

**A Multi-Tiered  
Testing-and-Feedback  
Approach That Links  
Technology & Pedagogy**

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# OUTLINE

- **Pedagogical Basis**
- **Adaptation to NATS 101**
- **Adding Learning Technology & Other Tools**
- **A Multi-Tiered Testing & Feedback Approach**
- **Summary & Suggestions**

# Pedagogical Basis

Larry Michaelsen, L. Dee Fink, Robert H. Black  
(1996) *What every faculty developer needs to  
know about learning groups*

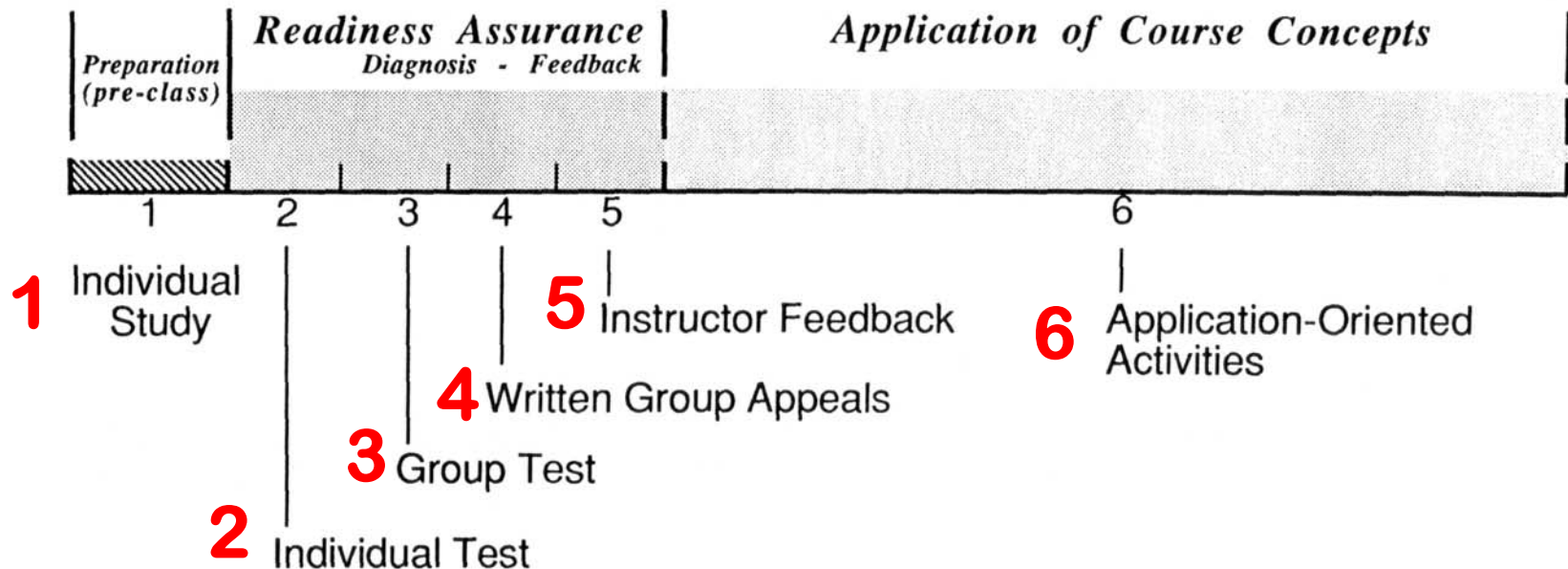
- (1) Learning Groups -- “Team Learning Instructional Activity Sequence”
- (2) Pivotal role of feedback in developing students’ higher-level cognitive skills

**Michaelsen et al. (1996) describe a  
"Readiness Assurance Process"  
consisting of:**

- (1) assigned readings for individual study**
- (2) an individual test**
- (3) a group test (taken within a collaborative learning group)**
- (4) immediate feedback on the group test with an opportunity for group appeals**
- (5) oral instructor feedback.**

# Team Learning Instructional Activity Sequence

## Readiness Assurance Process



(From Michaelsen et al. 1996)

## Readiness Assurance Process:

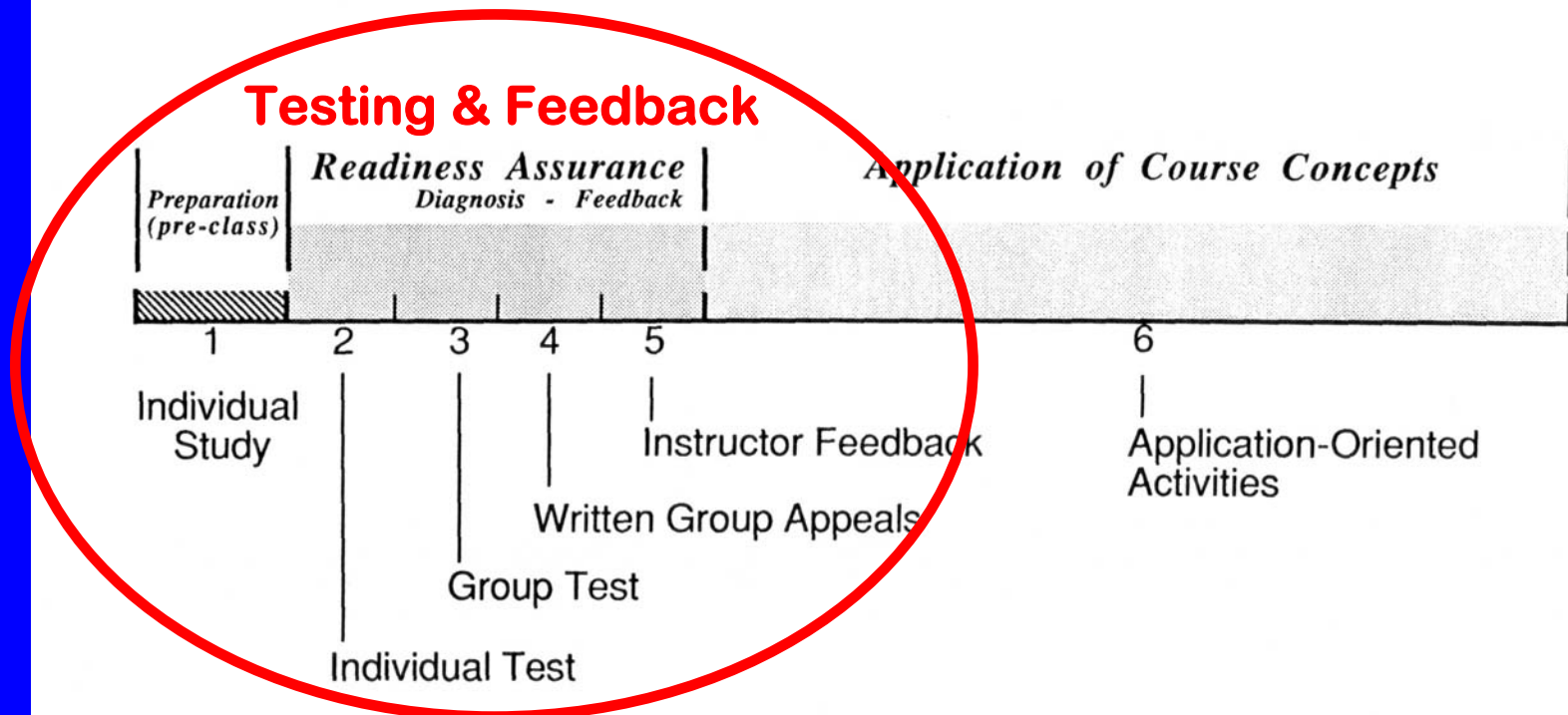
Used to introduce each major instructional unit and to ensure that students are intellectually prepared for assignments needing higher level cognitive skills.

One result of the process is that "students encounter new data that test their understanding of key concepts at least five different times and in five very different ways."

(From Michaelsen et al. 1996)

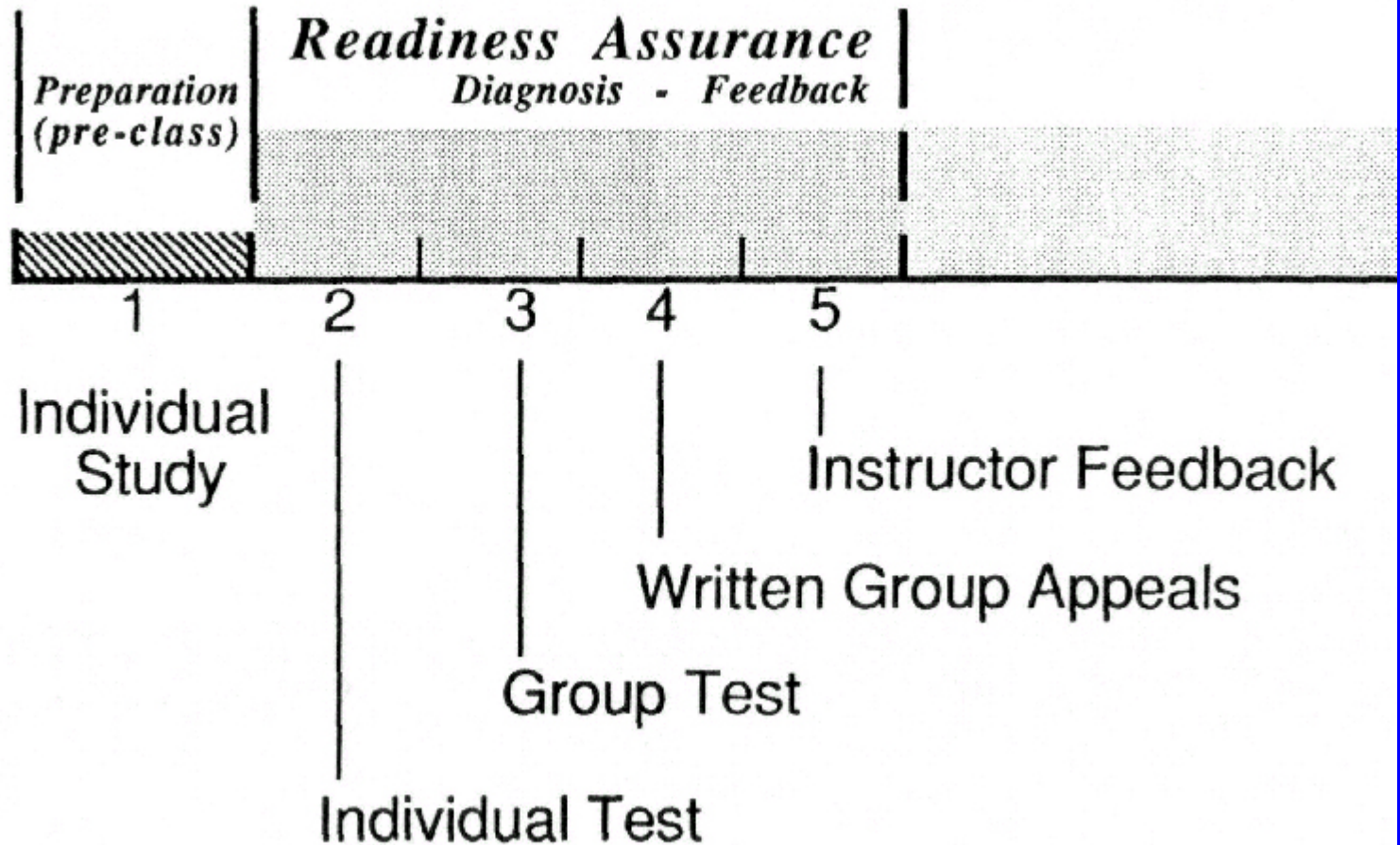
# Pedagogical Basis

## Team Learning Instructional Activity Sequence



(From Michaelsen et al. 1996)

