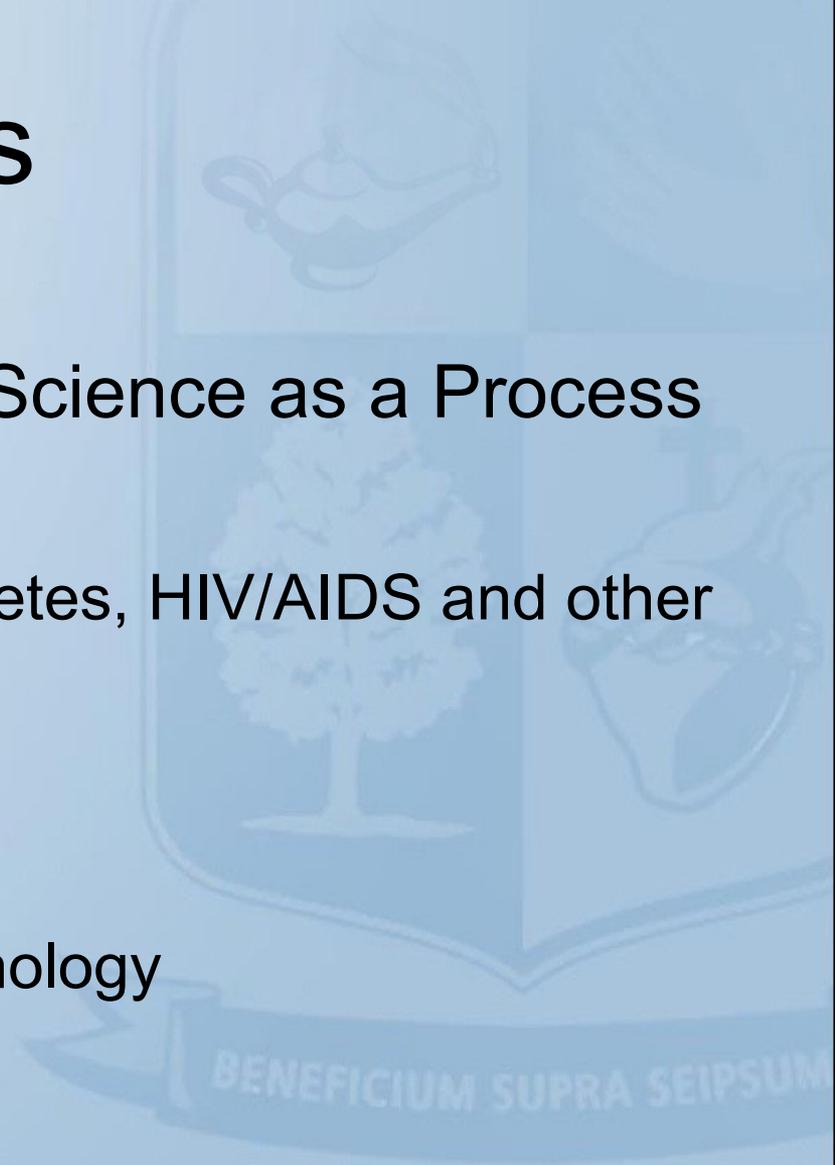
BIO 107 – Health and the Human Body

- Non-majors general education science course
- 3 credits – workshop style course with integrated lecture/lab format

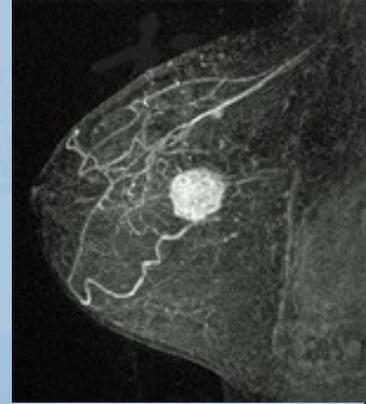


Topics

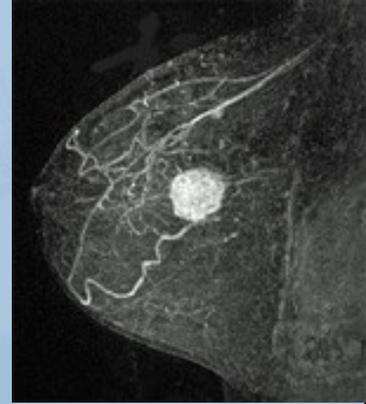
- The Scientific Method and Science as a Process
- Mechanisms of Disease
 - Heart Disease, Cancer, Diabetes, HIV/AIDS and other infections
- Fighting Disease
 - Our Immune System
 - Drug Discovery and Biotechnology
- Health Care in the U.S.



Cancer Performance Task



- You have just learned a good friend, Beth, has been diagnosed with Stage III metastatic breast cancer. Although her disease is at an advanced stage, her doctor thinks she will be a good candidate for chemotherapy and has a reasonable chance for survival. Dr. Brown, who is on staff at Bryn Mawr Hospital, has suggested treatment with the drug doxorubicin (Trade Name: Rubex®).



- Her family suggested she seek a second opinion and she met with Dr. Jones, an oncologist at Memorial Sloan-Kettering Cancer Center, one of the most respected cancer research hospitals in the world. While the diagnosis was identical, Dr. Jones suggested she first try treatment with the drug paclitaxel (Trade Name: Onxol®).

- Knowing that you're enrolled in a biology class in college, Beth has asked you to help her understand what cancer really is, what her treatment options are, and which of the two drugs you would recommend. She started some of her own research and provides you with documents to assist in your work.

- Specifically, respond to the following questions. Your answers should be in the form of an essay and factual evidence, from the provided documents or your own research, should support your position when appropriate. Please remember to cite sources using MLA format.

Sample documents



General Information

- **Document A:** Breast Cancer Information Sheet for Patients (National Cancer Institute)
 - Breast cancer is a disease in which malignant cells form in the tissues of the breast.
 - The **breast** is made up of **lobes** and **ducts**. Each breast has 15 to 20 sections called lobes, which have many smaller sections called **lobules**. Lobules end in dozens of tiny bulbs that can produce milk. The lobes, lobules, and bulbs are linked by thin tubes called ducts.
 - Each breast also has **blood vessels** and **lymph vessels**. The lymph vessels carry an almost colorless **fluid** called **lymph**. Lymph vessels lead to **organs** called **lymph nodes**. Lymph nodes are small bean-shaped structures that are found throughout the body. They filter substances in a fluid called lymph and help fight **infection** and disease. Clusters of lymph nodes are found near the breast in the **axilla** (under the arm), above the collarbone, and in the chest.
 -

■ Document A: Breast Cancer Information Sheet for Patients (National Cancer Institute)

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- Anatomy of the breast, showing lymph nodes and lymph vessels.
- Each breast also has **axillary lymph nodes** and **lymph vessels**. The lymph vessels carry an almost colorless **fluid** called **lymph**. Lymph vessels lead to **organs** called **lymph nodes**. Lymph nodes are small bean-shaped structures that are found throughout the body. They filter substances in a fluid called lymph and help fight **infection** and disease. Clusters of lymph nodes are found near the breast in the **axilla** (under the arm), above the collarbone, and in the chest.
- The most common type of **breast cancer** is **ductal carcinoma**, which begins in the **cells** of the ducts. Cancer that begins in the lobes or lobules is called **lobular carcinoma** and is more often found in both breasts than are other types of breast cancer. **Inflammatory breast cancer** is an uncommon type of breast cancer in which the breast is warm, red, and swollen.
- Age and health history can affect the risk of developing breast cancer.
- Anything that increases your chance of getting a disease is called a **risk factor**. Risk factors for breast cancer include the following:
 - Older age.
 - **Menstruating** at an early age.
 - Older age at first birth or never having given birth.
 - A personal history of breast cancer or **benign** breast disease.
 - A mother or sister with breast cancer.
 - Treatment with **radiation therapy** to the breast/chest.
 - Breast **tissue** that is dense on a **mammogram**.
 - Taking **hormones** such as **estrogen** and **progesterone**.
 - Drinking alcoholic beverages.
 - Being white.
- Breast cancer is sometimes caused by inherited gene mutations.
- The **genes** in cells carry the **hereditary** information that is received from a person's parents. Hereditary breast cancer makes up approximately 5% to 10% of all breast cancer. Some altered genes related to breast cancer are more common in certain ethnic groups.
- Women who have an altered gene related to breast cancer and who have had breast cancer in one breast have an increased risk of developing breast cancer in the other breast. These women also have an increased risk of developing **ovarian** cancer, and may have an increased risk of developing other cancers. Men who have an altered gene related to breast cancer also have an increased risk of developing this disease. For more information, see the PDQ summary on [Male Breast Cancer Treatment](#).
- Tests have been developed that can detect altered genes. These **genetic tests** are sometimes done for members of families with a high risk of cancer.
- Tests that examine the breasts are used to detect and diagnose breast cancer.
- A doctor should be seen if changes in the breast are noticed. The following tests and procedures may be used:
 - **Mammogram**: An **x-ray** of the breast.
 - Mammography of the right breast.
 - **Biopsy**: The removal of cells or tissues so they can be viewed under a microscope by a **pathologist** to check for signs of cancer. If a lump in the breast is found, the doctor may need to remove a small piece of the lump. Four types of biopsies are as follows:
 - **Excisional biopsy**: The removal of an entire lump of tissue.
 - **Incisional biopsy**: The removal of part of a lump or a sample of tissue.
 - **Core biopsy**: The removal of tissue using a wide needle.
 - **Fine-needle aspiration (FNA) biopsy**: The removal of tissue or fluid, using a thin needle.
- **Estrogen and progesterone receptor test**: A test to measure the amount of **estrogen** and **progesterone** (hormones) receptors in cancer tissue. If cancer is found in the breast, tissue from the **tumor** is checked in the laboratory to find out whether estrogen and progesterone could affect the way cancer grows. The test results show whether **hormone therapy** may stop the cancer from growing.
- **MRI** (magnetic resonance imaging): A procedure that uses a magnet, radio waves, and a computer to make a series of detailed pictures of areas inside the body. This procedure is also called nuclear magnetic resonance imaging (NMRI).
- Certain factors affect prognosis and treatment options.
- The **prognosis** and treatment options depend on the following:
 - The **stage** of the cancer (the size of the tumor and whether it is in the breast only or has spread to lymph nodes or other places in the body).
 - The type of breast cancer.
 - Estrogen-receptor and progesterone-receptor levels in the tumor tissue.
 - Whether the cells have high levels of **human epidermal growth factor type 2 receptors** (HER2/neu).
 - How fast the tumor is growing.
 - A woman's age, general health, and menopausal status.
 - Whether the cancer has just been diagnosed or has recurred.

