



AMS
American Meteorological Society

Supplemental Material

© Copyright 2022 American Meteorological Society (AMS)

For permission to reuse any portion of this work, please contact permissions@ametsoc.org. Any use of material in this work that is determined to be “fair use” under Section 107 of the U.S. Copyright Act (17 USC §107) or that satisfies the conditions specified in Section 108 of the U.S. Copyright Act (17 USC §108) does not require AMS’s permission. Republication, systematic reproduction, posting in electronic form, such as on a website or in a searchable database, or other uses of this material, except as exempted by the above statement, requires written permission or a license from AMS. All AMS journals and monograph publications are registered with the Copyright Clearance Center (<https://www.copyright.com>). Additional details are provided in the AMS Copyright Policy statement, available on the AMS website (<https://www.ametsoc.org/PUBSCopyrightPolicy>).

Characterizing Instructional Strategies in Atmospheric Science Courses - GT

Start of Block: Consent Form

CF1 CONSENT DOCUMENT FOR ENROLLING ADULT PARTICIPANTS IN A RESEARCH STUDY

Georgia Institute of Technology

Principal Investigators:

Dr. Zachary Handlos (email: zachary.handlos@eas.gatech.edu)

Dr. Casey Davenport (email: Casey.Davenport@uncc.edu)

Dr. Dawn Kopacz (email: dawn.kopacz@unl.edu)

Protocol and Consent Title: Characterizing Instructional Strategies within Atmospheric Science Courses

You are being asked to be a volunteer in a research study.

Purpose:

The purpose of this study is to assess the state of the use of active learning strategies by faculty within undergraduate and graduate atmospheric science courses across the United States.

You have been asked to participate because you have been identified as a potential instructor of atmospheric science courses at the collegiate/University level. We are interested in learning more about the type of active learning strategies you implement within atmospheric science courses you teach along with any professional development and/or training experiences you have participated in regarding active learning strategies. The goal of this research is to determine the percentage of faculty that utilize a variety of active learning strategy types and have received training in creating and implementing active learning strategies.

We expect ~1,000 people to enroll in this study.

Procedures:

The PI's of this study will be analyzing all survey responses from participants as aggregate data. Specifically, we will be computing mean statistics for each question to develop an understanding of the type of active learning strategies utilized by atmospheric science educators within the classroom, strategies that are potentially unused or underutilized and how often educators within the atmospheric sciences receive training and/or professional development

experience in the context of active learning.

Inclusion/Exclusion Criteria:

Participants that are under 18 years of age are excluded from participating in this study. Participants must be in the United States when completing the survey.

Risks or Discomforts:

There are no known risks to subjects within this study. Given that Qualtrics stores IP address information when participants complete the survey for this study, there is the potential risk of breach of confidentiality if this information is hacked or stolen. The risk of this information being spread outside of the user accounts of the PI's involved is very low, as this information is password protected and can only be accessed legally by the PI's.

Benefits:

You are not likely to benefit in any way from participating in this study. However, we hope that results from this study will be used to inform the broader atmospheric science community about the state of active learning within undergraduate and graduate-level atmospheric science courses across colleges and Universities with atmospheric science courses.

CF2 **Compensation to You:**

There is no compensation for participation.

Storing and Sharing your Information:

Your participation in this study is gratefully acknowledged. All information that you provide within this study will only be through the Qualtrics survey tool administered and will be stored within Qualtrics' database. This is password protected and only accessible to the PI's of this study.

Confidentiality:

No personal identifiers will be used in this study or tied to any grade information used. All survey information will be analyzed and published as aggregate data.

The information that you provide with respect to this consent form will be stored within Qualtrics, an online survey database that is kept secure by the software company as well as in

accordance with Georgia Institute of Technology's Office for Information and Technology (OIT) security policies.

You should be aware that the experiment is not being run from a secure https server of the kind typically used to handle credit card transactions, so there is a small possibility that responses could be viewed by unauthorized third parties such as computer hackers. In general, the web page software will log as header lines the I.P. address of the machine you use to access this page (e.g., "102.403.506.807"), but otherwise no information will be stored unless you explicitly enter it.

Your privacy will be protected to the extent required by law. The Georgia Institute of Technology IRB and the Office of Human Research Protections may look over study records during required reviews.

Costs to You:

There are no costs to you, other than your time, for reading and signing this consent form and participating in this study.