# Adaptation to NATS 101





# INTRODUCTION TO GLOBAL CHANGE

ANNOUNCEMENTS

SYLLABUS

TEACHING  
TEAM

LEARNING

GLOBAL  
CHANGE  
LINKS

SEC 34 H

CLASS  
SUPPORT  
LINKS

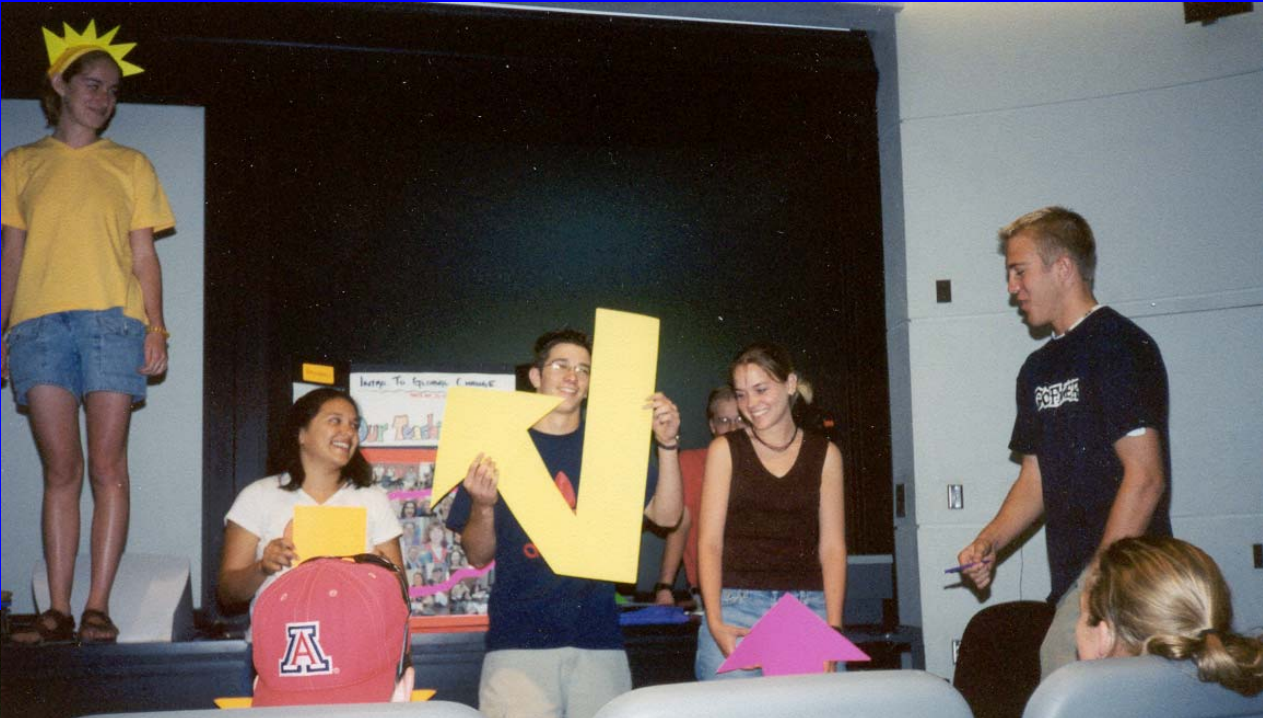
**Class is divided  
into ~ 20  
collaborative  
learning groups**



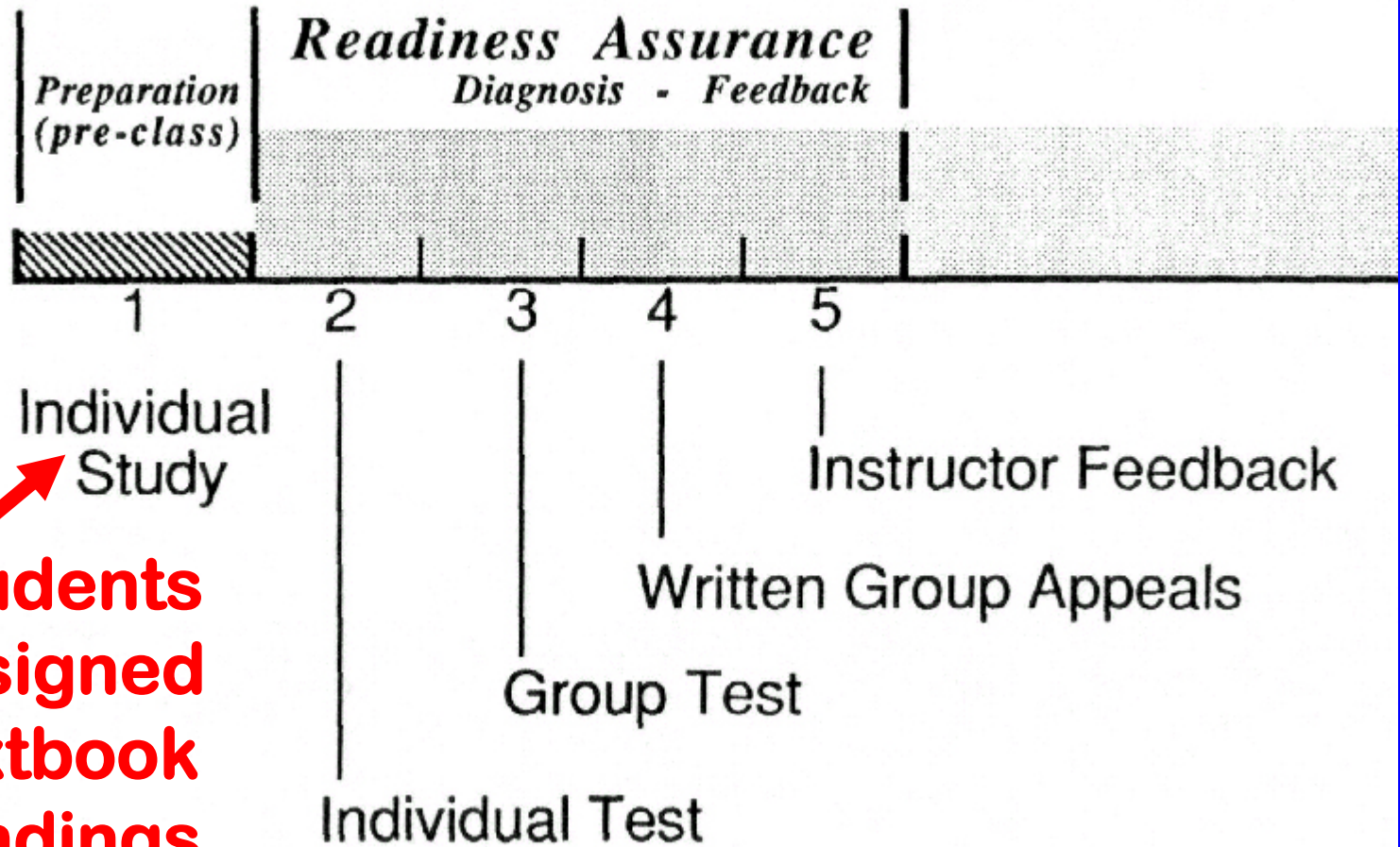
**Mostly first-  
year students  
& non-science  
majors**



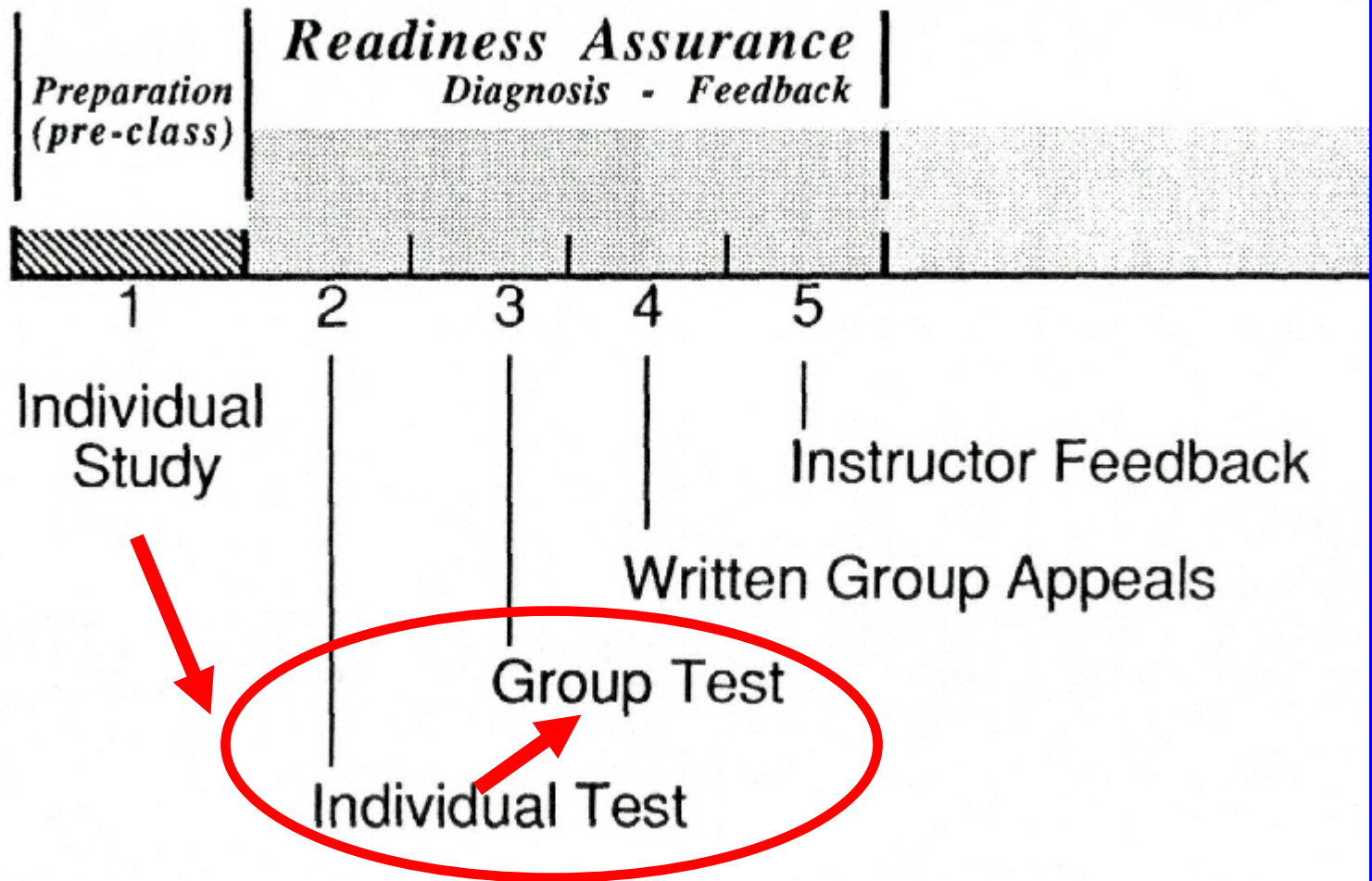
**Undergraduate  
preceptors  
assist in  
individual and  
group learning  
activities**



# “Readiness Assurance Process” as implemented in Fall '99 & Spring '00 semesters:



**Students assigned textbook readings**



# Individual in-class testing procedure used regular scantron forms:

**PART 1**

**IMPORTANT**  
USE NO. 2 PENCIL ONLY  
• MAKE DARK MARKS

BECAUSE OF THE UNIQUE MARKING POSITIONS ON THIS TEST FORM, A COMPLETE ERASURE OF AN INCORRECT RESPONSE IS IMPORTANT. POOR ERASURES COULD BE READ AS MARKS.