- **Document B: Breast Cancer Stages (MayoClinic.com)**

- **Staging classification**

The most common staging method, called the TNM staging system, includes three key components:

- **Tumor (T).** How big is the tumor, and has it spread to the skin or chest wall muscle? Tumor size is one of the most important predictors of how a cancer will behave.
- **Node (N).** Have cancer cells spread to nearby lymph nodes? Doctors count how many lymph nodes under the arm (axillary lymph nodes) test positive for cancer, because their status strongly relates to prognosis. Breast cancers may be described as "node positive" or "node negative."
- **Metastasis (M).** Has the cancer spread to other, distant areas of the body?
- The number assignments in these categories indicate the degree of tumor growth or spread. For example, N0 means no axillary lymph nodes are affected, while N1 means 1 to 3 nodes are positive and N2 means 4 to 9 positive nodes.

• Document B: Breast Cancer Stages (MayoClinic.com)

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• **Breast cancer stages**

Once the surgery is completed, your doctor can determine the stage of your cancer. Breast cancer stages range from 0 to IV, with many subcategories. Lower numbers indicate earlier stages of cancer, while higher numbers reflect a late-stage cancer.

• **Stage 0**

This stage describes noninvasive (in situ) breast cancer. It hasn't spread within the breast or to other parts of the body. Ductal carcinoma in situ (DCIS) is an example of stage 0 cancer.

• **Stage I**

This stage is an early stage of invasive breast cancer in which:

- The tumor measures no more than 2 centimeters (cm) in diameter (3/4 inch)
- No lymph nodes are involved — the cancer hasn't spread outside the breast

• **Stage II**

This stage, subdivided into IIA and IIB, describes invasive breast cancers in which one of the following is true:

- The tumor measures less than 2 cm but has spread to lymph nodes under the arm
- No tumor is found in the breast but cancer is found in the axillary lymph nodes
- The tumor is between 2 cm and 5 cm (about 1 to 2 inches) and may have spread to lymph nodes under the arm
- The tumor is larger than 5 cm but hasn't spread to any lymph nodes

• **Stage III**

Stage III breast cancers are subdivided into three categories — IIIA, IIIB and IIIC — based on a number of different criteria. By definition, stage III cancers haven't spread (metastasized) to distant sites.

- For example, a stage IIIA tumor is larger than 5 cm and has spread to one to three lymph nodes under the arm. Other stage IIIA tumors may be any size and have spread into multiple lymph nodes. The lymph nodes clump together and attach to one another or to the surrounding tissue.
- In stage IIIB breast cancer, a tumor of any size has spread to tissues near the breast — the skin and chest muscles — and may have spread to lymph nodes within the breast or under the arm. Stage IIIB also includes inflammatory breast cancer, an uncommon but aggressive type of breast cancer.
- Stage IIIC cancer is a tumor of any size that has spread:
 - To 10 or more lymph nodes under the arm
 - To lymph nodes above or beneath the collarbone and near the neck
 - To lymph nodes within the breast itself and to lymph nodes under the arm

• **Stage IV**

Stage IV breast cancer has spread to other, distant parts of the body, such as the lungs, liver, bones or brain.

Business Brief

Document C: Business Brief from IVAX Diagnostics



- *IVAX Diagnostics, Inc. is pleased to announce its partnership with Memorial Sloan-Kettering Cancer Center, New York in the continued clinical trials of its' drug ONXOL for the treatment of advanced ovarian and breast cancer. Emily Jones, M.D., Ph.D., has been awarded a \$4.5 million dollar grant to continue her studies on the long term uses of the drug and side effect management in metastasized cancers of the female reproductive system.*

Document C: Business Brief from IVAX Diagnostics

- *Ivax Diagnostics, Inc., is a global pharmaceutical company specializing in the development, production and marketing of generic and proprietary branded pharmaceuticals as well as active pharmaceutical ingredients. IVAX and Teva Pharmaceuticals, its' parent company, are among the top 20 pharmaceutical companies and among the largest generic pharmaceutical companies in the world.*

Newspaper Article

Document D: Newspaper Article



- **Ming-Na prescribes breast cancer awareness**
- By John Morgan, Spotlight Health, with medical adviser
- Stephen A. Shoop, M.D. 2004
- Content modified by K. Boyd 2007



On the hit NBC series *ER*, complete strangers rely on actress Ming-Na's medical expertise to save their lives. But Ming-Na never imagined that a real health crisis – breast cancer – would strike so close to home.

"Vivian is one of my closest friends and godmother to my daughter," says Ming-Na, who has played Dr. Jing-Mei Chen since *ER*'s sixth season. "When she told me she had breast cancer I was in shock because she's young, and she had no family history of the disease."

Once her friend was diagnosed, Ming-Na says she immediately educated herself about breast cancer and discovered that the majority of women who get breast cancer have no family history of the disease. The American Cancer Society reports that a woman's lifetime risk for breast cancer is now one in seven.

Betting on breast cancer odds is not something Ming-Na recommends. Instead, the actress, who won the World Poker Tour: Hollywood Home Game tournament for the Susan G. Komen Breast Cancer Foundation, says she hedges her bet by performing regular breast self-examinations.

"The self check is particularly helpful in saving breasts and finding tumors that are mammographically invisible, which are about 10%-12% of breast cancers," says William Wood, a surgical oncologist and chairman, department of surgery, Emory University in Atlanta. "Self checks help find them early when they are more easily treated and the breast-sparing surgery can be applied."

"Breast-sparing is now available for almost everyone,". "Initially if women have a tumor that is too big relative to the size of their breast for lumpectomy, we now give them chemotherapy first since they would be getting it anyway. About 80% or more patients will have sufficient reduction in size of the tumor that afterwards they can have breast-sparing surgery rather than mastectomy."

Wood stresses that chemotherapy has a very important role in the fight against breast cancer. While there is roughly a 50% annual reduction in risk of recurrence after treatment with tamoxifen, when the latest chemotherapy regimens, **including Onxol**, are added to treatment there is an additional 40% reduction of residual annual risk.