Questions about the Study:

If you have any questions about the study, you may contact any of the PI's of this study:

Dr. Zachary Handlos
Email: Zachary.handlos@eas.gatech.edu

Dr. Casey Davenport Email:
Casey.Davenport@uncc.edu

Dr. Dawn Kopacz
Email: dawn.kopacz@unl.edu

Questions about Your Rights as a Research Participant:

Your participation in this study is voluntary. You do not have to be in this study if you don't want to be. You have the right to change your mind and leave the study at any time without giving any reason and without penalty. Any new information that may make you change your mind about being in this study will be given to you. You do not waive any of your legal rights by agreeing to this consent form.

If you have any questions about your rights as a research participant, you may contact:

Ms. Melanie Clark, Georgia Institute of Technology
Office of Research Integrity Assurance, at (404) 894-6942.

By filling out the following information below, this implies that you have read (or have had read to you) the information given in this consent form, and you would like to be a participant in this

study. You also acknowledge that you are participating in this study voluntarily and on your behalf.

You will be emailed a copy of this consent form to keep.

You do not waive any of your legal rights by providing consent to participate in this study (i.e., checking the box below that states, "I agree to the consent form above, am at least 18 years of age or older and am completing this survey in the U.S. I also acknowledge that I am participating in this study voluntarily and on my behalf.").

CF3 Check one of the following below:

- I agree to the consent form above, am at least 18 years of age or older and am completing this survey in the U.S. I also acknowledge that I am participating in this study voluntarily and on my behalf. (1)
- I do not agree to the consent form above. (2)

End of Block: Consent Form

Start of Block: Courses, Teaching Strategies and Assessment

Q1.1 For the last academic year (Fall 2018 – Summer 2019), please indicate the number of courses that you taught in each of the categories below. If you taught a two-term course, or the same course for consecutive terms, please count each term separately.

	0	1	2	3	4	5	6	7	8	9	10	
Introductory courses (typically taken as a 1st or 2nd year undergraduate student) ()												
Upper level courses (typically taken as a 3rd and 4th year undergraduate student) ()												
Graduate-level courses ()												

Display This Question:

If For the last academic year (Fall 2018 – Summer 2019), please indicate the number of courses that... [Introductory courses (typically taken as a 1st or 2nd year undergraduate student)] > 0

Q1.1a Select all types of introductory level courses that you have taught within the last academic year (Fall 2018 - Summer 2019). Choose all that apply.

- Course for Non-Majors (i.e., does not count towards atmospheric science major) (1)
- Course for Majors (i.e., counts towards atmospheric science major) (2)
- Combined Non-Majors/Majors Course (5)
- Non-Calculus Based (3)
- Calculus-Based (4)

Display This Question:

If For the last academic year (Fall 2018 – Summer 2019), please indicate the number of courses that... [Upper level courses (typically taken as a 3rd and 4th year undergraduate student)] > 0

Or For the last academic year (Fall 2018 – Summer 2019), please indicate the number of courses that... [Graduate-level courses] > 0

Q1.1b Select all upper level and/or graduate-level courses that you have taught within the last academic year (Fall 2018 - Summer 2019). Choose all that apply.

- Atmospheric Dynamics (1)
- Atmospheric Thermodynamics (2)
- Atmospheric Physics/Radiation (3)
- Synoptic Meteorology (5)
- Mesoscale Meteorology (6)
- Radar and Satellite Meteorology (e.g., atmospheric instrumentation, remote sensing) (8)
- Capstone Course (e.g., work experience, internship, seminar, research project) (24)
- Atmospheric Science Elective Course (e.g., Tropical Meteorology, Advanced Dynamics, Global Climate Change, Atmospheric Chemistry, Numerical Modeling, Atmospheric Statistics, Atmospheric Field Methods, Atmospheric Science Communication/Writing, Middle Atmosphere, Large-Scale Atmospheric Circulation) - please specify the course(s) below: (22)

- n/a (29)

Display This Question:

If For the last academic year (Fall 2018 – Summer 2019), please indicate the number of courses that... [Introductory courses (typically taken as a 1st or 2nd year undergraduate student)] > 0

Q1.2a How often do you typically utilize the following in-class teaching strategies within your INTRODUCTORY courses?

Hover your mouse (available on desktop view only) on a strategy type to view a description.