TO USE SUBJECTIVE SCORE FEATURE:  
• Mark total possible subjective points  
• Only one mark per line on key  
• 150 points maximum

EXAMPLE OF STUDENT SCORE:  
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50

SCANTRON® FORM NO. 882-ES-LOVAS  
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NAME \_\_\_\_\_  
SUBJECT \_\_\_\_\_ TEST NO. \_\_\_\_\_  
DATE \_\_\_\_\_ HOUR \_\_\_\_\_

TEST RECORD

TEST RECORD	
PART 1	
PART 2	
TOTAL	

**SUBJECTIVE SCORE INSTRUCTOR USE ONLY**

(T)	(F)	(K)
50	50	50
49	49	49
48	48	48
47	47	47
46	46	46
45	45	45
44	44	44
43	43	43
42	42	42
41	41	41
40	40	40
39	39	39
38	38	38
37	37	37
36	36	36
35	35	35
34	34	34
33	33	33
32	32	32
31	31	31
30	30	30
29	29	29
28	28	28
27	27	27
26	26	26
25	25	25
24	24	24
23	23	23
22	22	22
21	21	21
20	20	20
19	19	19
18	18	18
17	17	17
16	16	16
15	15	15
14	14	14
13	13	13
12	12	12
11	11	11
10	10	10
9	9	9
8	8	8
7	7	7
6	6	6
5	5	5
4	4	4
3	3	3
2	2	2
1	1	1

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← FEED THIS DIRECTION →

PATENT NO. 3895381  
LOVAS

Students tested on their PREPARATION -- how well they understand material they have been reading and studying on their own before hearing about it in class.

On scantron forms, students answered each question 3 times:

Allows partial credit when they are unsure of the answer

**SUBJECTIVE SCORE INSTRUCTOR USE ONLY**

100	90	80	70	60
50	40	30	20	10
9	8	7	6	5
4	3	2	1	0

**PART 1**

**IMPORTANT**

BECAUSE OF THE UNIQUE MARKING POSITIONS ON THIS TEST FORM, A COMPLETE ERASURE OF AN INCORRECT RESPONSE IS IMPORTANT. POOR ERASURES COULD BE READ AS MARKS.

USE NO. 2 PENCIL ONLY  
MAKE DARK MARKS

**TO USE SUBJECTIVE SCORE FEATURE:**

- Mark total possible subjective points
- Only one mark per line on key
- 150 points maximum

**EXAMPLE OF STUDENT SCORE:**

1	2	3	4	5
2	3	4	5	6
3	4	5	6	7
4	5	6	7	8
5	6	7	8	9
6	7	8	9	10
7	8	9	10	11
8	9	10	11	12
9	10	11	12	13
10	11	12	13	14
11	12	13	14	15
12	13	14	15	16
13	14	15	16	17
14	15	16	17	18
15	16	17	18	19
16	17	18	19	20
17	18	19	20	21
18	19	20	21	22
19	20	21	22	23
20	21	22	23	24
21	22	23	24	25

1st  
2nd  
3rd  
4th  
5th  
6th  
7th

100 90 80 70 60  
50 40 30 20 10  
9 8 7 6 5  
4 3 2 1 0

(T) (F) KEY

1 A B C D E  
2 A B C D E  
3 A B C D E  
4 A B C D E  
5 A B C D E  
6 A B C D E  
7 A B C D E  
8 A B C D E  
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15 A B C D E  
16 A B C D E  
17 A B C D E  
18 A B C D E  
19 A B C D E  
20 A B C D E  
21 A B C D E

1 2 3 4 5

DA SL NA TO

After individual test forms were collected, students got into their learning groups and took the same test as a group



Individual test scantron forms were scored and returned to students at the next class



Students entered collaboratively derived answers on a separate GROUP answer form for in-class grading:



**ANSWER SHEET**  
form no. 71737

STUDENT ID

0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9
1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9

TEST BOOKLET

0	0	0	0	0	0	A														
1	1	1	1	1	1	B														
2	2	2	2	2	2	C														
3	3	3	3	3	3	D														
4	4	4	4	4	4	E														
5	5	5	5	5	5	F														
6	6	6	6	6	6	G														
7	7	7	7	7	7	H														
8	8	8	8	8	8	I														
9	9	9	9	9	9	J														

FOR TEACHER USE ONLY

TESTING SELECTED ITEMS

- Fill in the "Score marked items only" circle below.
- Indicate individual items to be scored by filling in the shaded area to the left of each appropriate test item.

SCORE MARKED ITEMS ONLY

<input type="radio"/> 1 <input checked="" type="radio"/> B <input type="radio"/> C <input type="radio"/> D <input type="radio"/> E	<input type="radio"/> 11 <input type="radio"/> A <input type="radio"/> B <input type="radio"/> C <input type="radio"/> D <input type="radio"/> E	<input type="radio"/> 21 <input type="radio"/> A <input type="radio"/> B <input type="radio"/> C <input type="radio"/> D <input type="radio"/> E	<input type="radio"/> 31 <input type="radio"/> A <input type="radio"/> B <input type="radio"/> C <input type="radio"/> D <input type="radio"/> E	<input type="radio"/> 41 <input type="radio"/> A <input type="radio"/> B <input type="radio"/> C <input type="radio"/> D <input type="radio"/> E
<input type="radio"/> 2 <input type="radio"/> A <input checked="" type="radio"/> C <input type="radio"/> D <input type="radio"/> E	<input type="radio"/> 12 <input type="radio"/> A <input type="radio"/> B <input type="radio"/> C <input type="radio"/> D <input type="radio"/> E	<input type="radio"/> 22 <input type="radio"/> A <input type="radio"/> B <input type="radio"/> C <input type="radio"/> D <input type="radio"/> E	<input type="radio"/> 32 <input type="radio"/> A <input type="radio"/> B <input type="radio"/> C <input type="radio"/> D <input type="radio"/> E	<input type="radio"/> 42 <input type="radio"/> A <input type="radio"/> B <input type="radio"/> C <input type="radio"/> D <input type="radio"/> E
<input type="radio"/> 3 <input type="radio"/> A <input checked="" type="radio"/> C <input type="radio"/> D <input type="radio"/> E	<input type="radio"/> 13 <input type="radio"/> A <input type="radio"/> B <input type="radio"/> C <input type="radio"/> D <input type="radio"/> E	<input type="radio"/> 23 <input type="radio"/> A <input type="radio"/> B <input type="radio"/> C <input type="radio"/> D <input type="radio"/> E	<input type="radio"/> 33 <input type="radio"/> A <input type="radio"/> B <input type="radio"/> C <input type="radio"/> D <input type="radio"/> E	<input type="radio"/> 43 <input type="radio"/> A <input type="radio"/> B <input type="radio"/> C <input type="radio"/> D <input type="radio"/> E
<input type="radio"/> 4 <input type="radio"/> A <input type="radio"/> B <input type="radio"/> C <input checked="" type="radio"/> E	<input type="radio"/> 14 <input type="radio"/> A <input type="radio"/> B <input type="radio"/> C <input type="radio"/> D <input type="radio"/> E	<input type="radio"/> 24 <input type="radio"/> A <input type="radio"/> B <input type="radio"/> C <input type="radio"/> D <input type="radio"/> E	<input type="radio"/> 34 <input type="radio"/> A <input type="radio"/> B <input type="radio"/> C <input type="radio"/> D <input type="radio"/> E	<input type="radio"/> 44 <input type="radio"/> A <input type="radio"/> B <input type="radio"/> C <input type="radio"/> D <input type="radio"/> E
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<input type="radio"/> 6 <input checked="" type="radio"/> B <input type="radio"/> C <input type="radio"/> D <input type="radio"/> E	<input type="radio"/> 16 <input type="radio"/> A <input type="radio"/> B <input type="radio"/> C <input type="radio"/> D <input type="radio"/> E	<input type="radio"/> 26 <input type="radio"/> A <input type="radio"/> B <input type="radio"/> C <input type="radio"/> D <input type="radio"/> E	<input type="radio"/> 36 <input type="radio"/> A <input type="radio"/> B <input type="radio"/> C <input type="radio"/> D <input type="radio"/> E	<input type="radio"/> 46 <input type="radio"/> A <input type="radio"/> B <input type="radio"/> C <input type="radio"/> D <input type="radio"/> E
<input type="radio"/> 7 <input type="radio"/> A <input checked="" type="radio"/> C <input type="radio"/> D <input type="radio"/> E	<input type="radio"/> 17 <input type="radio"/> A <input type="radio"/> B <input type="radio"/> C <input type="radio"/> D <input type="radio"/> E	<input type="radio"/> 27 <input type="radio"/> A <input type="radio"/> B <input type="radio"/> C <input type="radio"/> D <input type="radio"/> E	<input type="radio"/> 37 <input type="radio"/> A <input type="radio"/> B <input type="radio"/> C <input type="radio"/> D <input type="radio"/> E	<input type="radio"/> 47 <input type="radio"/> A <input type="radio"/> B <input type="radio"/> C <input type="radio"/> D <input type="radio"/> E
<input type="radio"/> 8 <input type="radio"/> A <input type="radio"/> B <input checked="" type="radio"/> D <input type="radio"/> E	<input type="radio"/> 18 <input type="radio"/> A <input type="radio"/> B <input type="radio"/> C <input type="radio"/> D <input type="radio"/> E	<input type="radio"/> 28 <input type="radio"/> A <input type="radio"/> B <input type="radio"/> C <input type="radio"/> D <input type="radio"/> E	<input type="radio"/> 38 <input type="radio"/> A <input type="radio"/> B <input type="radio"/> C <input type="radio"/> D <input type="radio"/> E	<input type="radio"/> 48 <input type="radio"/> A <input type="radio"/> B <input type="radio"/> C <input type="radio"/> D <input type="radio"/> E
<input type="radio"/> 9 <input type="radio"/> A <input type="radio"/> B <input checked="" type="radio"/> D <input type="radio"/> E	<input type="radio"/> 19 <input type="radio"/> A <input type="radio"/> B <input type="radio"/> C <input type="radio"/> D <input type="radio"/> E	<input type="radio"/> 29 <input type="radio"/> A <input type="radio"/> B <input type="radio"/> C <input type="radio"/> D <input type="radio"/> E	<input type="radio"/> 39 <input type="radio"/> A <input type="radio"/> B <input type="radio"/> C <input type="radio"/> D <input type="radio"/> E	<input type="radio"/> 49 <input type="radio"/> A <input type="radio"/> B <input type="radio"/> C <input type="radio"/> D <input type="radio"/> E
<input type="radio"/> 10 <input type="radio"/> A <input checked="" type="radio"/> C <input type="radio"/> D <input type="radio"/> E	<input type="radio"/> 20 <input type="radio"/> A <input type="radio"/> B <input type="radio"/> C <input type="radio"/> D <input type="radio"/> E	<input type="radio"/> 30 <input type="radio"/> A <input type="radio"/> B <input type="radio"/> C <input type="radio"/> D <input type="radio"/> E	<input type="radio"/> 40 <input type="radio"/> A <input type="radio"/> B <input type="radio"/> C <input type="radio"/> D <input type="radio"/> E	<input type="radio"/> 50 <input type="radio"/> A <input type="radio"/> B <input type="radio"/> C <input type="radio"/> D <input type="radio"/> E