“Vivian responded really well to **Onxol** chemotherapy treatments”, says Ming-Na. “While she suffered from the standard side effects many chemotherapeutic agents cause, Vivian felt good and could carry out her normal daily activities with little interruption. **Vivian said Onxol saved her life.**”

Research Data – Table Form

Document E: Research Data

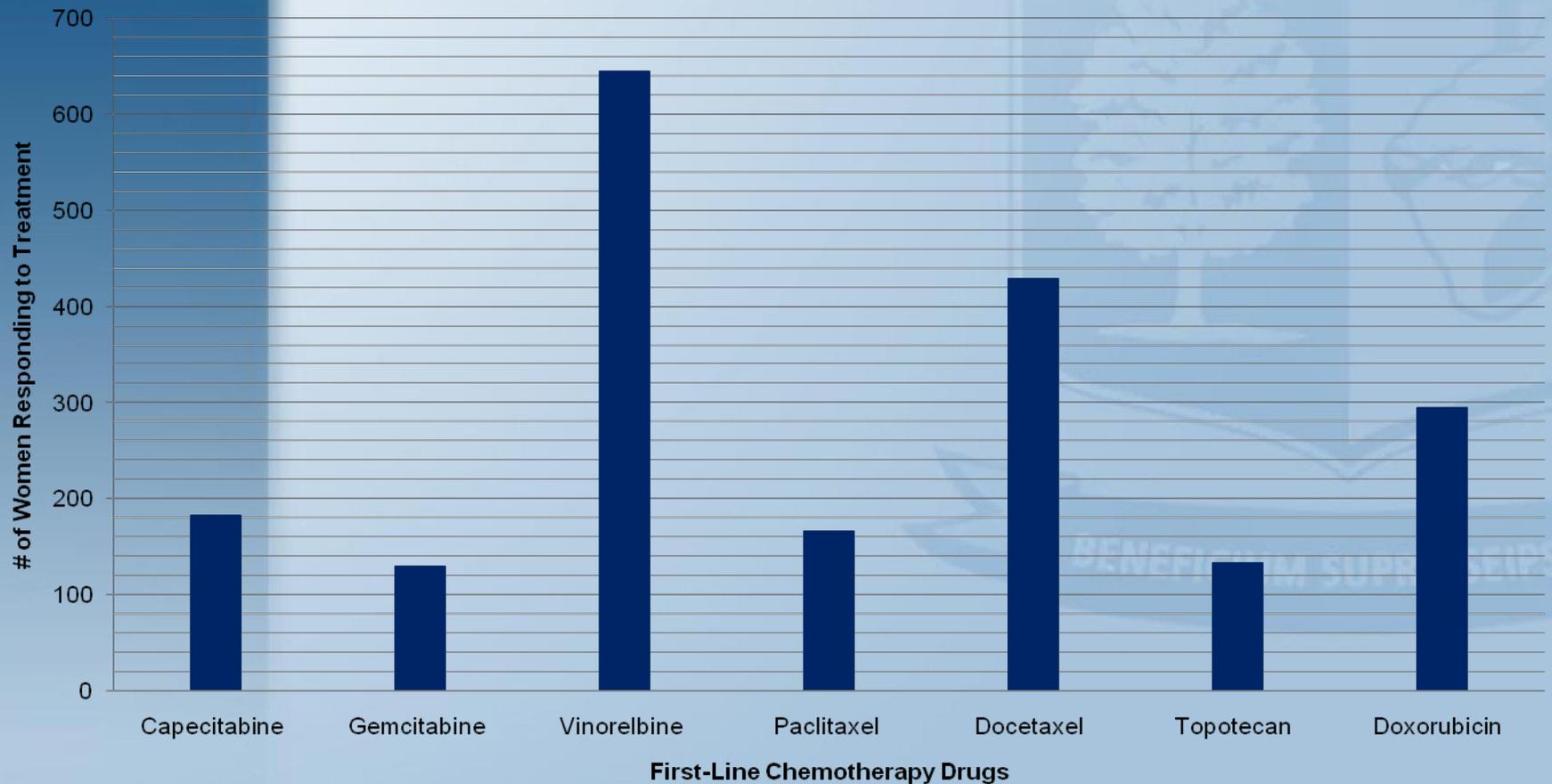
Clinical Trials of First-Line Chemotherapy for Advanced Breast Cancer (Stages IIIC and IV)

(Select data taken from O'Shaughnessy, Ann Oncol, 2001, Other Fictitious)

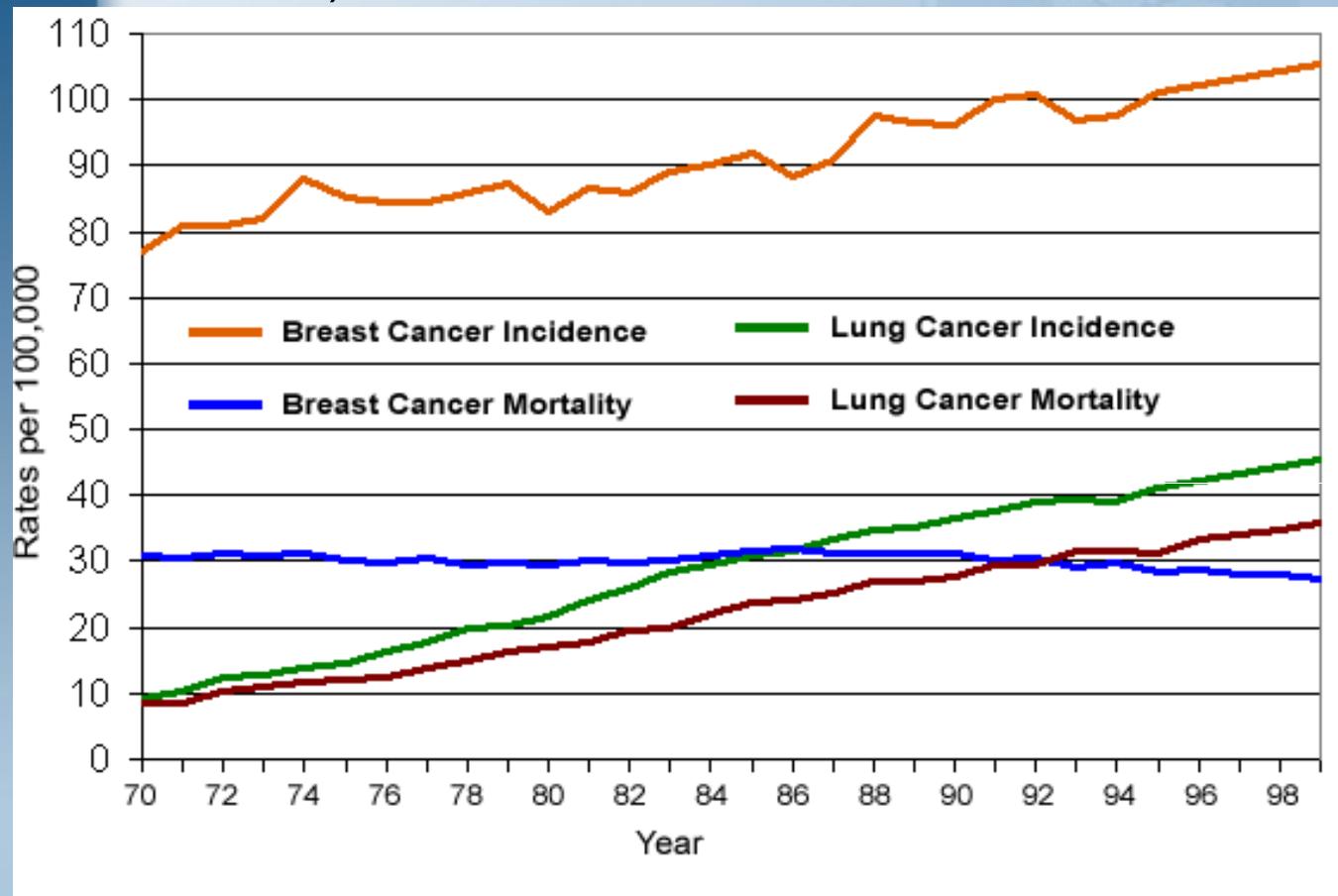
<u>Agent</u>	<u># Patients</u>	<u>Women responding to treatment</u> (#)	<u>Average life span from time of initial treatment</u> (months)	<u>Response Rate</u> (%)
Capecitabine	611	183	12.4	30
Gemcitabine	350	130	20.8	37
Vinorelbine	1260	645	3.5	51
Paclitaxel	387	166	24.0	43
Docetaxel	2258	429	6.8	19
Topotecan	380	133	16.5	35
Doxorubicin	708	295	19.3	41

Research Data – Graphic Form

Document F: Research Data



- **Document G:** Lung and Breast Cancer Statistics (National Cancer Institute of Canada)



Literature Search

Document H: Additional Web Research

Piccart-Gebhart, MJ, et al., *J Clin Oncol.*, 2007 Apr 20,
26(12): 1980-86

Taxane Combinations Marginally Better than Anthracyclines
for Metastatic Breast Cancer

Key Words: Breast cancer, taxanes, anthracyclines.

For Non-majors

Summary

Combined data from eleven clinical trials showed that patients receiving taxanes (paclitaxel or docetaxel) for the treatment of newly diagnosed advanced breast cancer lived about as long as those receiving anthracyclines (epirubicin or doxorubicin). As single-agents, however, the anthracyclines offered better progression-free survival. Combinations based on taxanes provided better response rates and also better progression-free survival than those based on anthracyclines.