	Never (1)	Rarely (2)	Occasionally (3)	Frequently (4)
Peer Instruction (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Think-pair-share (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Concept maps/sketches (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Case Studies (4)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Gallery Walks (5)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Jigsaw (6)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Lecture Tutorials (7)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Minute Papers (8)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Role Playing (9)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Group quizzes/tests (10)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
OTHER. Please describe and select how often the teaching strategy is utilized. (11)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Display This Question:

If For the last academic year (Fall 2018 – Summer 2019), please indicate the number of courses that... [Upper level courses (typically taken as a 3rd and 4th year undergraduate student)] > 0

Q1.2b How often do you typically utilize the following in-class teaching strategies within your UPPER LEVEL courses?

Hover your mouse (available on desktop view only) on a strategy type to view a description.

	Never (1)	Rarely (2)	Occasionally (3)	Frequently (4)
Peer Instruction (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Think-pair-share (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Concept maps/sketches (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Case Studies (4)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Gallery Walks (5)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Jigsaw (6)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Lecture Tutorials (7)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Minute Papers (8)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Role Playing (9)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Group quizzes/tests (10)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
OTHER. Please describe and select how often the teaching strategy is utilized. (11)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Display This Question:

If For the last academic year (Fall 2018 – Summer 2019), please indicate the number of courses that... [Graduate-level courses] > 0

Q1.2c How often do you typically utilize the following in-class teaching strategies within your GRADUATE courses?

Hover your mouse (available on desktop view only) on a strategy type to view a description.

	Never (1)	Rarely (2)	Occasionally (3)	Frequently (4)
Peer Instruction (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Think-pair-share (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Concept maps/sketches (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Case Studies (4)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Gallery Walks (5)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Jigsaw (6)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Lecture Tutorials (7)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Minute Papers (8)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Role Playing (9)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Group quizzes/tests (10)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
OTHER. Please describe and select how often the teaching strategy is utilized. (11)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Display This Question:

If For the last academic year (Fall 2018 – Summer 2019), please indicate the number of courses that... [Introductory courses (typically taken as a 1st or 2nd year undergraduate student)] > 0

Q1.3a How often do you typically utilize the following assessment types within your INTRODUCTORY courses? Hover your mouse (available on desktop view only) on an assessment type to view a description.

	Never (1)	Rarely (2)	Occasionally (3)	Frequently (4)
Mid-term exam (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Quiz (4)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Course project (5)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Lab Exercises (6)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Homework/problem sets (7)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Participation exercises (9)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
OTHER. Please describe and select how often assessment type is utilized. (19)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Display This Question:

If For the last academic year (Fall 2018 – Summer 2019), please indicate the number of courses that... [Upper level courses (typically taken as a 3rd and 4th year undergraduate student)] > 0

Q1.3b How often do you typically utilize the following assessment types within your UPPER LEVEL courses? Hover your mouse (available on desktop view only) on an assessment type to view a description.

	Never (1)	Rarely (2)	Occasionally (3)	Frequently (4)
Mid-term exam (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Quiz (4)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Course project (5)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Lab Exercises (6)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Homework/problem sets (7)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Participation exercises (9)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
OTHER. Please describe and select how often assessment type is utilized. (19)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Display This Question:

If For the last academic year (Fall 2018 – Summer 2019), please indicate the number of courses that... [Graduate-level courses] > 0

Q1.3c How often do you typically utilize the following assessment types within your GRADUATE courses? Hover your mouse (available on desktop view only) on an assessment type to view a description.

	Never (1)	Rarely (2)	Occasionally (3)	Frequently (4)
Mid-term exam (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Quiz (4)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Course project (5)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Lab Exercises (6)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Homework/problem sets (7)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Participation exercises (9)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
OTHER. Please describe and select how often assessment type is utilized. (19)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q1.4 Which of the following resources have you used to help you implement active learning strategies in your classroom?

Select ALL that apply.

- Journal Article, Book, Website (9)
 - Conference presentation (10)
 - Conference poster (11)
 - Informal discussions with a colleague OUTSIDE of your department (4)
 - Informal discussions with colleague WITHIN your department (1)
 - Individual consultation with Center for Teaching and Learning at your institution (7)
 - Completed coursework/certificate program (15)
 - Faculty Learning Community (19)
 - Professional development workshop (12)
 - Other. Please describe. (16)
-

Display This Question:

*If Which of the following resources have you used to help you implement active learning strategies i...
= Professional development workshop*

Q1.4a Where did the professional development workshop in which you learned about implementing active learning strategies in your classroom take place? Choose all that apply.