One answer per question – no partial credit

# Immediate feedback from: in-class "rapid return" grading method:

The image displays a stack of 'ANSWER SHEET form no. 71737' forms. The top form is clearly visible and contains the following sections:

- ANSWER SHEET form no. 71737**
- STUDENT ID**: A grid for recording student IDs.
- TEST BOOKLET**: A grid for recording test booklet IDs.
- FOR TEACHER USE ONLY**: A section for marking items to be scored.
- TESTING SELECTED ITEMS**: A list of 20 items, each with a shaded area for marking and a circle for the score.
- IMPORTANT DIRECTIONS**: A list of instructions for the teacher.
- STUDENT NAME** and **DATE**: Fields for student information.

The 'TESTING SELECTED ITEMS' section includes the following items:

1	<input checked="" type="radio"/>	B	C	D	E	
2	<input type="radio"/>	A	<input checked="" type="radio"/>	C	D	E
3	<input type="radio"/>	A	<input checked="" type="radio"/>	C	D	E
4	<input type="radio"/>	A	B	C	<input checked="" type="radio"/>	E
5	<input type="radio"/>	A	B	C	D	<input checked="" type="radio"/>
6	<input checked="" type="radio"/>	B	C	D	E	
7	<input type="radio"/>	A	<input checked="" type="radio"/>	C	D	E
8	<input type="radio"/>	A	B	<input checked="" type="radio"/>	D	E
9	<input type="radio"/>	A	B	<input checked="" type="radio"/>	D	E
10	<input type="radio"/>	A	<input checked="" type="radio"/>	C	D	E
11	<input type="radio"/>	A	B	C	D	E
12	<input type="radio"/>	A	B	C	D	E
13	<input type="radio"/>	A	B	C	D	E
14	<input type="radio"/>	A	B	C	D	E
15	<input type="radio"/>	A	B	C	D	E
16	<input type="radio"/>	A	B	C	D	E
17	<input type="radio"/>	A	B	C	D	E
18	<input type="radio"/>	A	B	C	D	E
19	<input type="radio"/>	A	B	C	D	E
20	<input type="radio"/>	A	B	C	D	E

The 'IMPORTANT DIRECTIONS' section includes the following instructions:

- Use a pencil.
- Do not use ballpoint pens.
- Erase clearly.
- Make marks in the shaded area.

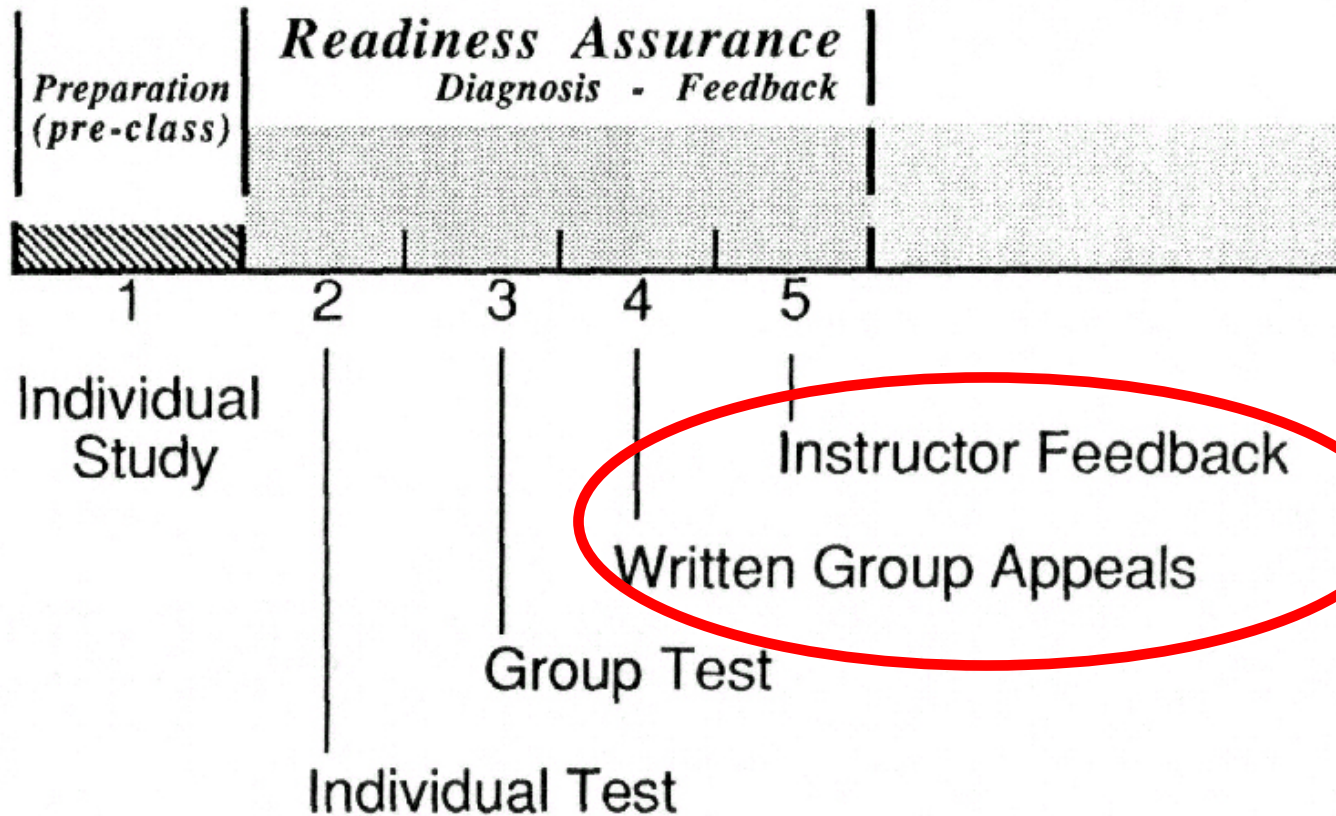
The photograph on the right shows a person using a 'Drill Box' to grade the forms. The Drill Box is a device that allows the teacher to quickly mark the 'Score marked items only' circle on the form.

## Beth Harrison's Drill Box !

**Stacks of test forms were drilled to mark the correct answer . . .**



**. . . Forms were then scored and returned to each group right away**



- **Groups discussed correct answers**
- **Submitted written appeals**
- **Test reviewed with whole class**

# Reassessment of Procedure in NATS 101 Course:

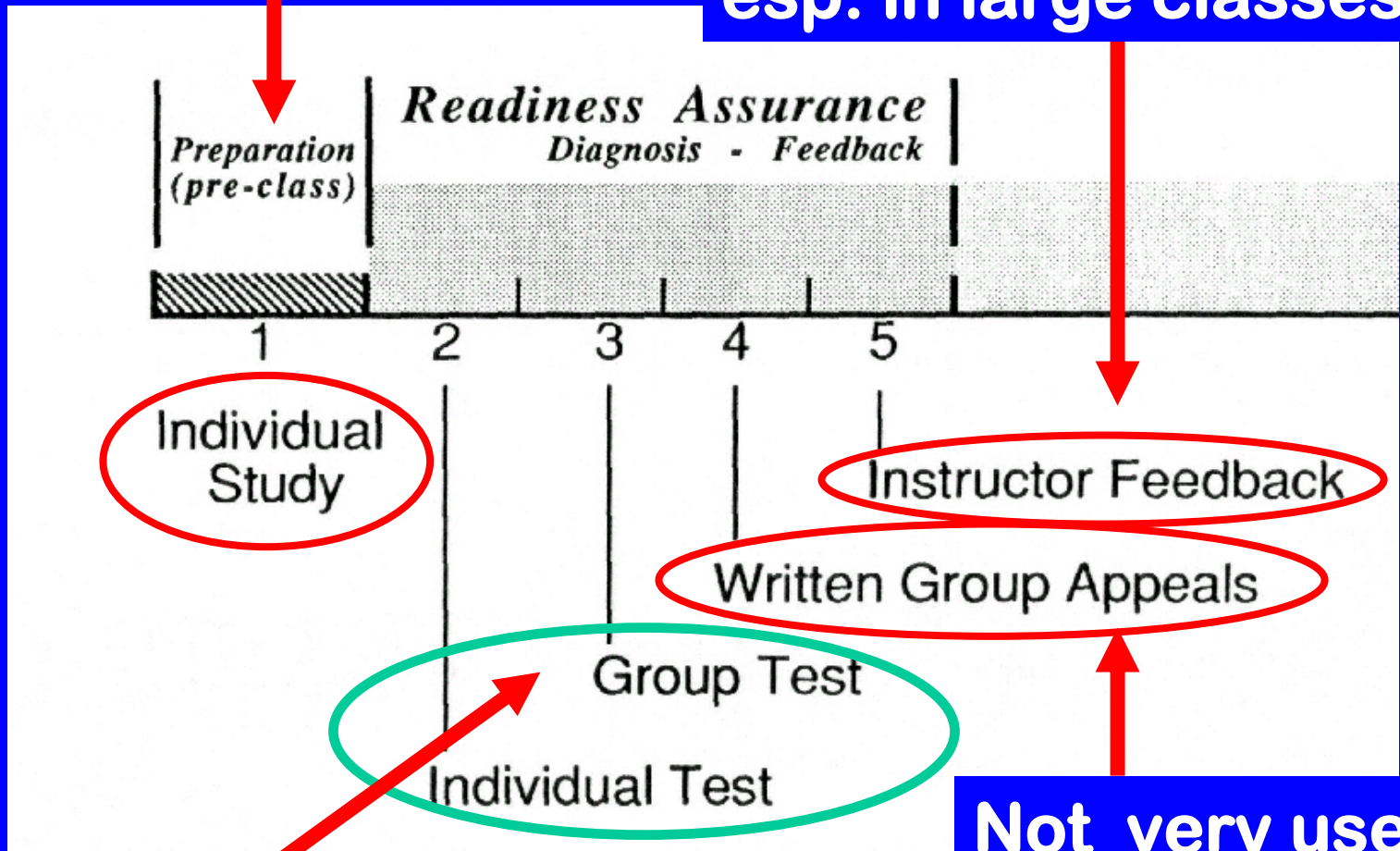
- **Students complained that concepts too difficult to be tested on without prior lecture explanations**
- **Readiness Tests were made simpler to compensate; hence little testing on higher level concepts took place**

- **Lots of class time taken up by Readiness Assurance testing sessions when material was broken down into more “digestible” units**
- **“Appeals” process did not lead to new learning (with Tier One students)**

# INTERIM CONCLUSIONS:

A weak link

ALWAYS more needed,  
esp. in large classes



Not very useful

Works pretty well!