For Majors

More Detail

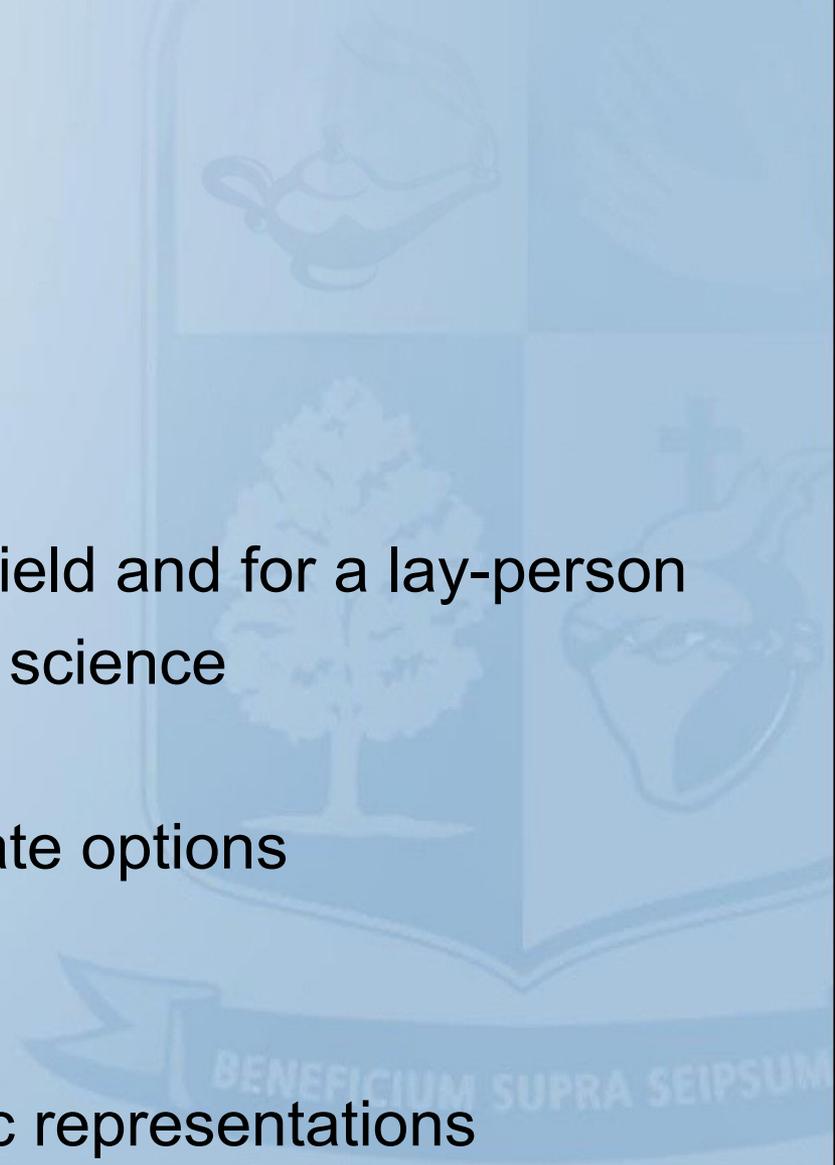
PURPOSE: Taxanes (paclitaxel or docetaxel) have been sequenced or combined with anthracyclines (doxorubicin or epirubicin) for the first-line treatment of advanced breast cancer. This meta-analysis uses data from all relevant trials to detect any advantages of taxanes in terms of tumor response, progression-free survival (PFS), and survival.

PATIENTS AND METHODS: Individual patient data were collected on eight randomized combination trials comparing anthracyclines + taxanes (+ cyclophosphamide in one trial) with anthracyclines + cyclophosphamide (+ fluorouracil in four trials), and on three single-agent trials comparing taxanes with anthracyclines. Combination trials included 3,034 patients; single-agent trials included 919 patients.

RESULTS: Median follow-up of living patients was 43 months, median survival was 19.3 months, and median PFS was 7.1 months. In single-agent trials, response rates were similar in the taxanes (38%) and in the anthracyclines (33%) arms ($P = .08$). The hazard ratios for taxanes compared with anthracyclines were 1.19 (95% CI, 1.04 to 1.36; $P = .011$) for PFS and 1.01 (95% CI, 0.88 to 1.16; $P = .90$) for survival. In combination trials, response rates were 57% (10% complete) in taxane-based combinations and 46% (6% complete) in control arms ($P < .001$). The hazard ratios for taxane-based combinations compared with control arms were 0.92 (95% CI, 0.85 to 0.99; $P = .031$) for PFS and 0.95 (95% CI, 0.88 to 1.03; $P = .24$) for survival.

CONCLUSION: Taxanes were significantly worse than single-agent anthracyclines in terms of PFS, but not in terms of response rates or survival. Taxane-based combinations were significantly better than anthracycline-based combinations in terms of response rates and PFS, but not in terms of survival.

- Documents provide:
 - A realistic scenario
 - Exposure to literature in the field and for a lay-person
 - Usable information, based in science
 - Anecdotal information
 - Information leading to alternate options
 - Unusable information
 - Introduction of bias
 - Quantitative data and graphic representations



Sample Questions



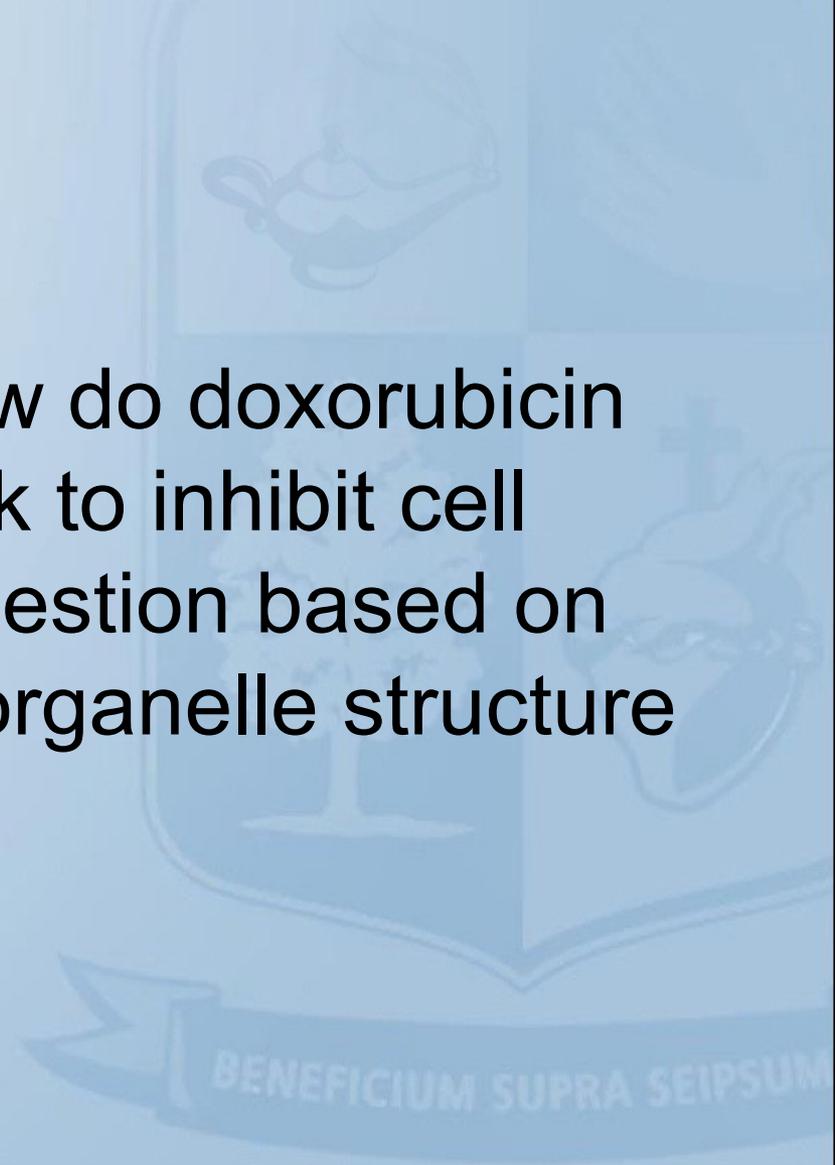
Learning a definition

- 1. Beth tells you that 8 years ago she was diagnosed with a benign breast tumor. While she had it surgically removed, she was stumped by the fact that her doctors weren't more concerned.....after all she had a tumor. Explain to Beth the difference between a benign and a malignant tumor.

Applying lecture material

- 2. Chemotherapy drugs, in general, kill rapidly dividing cells, often indiscriminately, and cause numerous side effects. Beth wants to know why each of these side effects actually occurs. Apply your knowledge of human body function and what cell types divide rapidly, slowly, or not at all, to explain why the following specific side effects occur.
 - A. Anemia and increased risk of infection
 - B. Hair loss
 - C. Nausea, vomiting, diarrhea and weight loss

- 3. More specifically, how do doxorubicin and paclitaxel each work to inhibit cell growth? Answer this question based on your knowledge of cell/organelle structure function.