- During graduate school (4)
 - At my home institution (1)
 - At a disciplinary conference (2)
 - Other. Please describe. (3)
-

Display This Question:

*If Which of the following resources have you used to help you implement active learning strategies i...
= Professional development workshop*

Q1.4b Which of the following best describes the LENGTH of the professional development workshop in which you learned about implementing active learning strategies in your classroom? Choose all that apply.

- half-day or shorter workshop (1)
 - full-day workshop (2)
 - multi-day or week-long workshop (3)
 - semester-long or year-long workshop (6)
-

Q1.5 Please use this space to share any comments on instructional practices in atmospheric science classrooms that were not covered in this survey.

End of Block: Courses, Teaching Strategies and Assessment

Start of Block: Demographics

Q2.1 How many years have you taught as the instructor of record at the college or university level?

- Less than 2 years (1)
 - 2-5 years (2)
 - 5-10 years (3)
 - 10+ (4)
-

Q2.2 Which of the following course delivery formats do you typically utilize?

- In-person/traditional (1)
 - Online (2)
 - Hybrid (3)
 - Other. Please describe. (4) _____
-

Q2.3 Which of the following describes your current position?

- Graduate Student (1)
- Adjunct Professor (2)
- Lecturer/Instructor (3)
- Professor (4)
- Professor of Practice (5)
- Visiting Professor (6)
- Academic Professional (Please specify rank) (7)

- Other. Please describe. (8) _____

Display This Question:

If Which of the following describes your current position? = Professor

Q2.3a Please specify your rank.

- Assistant (1)
- Associate (2)
- Full (3)

Display This Question:

If Which of the following describes your current position? = Professor of Practice

Q2.3b Please specify your rank.

- Assistant (1)
 - Associate (2)
 - Full (3)
-

Display This Question:

If Which of the following describes your current position? = Visiting Professor

Q2.3c Please specify your rank.

- Assistant (1)
 - Associate (2)
 - Full (3)
-

Q2.4 What is your tenure status at your place of employment?

- I am tenured (1)
 - I am on the tenure track but not yet tenured (2)
 - I am not on the tenure track (includes non-tenure track jobs) (3)
-

Q2.5 How does the institution with which are you affiliated fit into the [Carnegie Classification of Institutions of Higher Education](#)?

- Associate's College (1)
- Baccalaureate College (2)
- Master's Colleges and Universities (3)
- Doctoral Universities (4)
- Other. Please describe. (5) _____

Display This Question:

If How does the institution with which are you affiliated fit into the Carnegie Classification of In... = Doctoral Universities

Q2.5a Is your institution considered an R1, R2 or R3 university?

- R1: Doctoral Universities – Very high research activity (1)
- R2: Doctoral Universities – High research activity (4)
- D/PU: Doctoral/Professional Universities (5)

Q2.6 What is the highest degree you have received? If currently enrolled, highest degree received.

- Associate degree (1)
- Bachelor's degree (2)
- Master's degree (3)
- Doctoral degree (4)
- Other. Please describe. (5) _____

Q2.7 How do you describe yourself?

- Female (1)
 - Male (7)
 - Trans female/Trans woman (2)
 - Trans male/Trans man (3)
 - Genderqueer/Gender Non-Conforming (4)
 - I prefer not to answer (5)
 - Prefer to self-describe (6) _____
-

Q2.8 What is your age?

- 18-24 (1)
- 25-34 (2)
- 35-44 (3)
- 45-54 (4)
- 55-64 (5)
- 64+ (6)

End of Block: Demographics

Active Learning Strategy Descriptions

The following below is a table describing all active learning strategy descriptions provided to participants when completing Q1.2a-Q1.2c of the survey for this study.

Active Learning Strategy	Definition from Online Survey
Peer Instruction	Instructor poses a conceptual multiple-choice question to students, whose responses are collected using low-tech (e.g., hand raising) or high-tech (e.g., clickers) methods. Typically, if less than 70% answer correctly, students are instructed to discuss the reasoning behind their choices with their neighbors in pairs or small groups and vote a second time. The instructor then provides an explanation for the correct answer.
Think-pair-share	Students are provided with a problem or question by the instructor and are told to first individually reflect on their answer, then pair up with a classmate to discuss a potential response, and finally share their thoughts with the rest of the class and instructor.
Concept maps/sketches	Graphical representation of a student's knowledge of a topic. Typically drawn within a circle or box, with labeled arrows or lines that indicate related information. The idea is to emphasize similarities and connections among various ideas and concepts.
Case Studies	Stories that present realistic and complex situations, often involving a dilemma, conflict, or problem. Typically, case study events are relatively recent, involve a relevant topic, and there is an element of empathy engendered for the characters in the given scenario. For example, predicting weather in a single or multiple locations, then reviewing the success of that forecast.