## Adaptations / Improvements:

- **More feedback during preparation phase (with “low stakes grading”) to help students understand and gain confidence with material**
- **Less class time taken up by individual phase of “Readiness Assessment”**



## Adaptations / Improvements:

- Continue with in-class Individual & Group Test process, but with “higher stakes testing”
- Ensure individual accountability for learning = high stakes exams
- More FEEDBACK needed overall

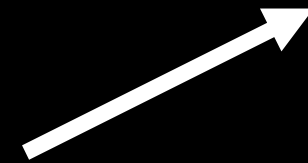
# Learning Technology Tools

INTRODUCTION TO GLOBAL CHANGE

FALL 2000 NATS 101, SEC 42 & 43



WebCT



# Learning Technology Tools


WebCT Homepage - Microsoft Internet Explorer

File Edit View Favorites Tools Help

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Links | IMPs | SEARCH | Katie | kt | NATS | GloClim | Courses | UA | SABIO | U of A | UA Dept | GenEd | News | vWx | Org | Govt

Address <http://webct.arizona.edu:8000/webct/public/home.pl> Go



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Expand Content

Home:  View  Designer Options

## Introduction to Global Change

Home

### INTRODUCTION TO GLOBAL CHANGE

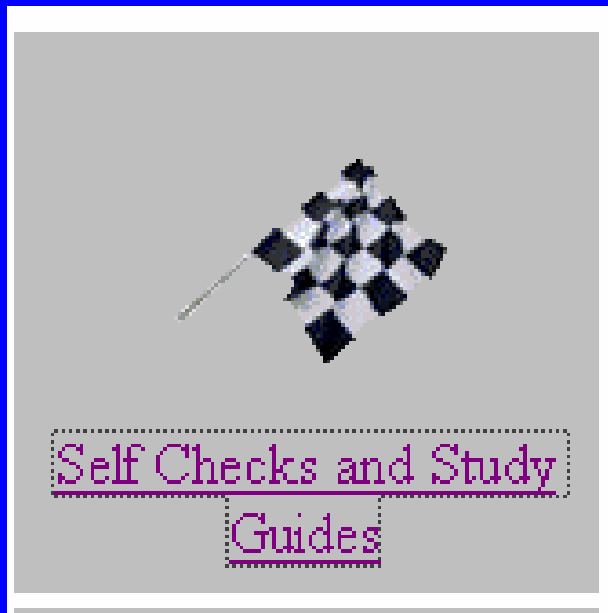


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Visible to Designers
- Take Guided Tour
  - View Designer Map
  - Add Page or Tool
  - Manage Files
  - Manage Course
  - Change Settings
  - Content Assistant

- Course Menu
- Homepage
  - GC WEBSITE
  - Calendar
  - Class Follow Up
  - Self Checks
  - Readiness Quizzes
  - Assignments
  - GC Boards
  - GC Chat Rooms
  - Tips for WebCT
  - Grades

 <a href="#">GC WEBSITE</a>	 <a href="#">Calendar</a>	 <a href="#">Class Follow Up</a>	 <a href="#">Self Checks and Study Guides</a>	 <a href="#">Readiness Quizzes &amp; Surveys</a>
 <a href="#">Assignments</a>	 <a href="#">GC Discussion Boards</a>	 <a href="#">GC Chat Rooms</a>	 <a href="#">Tips for WebCT</a>	 <a href="#">Grades</a>

# WebCT: Self Tests & Online Quizzes

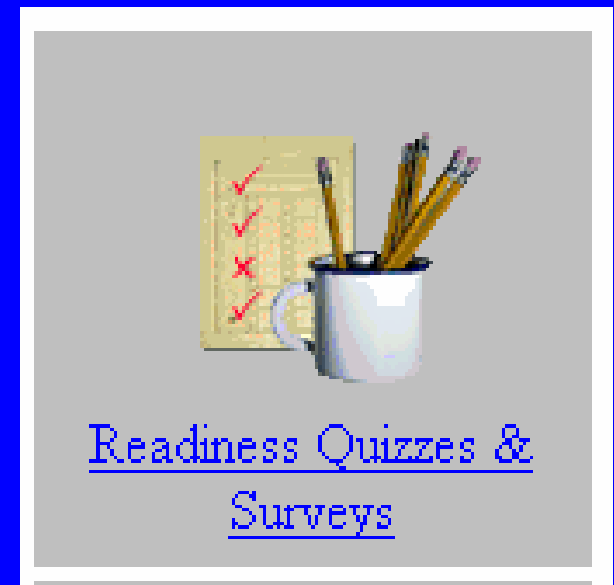


**Non-graded “Self Check”  
on how well student  
understands reading  
material**

**w/ detailed explanatory  
feedback**

**Low-stakes online  
“Readiness Quiz” to test  
student’s preparedness**

**Replaces in-class individual  
test before lecturing on  
course material**



# Example of Self-Check question:



The screenshot shows a WebCT interface. At the top left is the WebCT logo. To its right is a navigation bar with links: MYWEBCT | RESUME COURSE | COURSE MAP | HELP | COURSE RESOURCES. Below this is a black bar with the text "Self Check # 6:  View  Designer Options". Underneath is the title "Introduction to Global Change" and a breadcrumb trail: Home > Self Checks and Study Guides > Self Check # 6. An "ACTION MENU:" is located below the breadcrumb, with buttons for Previous, Next, Contents, Retrace, Refresh, and Self Test. The main content area contains a question numbered "2": "Greenhouse gases" are gases that warm a planet's surface by \_\_\_\_\_. Three radio button options are listed: 1) absorbing outgoing infrared radiation (radiant heat) and reradiating some of it back toward the surface. 2) trapping heat coming directly from the Sun and then radiating it down to the Earth's surface. 3) inhibiting heat loss due to upward air motions from the Earth's surface, just the same way that the glass walls of a greenhouse inhibit heat loss -- hence the name "greenhouse gas." A red arrow points to the third option.

WebCT

MYWEBCT | RESUME COURSE | COURSE MAP | HELP | COURSE RESOURCES

Self Check # 6:  View  Designer Options

Introduction to Global Change

Home > Self Checks and Study Guides > Self Check # 6

ACTION MENU: Previous Next Contents Retrace Refresh Self Test

2 "Greenhouse gases" are gases that warm a planet's surface by \_\_\_\_\_ .


- absorbing outgoing infrared radiation (radiant heat) and reradiating some of it back toward the surface.
- trapping heat coming directly from the Sun and then radiating it down to the Earth's surface.
- inhibiting heat loss due to upward air motions from the Earth's surface, just the same way that the glass walls of a greenhouse inhibit heat loss -- hence the name "greenhouse gas."

## Detailed feedback for each right and wrong answer

2

"Greenhouse gases" are gases that warm a planet's surface by \_\_\_\_\_.

- absorbing outgoing infrared radiation (radiant heat) and reradiating some of it back toward the surface.
- trapping heat coming directly from the Sun and then radiating it down to the Earth's surface.
- inhibiting heat loss due to upward air motions from the Earth's surface, just the same way that the glass walls of a greenhouse inhibit heat loss -- hence the name "greenhouse gas."

 No. As your ES textbook explains, the "greenhouse analogy" is not perfect. A real greenhouse keeps things warm because the glass walls and ceiling trap heat that might otherwise be lost from the greenhouse by warm upward air currents. Greenhouse gases do not really "trap" heat in this way -- it is more accurate to say that they absorb energy and then radiate it back to the surface. In other words, the process does NOT operate like currents of warm air rising from the surface which are then trapped and "bounced" back to Earth by the greenhouse gases. Such a description is overly simple and misleading. Try to use more accurate and precise terms to describe these processes -- we'll be working on this a lot in class. :)

# Detailed feedback helps to fine-tune understanding of reading material and “re-wire” misconceptions students often bring in with them to the course

ACTION MENU: [Previous](#) [Next](#) [Contents](#) [Retrace](#) [Refresh](#) [Self Test](#)

2

"Greenhouse gases" are gases that warm a planet's surface by \_\_\_\_\_.

absorbing outgoing infrared radiation (radiant heat) and reradiating some of it back toward the surface.

- trapping heat coming directly from the Sun and then radiating it down to the Earth's surface.
- inhibiting heat loss due to upward air motions from the Earth's surface, just the same way that the glass walls of a greenhouse inhibit heat loss -- hence the name "greenhouse gas."



Correct! The source of the "heat" or radiant energy involved in the greenhouse effect is energy from the Earth's surface that is absorbed by the greenhouse gases and then radiated back to the surface. Greenhouse gases do a better job of absorbing infrared energy that is radiated from the Earth than they do in absorbing solar energy coming directly from the Sun.



# Example of Online Readiness Quiz question:

Quiz builds  
on Self-  
Check  
material but  
with some  
testing of  
higher level  
concepts

WebCT Quiz - Microsoft Internet Explorer

RQ #6

Name: Stella Student

Start Time: Apr 02, 2001 11:39 Time Allowed: 15 minutes

Number of Questions: 10

Finish Help

Time Remaining:  
time expired

Unanswered  
Answered

1	2	3	4	5
6	7	8	9	10

Question 1 (1 point)

Greenhouse gases are gases that warm a planet's surface by\_\_\_\_\_.

- 1. radiating infrared radiation out to space
- 2. trapping heat coming directly from the Sun and bouncing it down to the Earth's surface
- 3. inhibiting heat loss due to upward air motions, like the glass walls of a greenhouse
- 4. absorbing infrared radiation from the Earth's surface and reradiating some of it back toward the surface

Save answer

## Introduction to Global Change

[Home](#) › [Quiz](#) › [Scores](#) › [Attempts](#)

Clouds play an important role in the planetary energy balance, but their effects on global warming are difficult to model in General Circulation Models (GCMs) because . . .