- 4. Beth's doctors explained because of the number and locations of her tumors that surgery or radiation therapy alone would not be the best treatment. Beth questions why her doctors think chemotherapy is the best treatment option and wants to learn more about other possible cancer treatments. Explain to her how each of the following alternative treatments work at the cellular level. Be as specific as possible in your description. Also, considering the stage of her cancer, can you find any evidence from why her doctors think chemotherapy is a better option?
 - A. Radiation therapy
 - B. Angiogenesis inhibition
 - C. Immunotherapy

Choose an option

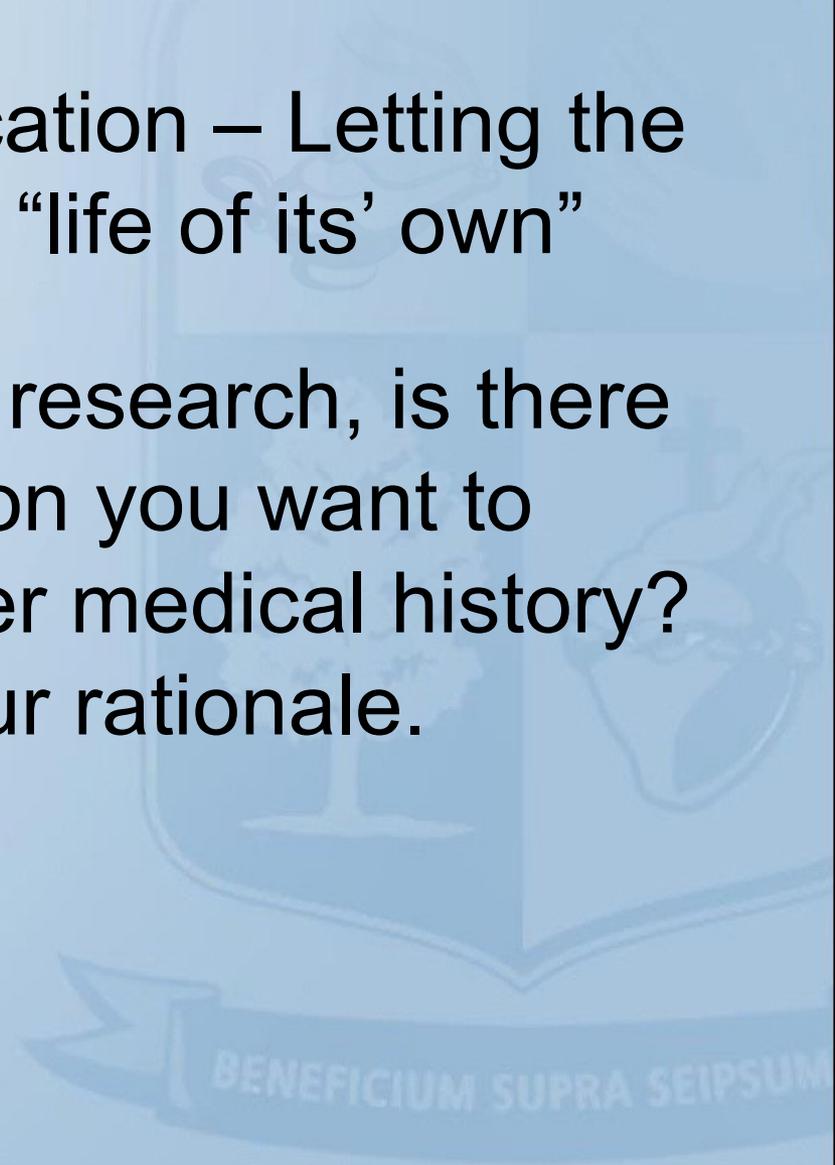
- 5. After your initial findings, Beth has decided to attempt chemotherapy. Based on the documents provided, do you support Dr. Brown's OR Dr. Jones' recommendation for drug treatment? Explain the evidence you have collected that supports your answer both for the drug you choose and against the drug you do not select.

Pushing past the original two choices

- 6. Considering the data collected from O'Shaughnessy et al., Beth wonders if treatment with vinorelbine would actually be better. Based on your analysis, is this better choice? Explain your rationale.

Asking for clarification – Letting the task take on a “life of its’ own”

- 7. As you’ve done your research, is there any additional information you want to know about Beth and her medical history? If so, what? Explain your rationale.

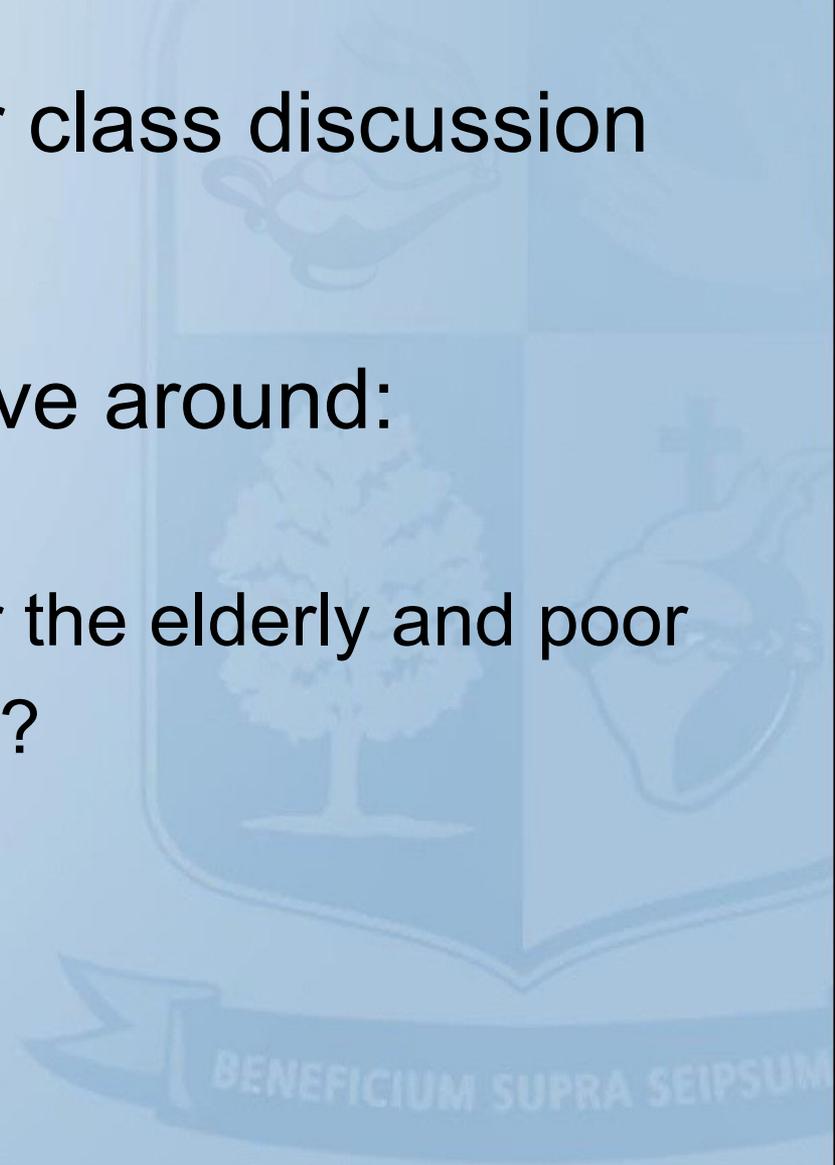


Provide answers ONLY for things they suggest

- For example
 - Family history – Is this breast cancer possibly caused by abnormal oncogene expression? If so, certain types of hormonal therapy or receptor antagonists are more effective treatments.
 - What level of stage III cancer, A, B or C?

Leaving time for class discussion

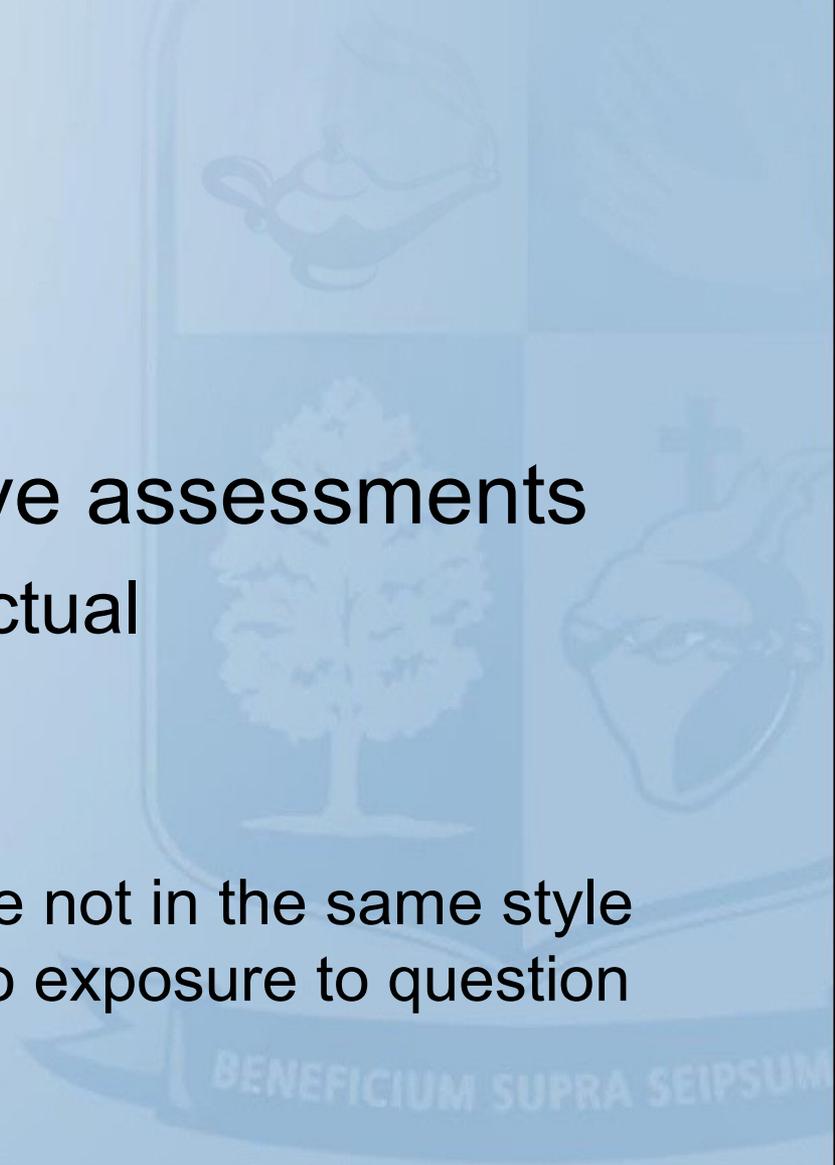
- Student questions revolve around:
 - Other types of cancers
 - Access of health care for the elderly and poor
 - Why drugs cost so much?
 - Etc.