Gallery Walks	Instructor provides a series of questions or prompts to students, posting them at stations around a room on large sheets of paper or whiteboards. Students work in small groups, rotating between stations to provide responses to each prompts, adding comments and ideas to those left by previous groups. Responses left at each station are discussed by the class as a whole.
Jigsaw	An instructor first places students in small groups to become experts on a given topic by providing appropriate materials and allowing time for everyone to arrive at a common understanding. Next, students are reorganized into new groups such that each member of the group is an expert on a different topic. This group uses their combined expertise to complete a task in response to an instructor's prompt or question.
Lecture Tutorials	Following instruction on a given topic, structured prompts are provided to students that are designed to target misconceptions and conceptually challenging content, encouraging critical thinking and drawing figures or tables as appropriate. Students work collaboratively to answer the questions and are then debriefed by the instructor.
Minute Papers	Commonly used during the last few minutes of a class period. Instructor provides a prompt to students (e.g., What is the most important thing you learned today? What is the muddiest point (most confusing concept) of today's class?), who then provide a written, often anonymous, response. These are reviewed by the instructor and ideally addressed at the start of the next class.
Role Playing	Activity that asks students to take on the roles

	<p>of people who will affect, or be affected by, a topic or phenomena. For example, students simulate a Senate subcommittee hearing on global climate change, arguing different positions based on assigned roles.</p>
<p>Group quizzes/tests</p>	<p>Students work in small groups on a quiz or exam, where they must collaborate and agree on an answer to each problem. Often involves some portion of the grade based on individual assessment as well.</p>

No description was provided for “OTHER. Please describe and select how often the teaching strategy is used”. See “Supplemental Material” for listing of participants’ responses to “Other.”

List of High-Use Active Learning Strategies Listed as “Other” in Q1.2

Introductory Level Courses

- Group projects
- discovery method worksheets
- Clustering and I develop games for my introductory class like bingo, taboo
- iClicker Polling Questions
- Independent work on a worksheet, followed by sharing and discussing solutions with class
- exercises
- Position Papers
- Interactive questions where students answer multiple choice, image-based, numerical and short-answer questions and are required to also justify their answer.
- Use of models
- Group exercises
- game-based learning
- Just-in-Time Teaching
- Poll Everywhere
- Inverting the classroom, Assertion/Evidence
- Educational video games
- scratchoff (IFAT) forms for quizzes and exams. Also, PollEverywhere.
- video presentation
- 90 sec talks
- group Weather Discussions
- Data and experiment analysis
- Hands-on activities
- on-line discussions
- Socratic Discussion - A concept is introduced by the instructor, and then taken to small groups to discuss, before then debriefing to a wider room.

Upper-Level Undergraduate Courses

- Practical Group Labs
- Daily Quizzes
- Forecast discussion
- I use a lot of POGIL (process oriented guided inquiry) lessons I have developed
- Independent work on a worksheet, followed by sharing and discussing solutions as a class (my indicated response is "frequently" for this // field trips/experiential learning - "rarely" for non-field courses)
- term project divided into milestones
- Collaborative worksheets
- Group Discussion Questions and scenarios: I post a multiple choice question on the screen, students discuss in their groups, each group comes up with an answer and then all groups hold up a card with their answer. We then have a class discussion based upon group answers.

- worksheet examples
- In class exercises (I assume these are lecture tutorials?)
- I frequently lecture and ask questions as I lecture so that students are engaged. I also provide Active Learning exercises in which problems are handed out in class and worked through during the period.
- Hands on demonstrations
- hands-on group work
- Group presentations
- Real-time data analysis and forecasting
- PollEverywhere (clickers)
- Problem-based learning
- Daily Quizzes
- Discussions lead by students
- Research and project designs, peer review/feedback
- student led lectures

Graduate Level Courses

- Active Learning Teaching Demos
- In class coding workshops
- I frequently lecture and ask questions as I lecture so that students are engaged. I also provide Active Learning exercises in which problems are handed out in class and worked through during the period.
- hands-on labs
- Real-time data analysis and examples
- Discussions lead by students
- student presentations
- student led paper/topic discussions