1. Their typical areal extent is much larger than the resolution of a GCM.
2. High-altitude clouds and low-altitude clouds can have opposite feedback effects.
3. Clouds have a lot of water vapor in them and water vapor is a greenhouse gas only some of the time.
4. Clouds interfere with the GCM's ability to reach an equilibrium surface warming.

100.0% ▶

Score: 1 / 1

**Immediate feedback possible as soon as student submits the quiz**

8 (1 point)

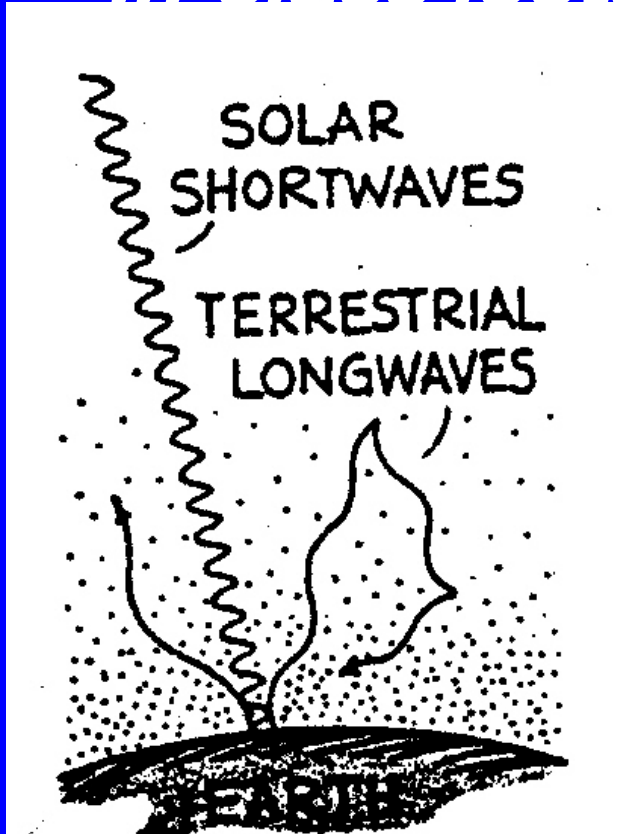
Which of the following is **NOT** one of the predictions coming from the computer model projections of future CO<sub>2</sub> levels or the predictions of their consequences:

1. An average equilibrium surface warming of between 1.5 and 4.5 degrees C will occur with a doubling of atmospheric CO<sub>2</sub> concentration.
2. The warming caused by increased CO<sub>2</sub> will be evenly distributed in both space and time.
3. Substantial sea level rise will occur and submerge low-lying coastal areas.
4. Ecosystems will be affected by changes in species distributions
5. All of the above are expected to occur

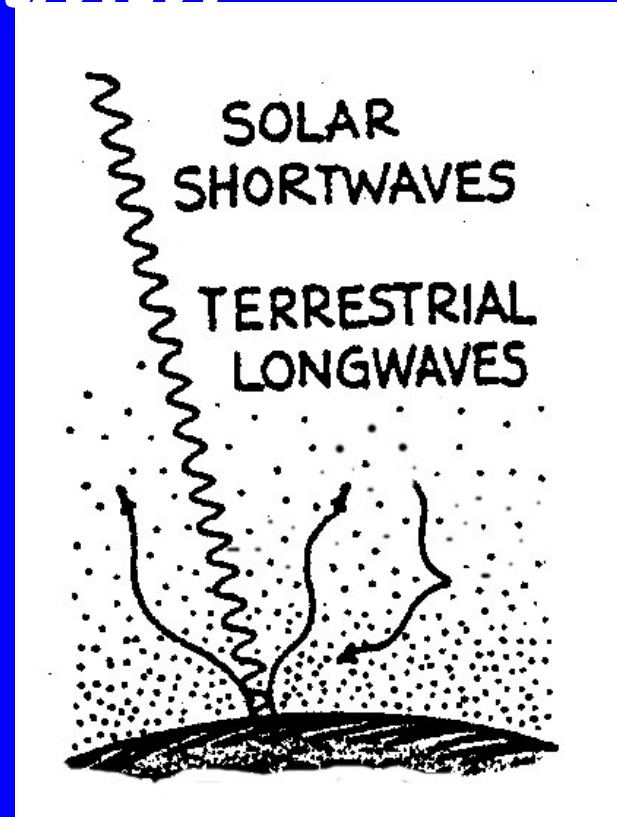
0.0% ▶

Score: 0 / 1

*In-class lecture activity:*

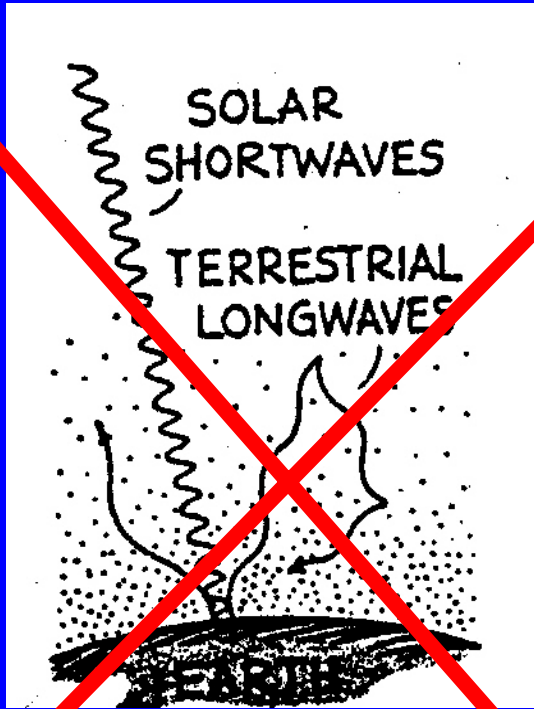


**A**

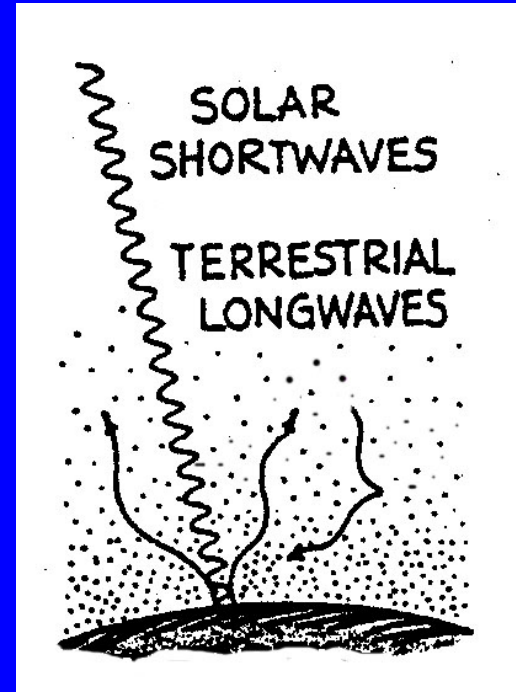


**B**

**Which one is the more accurate depiction of the Greenhouse Effect??**



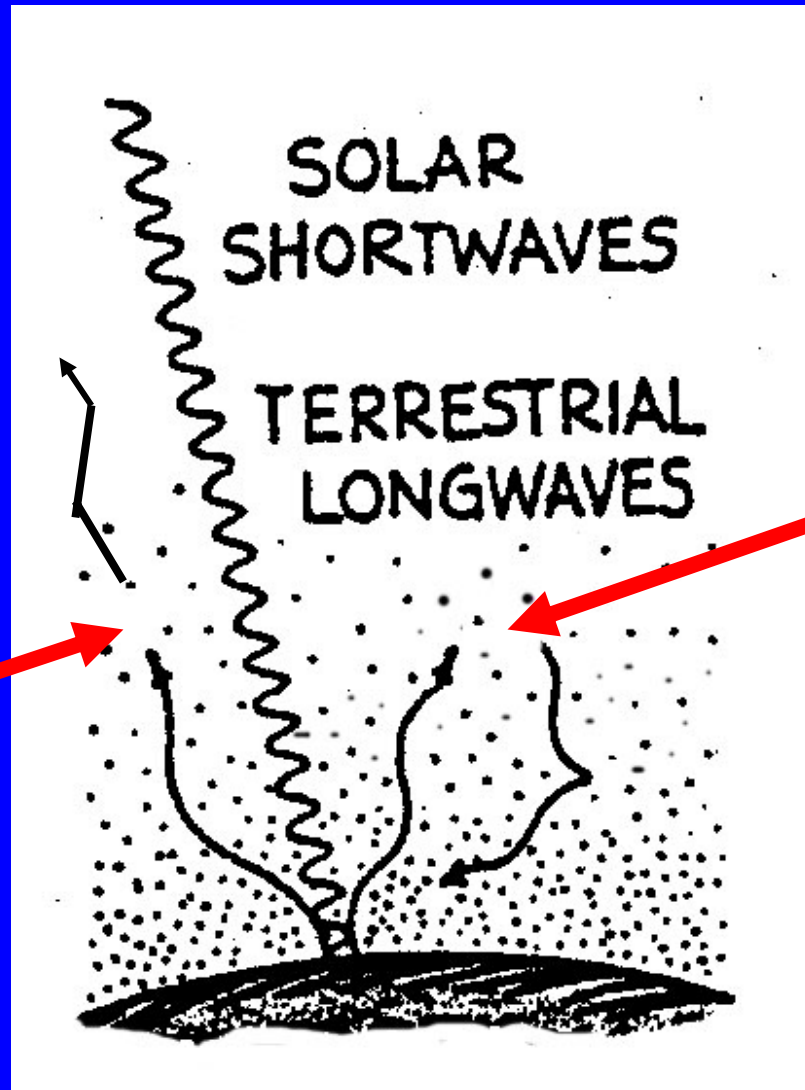
A



B

**B is better!!!!**

IR radiation is absorbed by GH gases in the atmosphere and emitted out to space



IR radiation is absorbed by GH gases in the atmosphere and emitted back to Earth

# Multi-Tiered Testing Approach:

Midterm & Final Individual Exams

In-class Individual & Group Tests

Online Readiness Quizzes

Ungraded Self-Checks

HIGH  
STAKES  
TESTING

LOW  
STAKES  
TESTING



**The various testing tiers progress from low-stakes testing (non-graded self-tests) to high-stakes testing (major graded exams).**

**Tiered approach allows the student to gain knowledge and confidence with the material at each progressive level because of the immediate feedback provided.**

# A new IMMEDIATE FEEDBACK tool for use during in-class exams:

**IMMEDIATE FEEDBACK ASSESSMENT TECHNIQUE (IF AT)**

Name \_\_\_\_\_ Test # \_\_\_\_\_

Subject \_\_\_\_\_ Total \_\_\_\_\_

**SCRATCH OFF COVERING TO EXPOSE ANSWER**

	A	B	C	D	Score
1.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
2.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
3.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
4.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
5.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
6.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
7.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
8.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
9.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
10.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____



Immediate Feedback

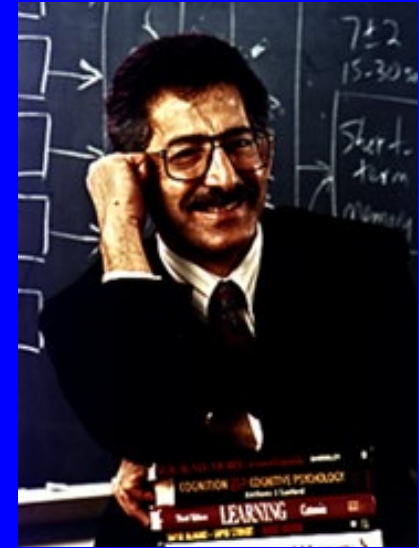
If at first you don't succeed,

**IF-AT**

try, try again.