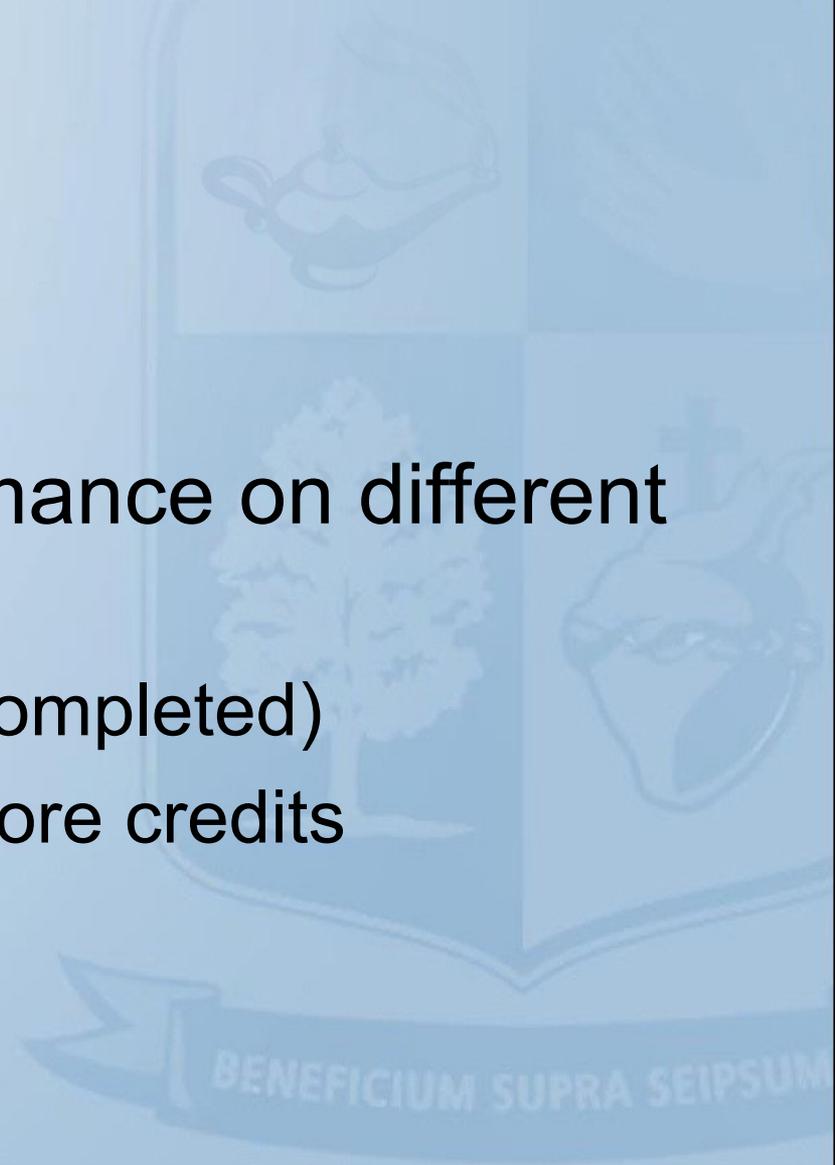
Did introducing performance tasks in the classroom improve students ability to think critically?

- The Experiment
- Teach different sections of BIO 107
 - ½ with traditional lecture/lab pedagogy
 - ½ incorporating multiple performance-based formative assessments
 - Both with same content learning objectives

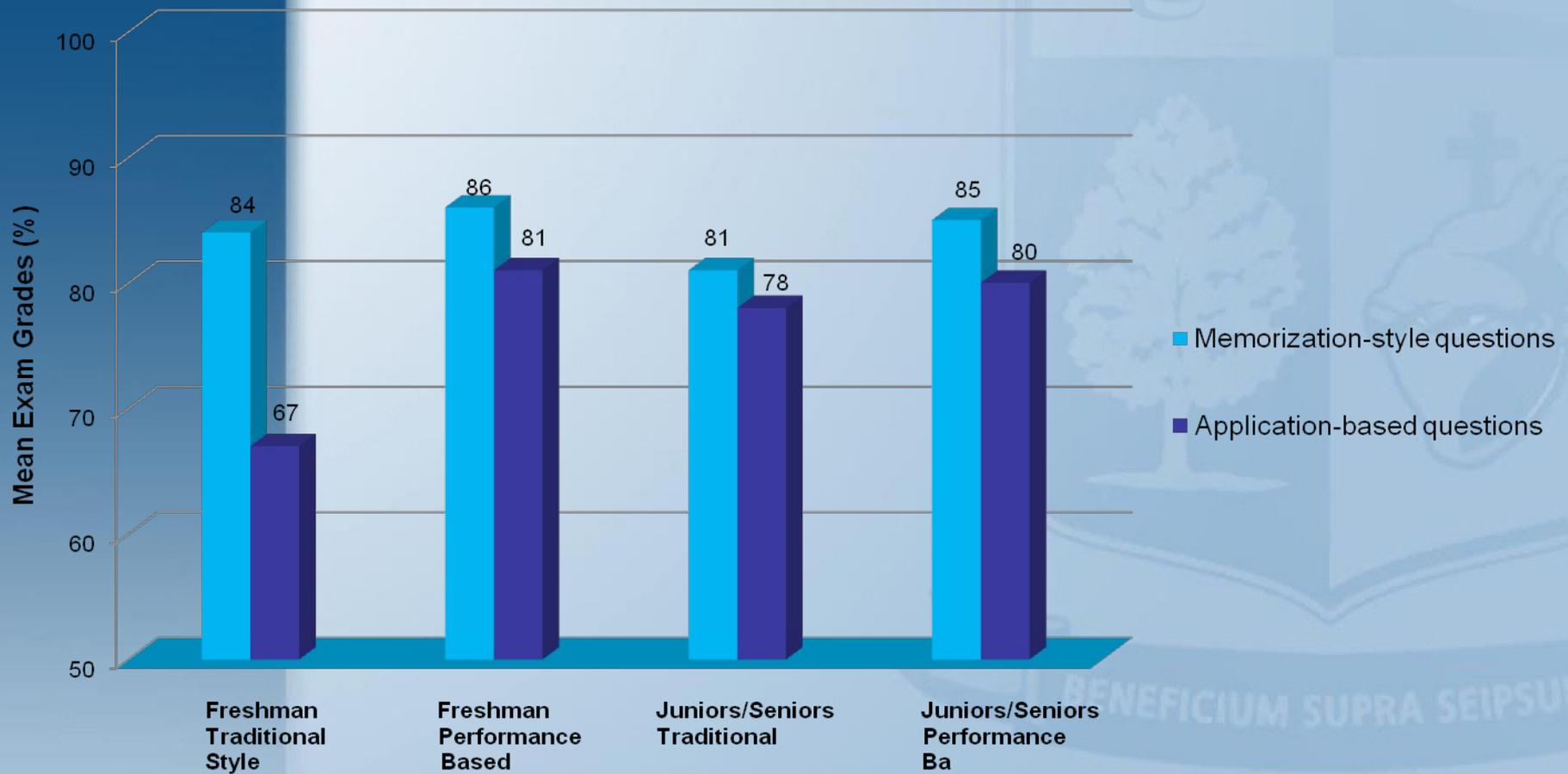
- Use the same summative assessments
 - Some questions were factual recall/memorization
 - Some were application
 - Application questions were not in the same style as performance tasks – so exposure to question style was not an issue



- Compare cohort performance on different style questions
 - Freshman (<30 credits completed)
 - Juniors/Seniors (60 or more credits completed)

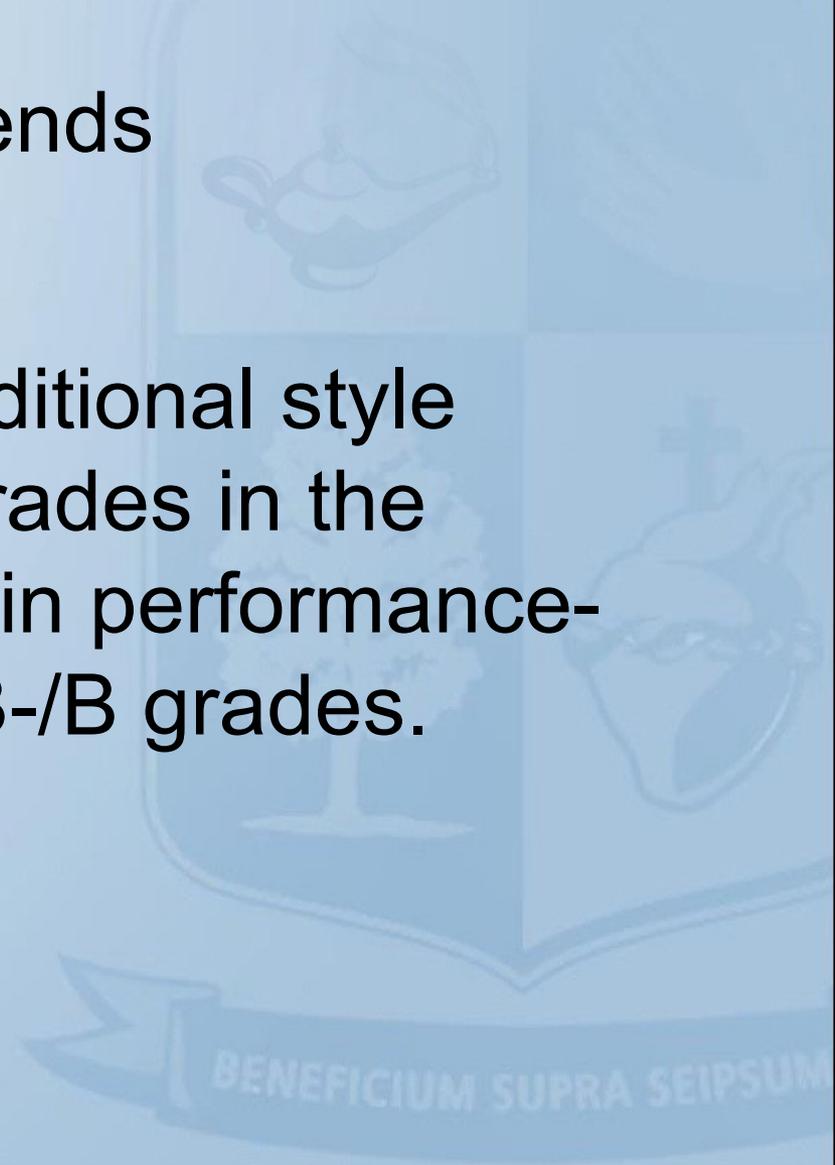


- Relevance of cohort comparison
 - Insignificant differences in mean entering SAT scores
 - All students were enrolled in or had taken College middle-track math courses
 - Only used juniors/seniors who had taken no other science classes
 - Didn't control for student GPA or other prior course selection



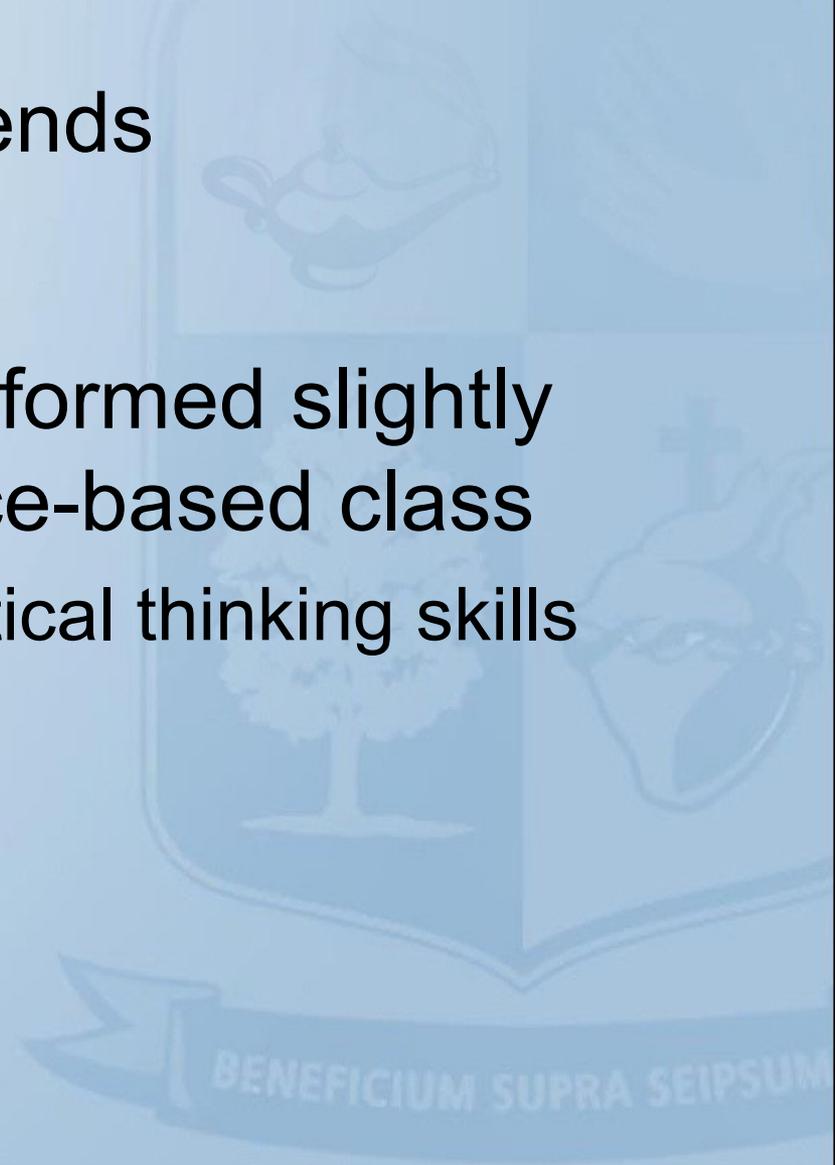
Trends

- Overall, freshman in traditional style courses earned C/C+ grades in the course, while freshman in performance-based classes earned B-/B grades.



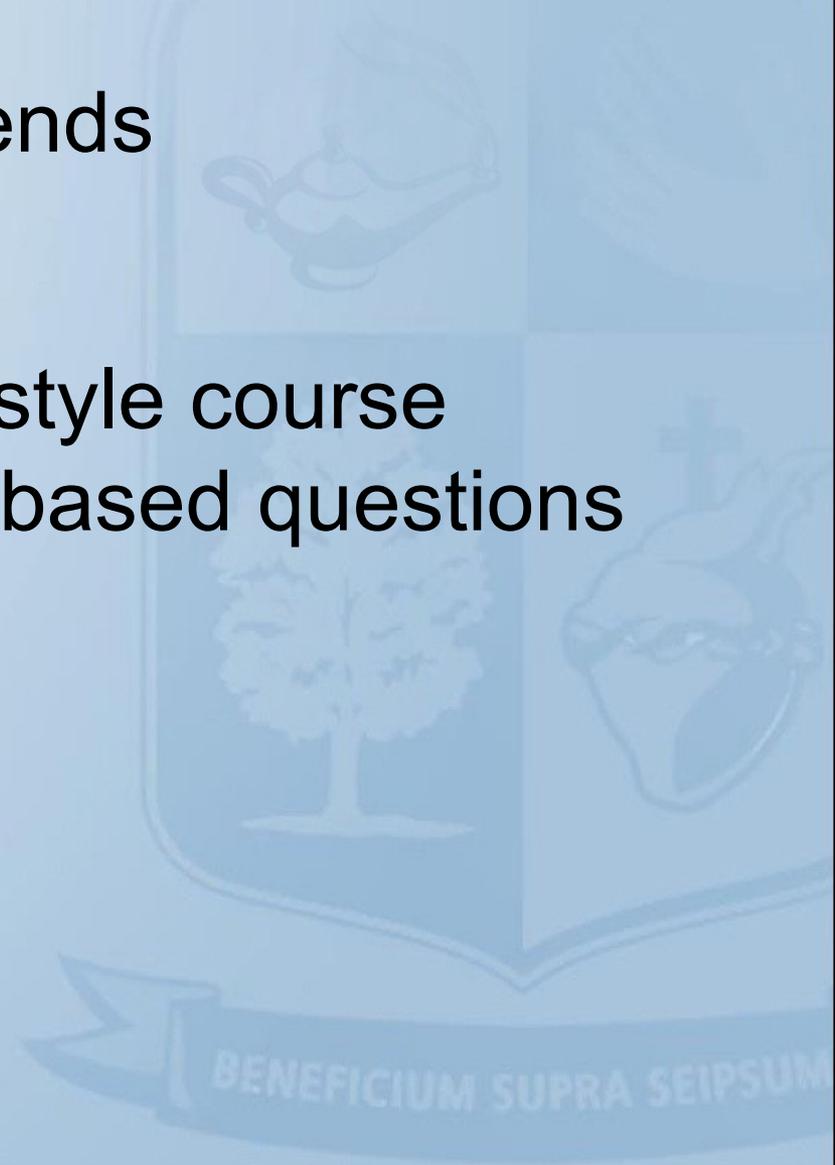
Trends

- Juniors/seniors only performed slightly better in the performance-based class
 - Have they developed critical thinking skills already?