Assessment Technique

Get Hold of the Latest Development in Testing Methods.



**Created by:**

**Michael Epstein, PhD  
Rider University, NJ**

<http://enigma.rider.edu/~epstein/ifat/>

# IMMEDIATE FEEDBACK ASSESSMENT TECHNIQUE (IF AT)

Name \_\_\_\_\_

Test # \_\_\_\_\_

Subject \_\_\_\_\_

Total \_\_\_\_\_

**SCRATCH OFF COVERING TO EXPOSE ANSWER**

	A	B	C	D	Score
1.					_____
2.					_____
3.					_____
4.					_____
5.					_____
6.					_____
7.					_____
8.					_____
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10.					_____
11.					_____
12.					_____
13.					_____
14.					_____
15.					_____
16.					_____
17.					_____

# IMMEDIATE FEEDBACK ASSESSMENT TECHNIQUE (IF AT)

Name \_\_\_\_\_

Test # \_\_\_\_\_

Subject \_\_\_\_\_

Total \_\_\_\_\_

**SCRATCH OFF COVERING TO EXPOSE ANSWER**

	A	B	C	D	Score
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3.					_____
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15.					_____
16.					_____
17.					_____

# IMMEDIATE FEEDBACK ASSESSMENT TECHNIQUE (IF AT)

Name \_\_\_\_\_

Test # \_\_\_\_\_

Subject \_\_\_\_\_

Total \_\_\_\_\_

**SCRATCH OFF COVERING TO EXPOSE ANSWER**

	A	B	C	D	Score
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2.					_____
3.					_____
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# IMMEDIATE FEEDBACK ASSESSMENT TECHNIQUE (IF AT)

Name \_\_\_\_\_

Test # \_\_\_\_\_

Subject \_\_\_\_\_

Total \_\_\_\_\_

**SCRATCH OFF COVERING TO EXPOSE ANSWER**

	A	B	C	D	Score
1.				★	_____
2.	★	★			_____
3.					_____
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16.					_____
17.					_____

# IMMEDIATE FEEDBACK ASSESSMENT TECHNIQUE (IF AT)

Name \_\_\_\_\_

Test # \_\_\_\_\_

Subject \_\_\_\_\_

Total \_\_\_\_\_

**SCRATCH OFF COVERING TO EXPOSE ANSWER**

	A	B	C	D	Score
1.				★	_____
2.	★				_____
3.			★		_____
4.					_____
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# IMMEDIATE FEEDBACK ASSESSMENT TECHNIQUE (IF AT)

Name \_\_\_\_\_

Test # \_\_\_\_\_

Subject \_\_\_\_\_

Total \_\_\_\_\_

**SCRATCH OFF COVERING TO EXPOSE ANSWER**

	A	B	C	D	Score
1.				★	_____
2.	★				_____
3.			★		_____
4.					_____
5.					_____
6.					_____
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17.					_____



### IMMEDIATE FEEDBACK ASSESSMENT TECHNIQUE (IF AT)

Name \_\_\_\_\_ Test # \_\_\_\_\_

Subject \_\_\_\_\_ Total \_\_\_\_\_

**SCRATCH OFF COVERING TO EXPOSE ANSWER**

	A	B	C	D	Score
1.					_____
2.					_____
3.					_____
4.					_____
5.					_____
6.					_____
7.					_____
8.					_____
9.					_____
10.					_____



**Students use IF-AT form for immediate feedback on their Group Tests & compute their group score themselves**








# WebCT anonymous online survey tool used to assess students' attitudes about the form:

## Question:

I liked using the IF-AT form during the Midterm Exam.

1. Strongly agree  2. Agree  3. Neutral  4. Disagree  5. Strongly disagree





Answer	Value	Frequency Distribution	
1	0%	74	
2	0%	20	
3	0%	1	
4	0%	3	
5	0%	1	

## Question:

The IF-AT Form helped me on the test because knowing the right answer to some questions helped to guide me to the right answer in other questions.

1. Strongly Agree  2. Agree  3. Neutral  4. Disagree  5. Strongly Disagree






---

Answer	Value	Frequency Distribution	
1	0%	48	
2	0%	30	
3	0%	17	
4	0%	4	
5	0%	0	

## Question:

The IF-AT form had the following effect on my morale during the Midterm Exam:

- 1. It had a positive effect on my morale because I gained confidence with each correct answer I scratched off.
- 2. It had a positive effect on my morale because I knew I could get partial credit even if I didn't get it right the first time.
- 3. It didn't affect my morale one way or the other.
- 4. It had a negative effect on my morale because I lost confidence when I discovered I was wrong. I would rather not have known.
- 5. It had a negative effect on my morale because I got more and more anxious with each question, knowing I'd already gotten some wrong.

Answer	Value	Frequency Distribution	
1	0%	46	
2	0%	45	
3	0%	4	
4	0%	2	
5	0%	2	

***Student comments from anonymous online survey:***

**“I thought the IF-AT form was helpful because even though I would get a couple answers wrong the first time I knew that I could still get partial credit for it. I also like it because it is kind of fun and different from ordinary tests. I just wish that the questions were a bit easier, that’s all.”**

**“The If-At form helps me understand just why I got an answer wrong, versus other classes where you lose a point or two without any explanation. The best way to learn is from one's mistakes.”**

**“I feel it is a very fair way to do a test because we are really learning and it forces you to learn what the correct answer is instead of just getting one try and not knowing if you are right or wrong.”**

**“I thought it was a good way to take the midterm. I liked knowing when I got the right answer and when I missed an answer, it made me want to concentrate harder and get the next one right.”**

**“The If-At form made the test more interesting by having to scratch off the answers. It helps me to keep from zoning out too much during the test.”**

**“The form was a good tool because it allowed me to have partial credit for answers if I wasn't sure between two answers.**

**This also helped because if I got the answer right the second time it allowed me to straighten out the two concepts in my head. It allowed for interactive learning with the test.”**

**“I really liked knowing what questions I got right or wrong and then using those questions to help answer later questions.**

**It also helped my confidence in the test because I knew right away that I did really well, and I believe that that also helped me in the second (essay) section of the test.”**



**“I got a lot better grade on the test because of the If-At form. Sometimes I read questions wrong when I really understand the material.**

**Because we use these forms I was able to correct my mistakes within the next try. I got an A but would have certainly had a B if not for the form. Thanks.”**





**“It was good until the last couple questions. When I missed some of the questions, I became discouraged.”**

**“On this test I truly believe that for me it wasn't a positive thing. I didn't do very well so when I knew that, I felt horrible leaving the test.”**

## Question:

The IF-AT form should be used again on the Final Exam in this course.

1. Strongly agree  2. Agree  3. Neutral  4. Disagree  5. Strongly disagree

Answer	Value	Frequency Distribution	
1	0%	78	
2	0%	15	
3	0%	4	
4	0%	2	
5	0%	0	

# What about feedback for essay questions?

## QUESTION # 28.

### Follow up on Webpage



(a) Give a scientifically accurate **DEFINITION** of the natural greenhouse effect in your own words:

*EXAMPLES OF GOOD ANSWERS – Note how many creative and original ways the same concept can be worded!*

Student 1: "The greenhouse effect is the absorption of escaping infrared radiation by greenhouse gases, such as CO<sub>2</sub> and H<sub>2</sub>O, which then emit some of this radiation back to Earth. This process warms the planet by preventing some infrared from escaping to space."

Student 2: "The greenhouse effect is the absorption of terrestrial longwave radiation by greenhouse gases, which is then radiated out towards the earth." [Note that this is not a perfect answer because it's not clear what is radiating out towards the earth. Here's a slightly better wording: " The greenhouse effect is the absorption of terrestrial longwave (IR) radiation by greenhouse gases. The GH gases then radiate the IR back towards the earth." ]

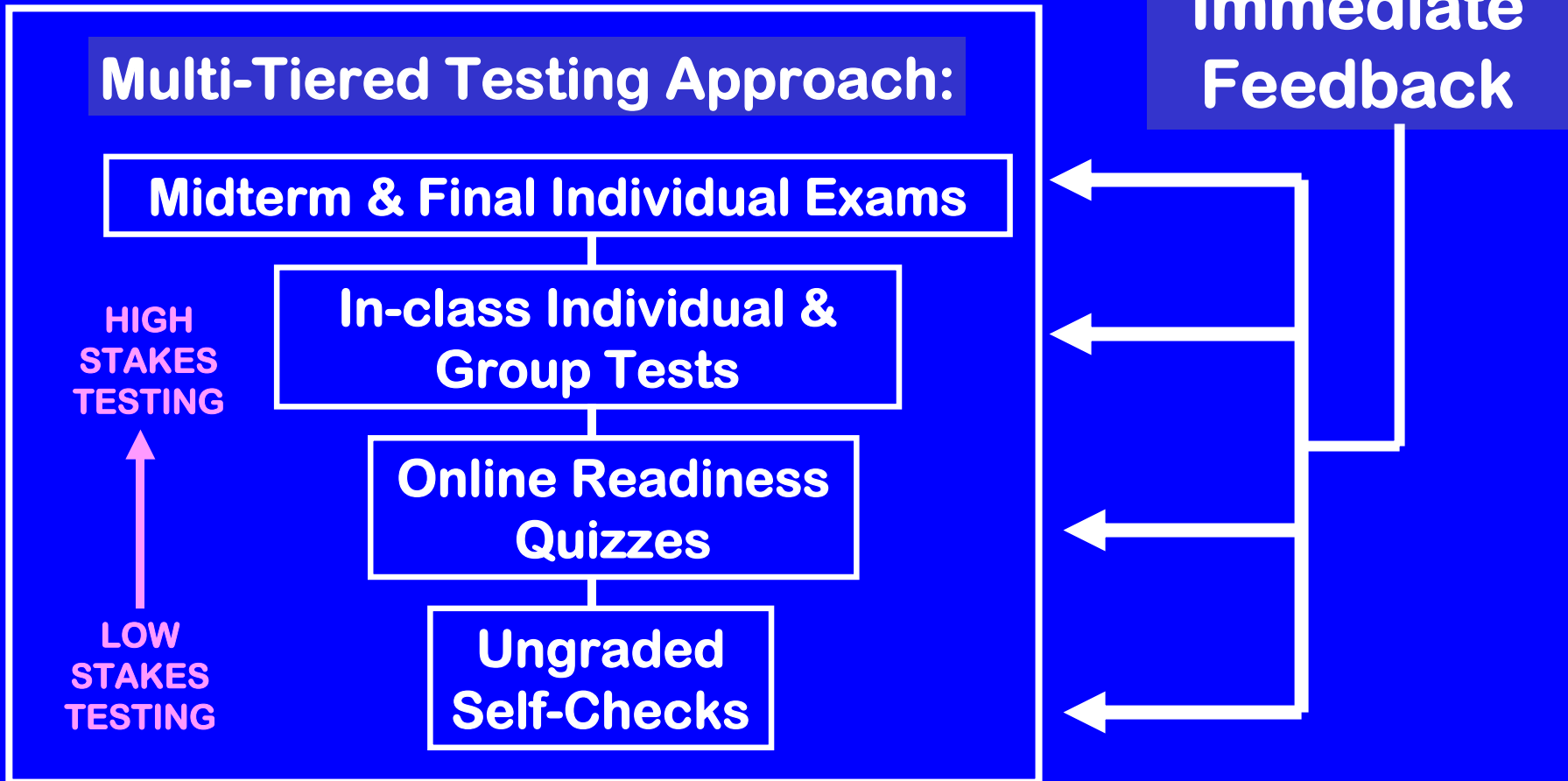
## *EXAMPLES OF ANSWERS WITH ONE OR TWO PROBLEMS:*

Student 7: "The Greenhouse effect happens when the earth emits Infrared Radiation upwards, then some is absorbed by the atmosphere (primarily CO<sub>2</sub> and water vapor) and then reflected back to the earth (longwave radiation). This is needed by the earth or else everything would be extremely cold." [Can you identify what's wrong here? The fatal flaw is the use of the word **reflected** instead of **radiated**. The main IR wavelength ranges involved in the GHE are NOT reflected -- **the IR is absorbed and then radiated**. There is a very small band of IR wavelengths (close to visible light) called Near-IR that can be reflected in the manner that visible light is reflected, but the IR primarily involved in the GHE is NOT reflected like visible light! In this answer there is also a suggestion that the student may think that infrared radiation emitted upward by the Earth is something a bit different than the longwave radiation sent back to Earth. As we use the terms in this class, infrared and longwave radiation are the same thing -- the Earth emits IR / longwave radiation and the GH gases absorb and emit IR / longwave radiation as well.]

## *EXAMPLES OF ANSWERS WITH MAJOR PROBLEMS:*

Student 8: "The natural greenhouse effect is when some of the gases that are bounced off earth does not leave the ozone and circles back to earth. This is used with gases such as CO<sub>2</sub> and H<sub>2</sub>O." [This answer has at least two major problems. First of all **GASES** are described as "bouncing off the earth" which is wrong -- even if the student were to use the term reflecting instead of bouncing, the process of reflection in the context of the energy balance does not apply to gases. What *is* reflected is some of the incoming shortwave (UV and visible) radiation, BUT the GHE does not involve shortwave radiation, only terrestrial longwave. Second, for some reason the term ozone is introduced -- but in an odd way, almost as if ozone is being used as a synonym for the troposphere. Overall, the answer uses terms and concepts wrong, is poorly phrased, and presents information that doesn't mean anything.]

# Summary



# Suggestions

- **To facilitate higher-level learning, detailed feedback on Self Tests must be based on instructor's accumulated experience of how students tend to interact with material; plus awareness of common misconceptions, learning pitfalls, etc.**
- not a job for new GTA assigned to course for the first time!**



- **Various options in WebCT for online quizzes:**

- take 3 times; grade = average of 3 attempts**

- feedback on whether right or wrong when test submitted**

- overall feedback or hints on question can be provided without giving away correct answer**

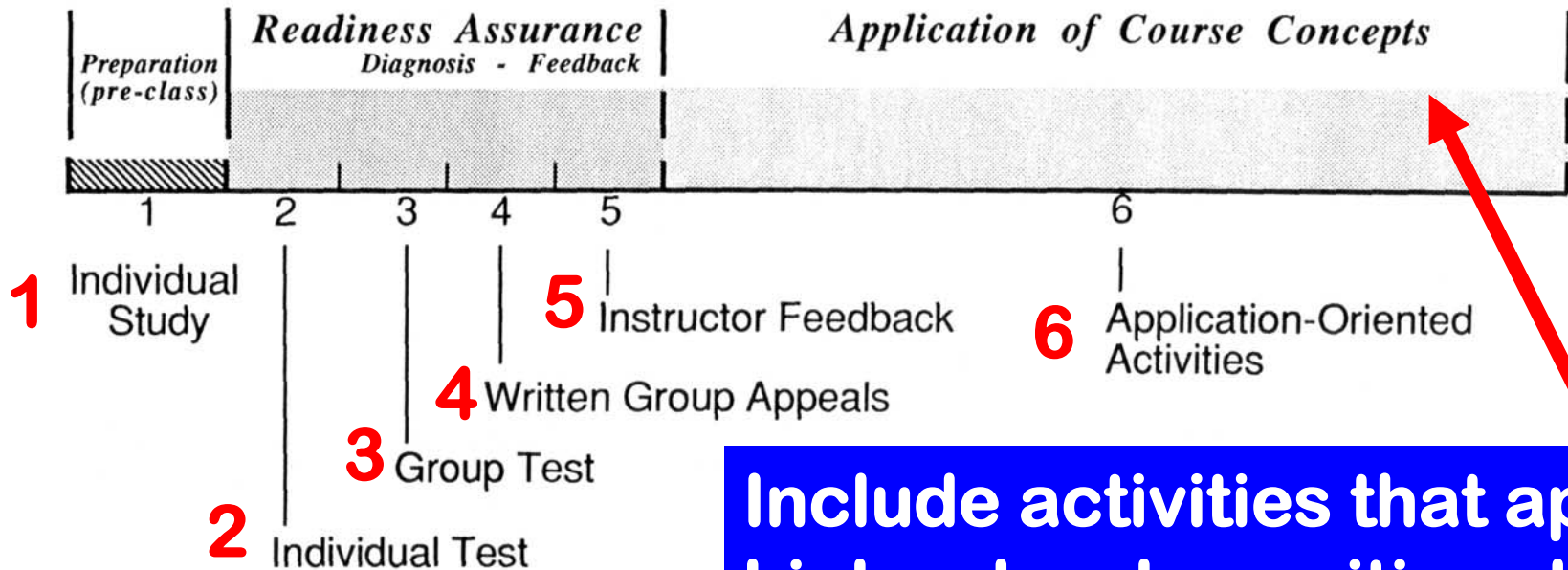
- **Students must have opportunity to “practice” with IF-AT forms before first use on high-stakes exam**

**-- another benefit of using the form on Group Tests**

# Structure units of instruction based on desired learning outcomes

## Team Learning Instructional Activity Sequence

### Readiness Assurance Process

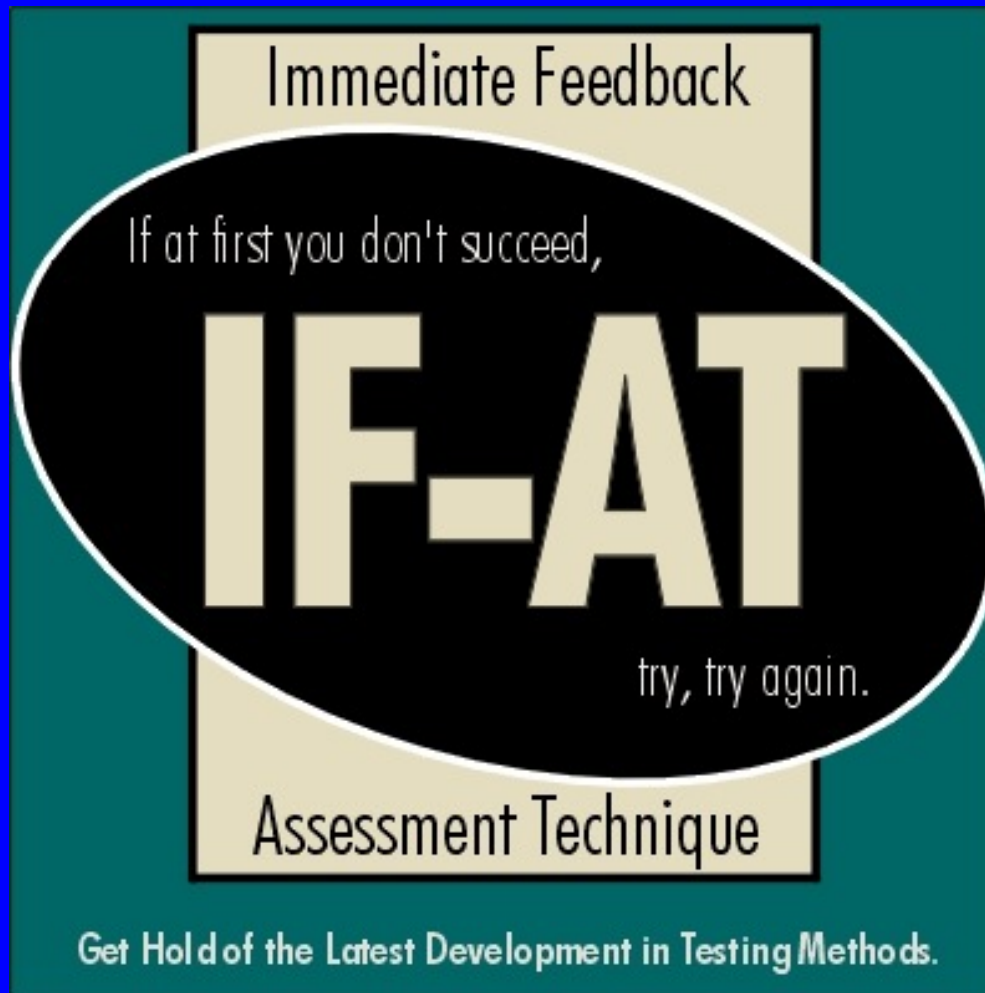


**Include activities that apply higher-level cognitive skills to course concepts**

<http://www.gened.arizona.edu/nats101gc/>



[katie@LTRR.arizona.edu](mailto:katie@LTRR.arizona.edu)

The logo is a dark green square with a white border. At the top, a white rectangular box contains the text "Immediate Feedback". In the center, a large black oval contains the text "If at first you don't succeed," at the top, "IF-AT" in large, bold, white letters in the middle, and "try, try again." at the bottom. Below the oval, another white rectangular box contains the text "Assessment Technique". At the very bottom of the green square, the text "Get Hold of the Latest Development in Testing Methods." is written in white.

Immediate Feedback

If at first you don't succeed,

**IF-AT**

try, try again.

Assessment Technique

Get Hold of the Latest Development in Testing Methods.

<http://enigma.rider.edu/~epstein/ifat/>

## REFERENCE:

Larry Michaelsen, L. Dee Fink, Robert H. Black (1996). What every faculty developer needs to know about learning groups, in L. Richlin, ed. *To Improve the Academy*, Vol 15 (pp 31-57). Stillwater, OK: New Forums Press and the Professional and Organizational Development Network in Higher Education.

... and assorted workshop handouts