Trends

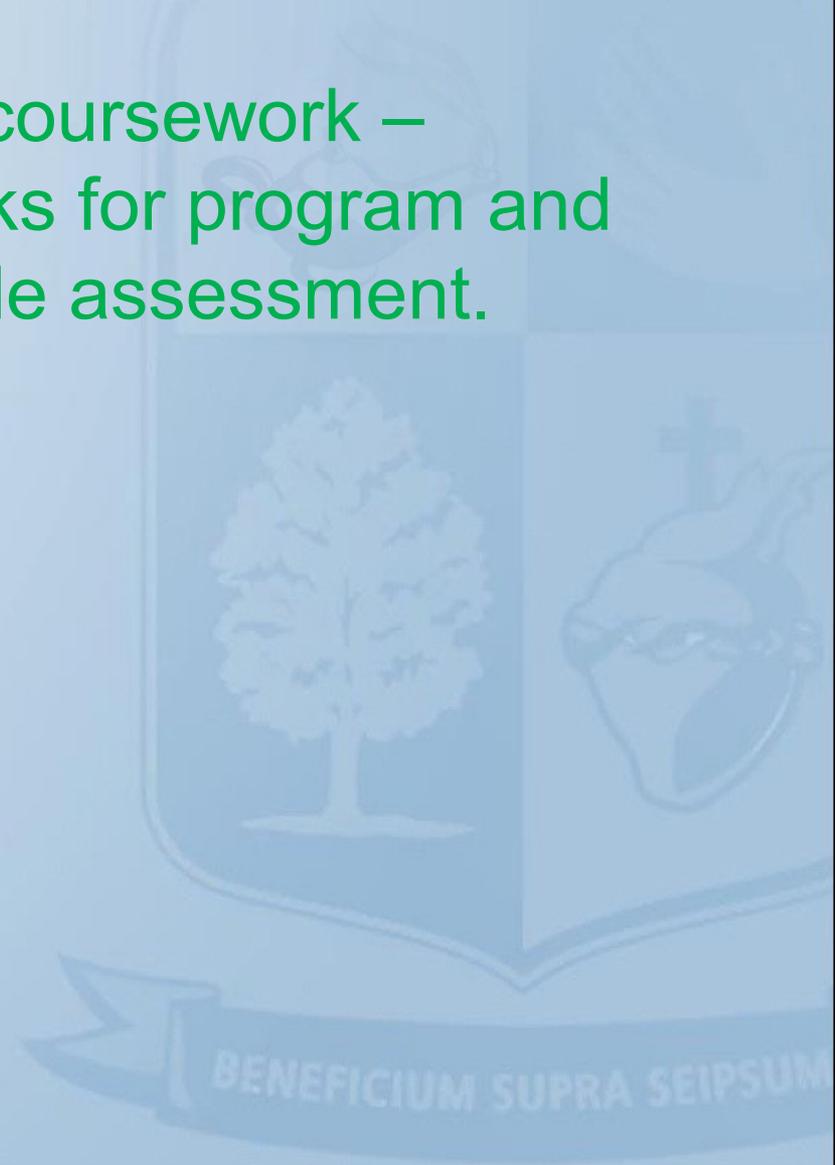
- Freshman in traditional style course struggled in application-based questions



Trends

- Freshman in performance-based classes fared as well as their junior/senior counterparts in application-based questions
 - Are they developing critical thinking skills through exposure to performance tasks?

4. Beyond coursework –
Performance tasks for program and
institution-wide assessment.



Break-out Group Discussion

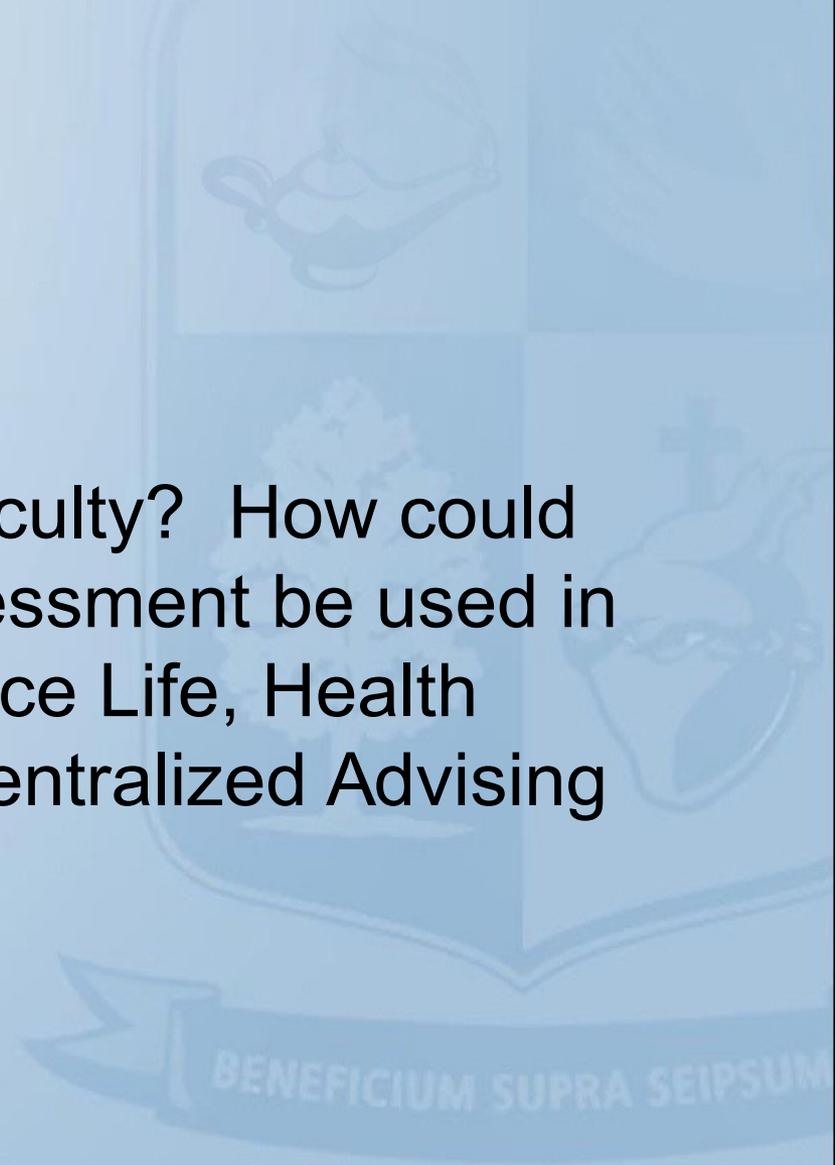
- FACULTY

- Do you need to sacrifice content to incorporate performance tasks?
- What other pedagogical strategies can be used (besides CLA-style) that are considered performance-based?
- What type of faculty development is needed to train faculty how to use this strategy?
- How could this be used at the departmental level?

- ADMINISTRATORS
 - Can performance-based assessments complement data obtained from NSSE, CIRP, CSI, etc?
 - How can performance-based assessments be used as part of accreditation?
 - As part of marketing your college to prospective students?
 - How do you train your faculty and staff?

- STAFF

- Is this strategy just for faculty? How could performance-based assessment be used in your area? (i.e. Residence Life, Health Services, Admissions, Centralized Advising Offices)



Developing program level assessment

- Using performance tasks in freshman introductory courses AND senior capstone courses to evaluate student skill development for departmental program reviews
- Using performance tasks in integrated general education core course classes

Training Faculty and Staff - Summer Academy for Engaged Pedagogies

- Four day workshop in June 2008 + one day presentation in August 2008
- Taught by 3 faculty and the CTL director
- All full-time faculty and select staff invited to apply
- Competitive application process
- Approx 1/3 of the full-time faculty will participate
- \$800 stipend

Institutional-level assessment



National Survey of Student Engagement

in conjunction with



- Using NSSE to assess student's perception of learning
- Using CLA to assess actual skills

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 - Ms. Esther Hong – Program Manager
 - www.claintheclassroom.org
 - www.cae.org

