5-10 min	Role-Playing	Students are asked to act out a part. In doing so, they get a better idea of the concepts and theories being discussed. Role-playing exercises can range from simple to complex.	*Biology* - Each student is assigned a scientist who had a role in developing the birth control pill. They must research the scientist on their own and write 350 words arguing that their scientist deserves the most credit for bringing about the birth control pill. They will use their research and written piece to verbally convince their classmates of their scientist's contributions.
10 min	Case Studies	Use real-life stories that describe what happened to a community, family, school, industry, or individual to prompt students to integrate classroom knowledge with real-world situations, actions, and consequences.	*Mathematics* – [Instructor provides necessary data] "Using this data, set up and solve a differential equation describing the action of the wind on the Tacoma Narrows Bridge. Use this information to explain why the bridge collapsed."
10 min	*Inquiry-Based Learning	Students use an investigative process to discover scientific or engineering concepts for themselves. After the instructor identifies an idea or concept for mastery, a question is posed that asks students to make observations, pose hypotheses, and speculate on conclusions. Then students are asked to tie the activity back to the main idea/concept.	*Chemistry* – Before electroplating zinc onto the surface of a penny, ask students to predict what will happen. After giving students time to reflect and explain their observations, change the scenario – "What will happen when the Zn-plated penny is heated?"
20 min	Peer Review	Students are asked to complete an individual homework assignment, paper, or project. On the day the assignment is due, students submit a copy to one or two classmates. Each student then gives constructive feedback (e.g., corrects mistakes in problem-solving, makes suggestions about improving argumentation, etc.)	*Biology* - Students are assigned a population biology homework problem set. They exchange their work with a peer and are given a rubric and/or answer key. Students grade and/or give constructive feedback on their peer's work. They submit their peer feedback to the instructor for verification before giving back to the author.
20 min	Jigsaw	A general topic is divided into smaller, interrelated pieces. Student groups are assigned one of the pieces to review/confirm knowledge. Then the groups "jigsaw" so that there's a representative from each piece in each new group; students then teach each other about their piece.	*Chemistry* - Students are assigned to read one of three recent journal articles on biodegradable polymers for tissue scaffolding. After discussing the study design with their "home groups," students split into new groups and share the results of their paper, and its strengths and weaknesses with each other.

* = Discussed during seminar

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5-10 min	*Practice Expert Problem-Solving Skills	Have students work in pairs or groups. Provide a worksheet that outlines an **ill-defined problem** and a list of questions that an expert would ask him/herself to approach the problem.	*Mathematics* – "What is the longest metal pole one can move into a room without bending or breaking it? ○ Room is 30' x 20' rectangle ○ Room has one entrance at midpoint of 30' wall ○ Hallway & doorway leading to room are 5' wide" *Questions to ask students:* • What is the question asking (what is the deliverable?)? • What are the important pieces of information given? • What pieces of information are extraneous? • What info is missing, but needed to solve this? How will you get it? • What are the assumptions you need to make? Are they reasonable? • What course concepts are relevant to this problem? How will you use them to solve the problem? • Activate relevant prior knowledge within the current course or from past courses. How does this relate to [*insert concept here*]? • What is the first step/how would you set up the problem? • Look at your answer. Is it reasonable?
5-10 min	Concept Maps	Direct students to create a concept map in pairs or small groups. Concept maps represent networks of nodes and links. Nodes are labeled boxes representing concepts; nodes are connected by links (lines connecting the nodes that are defined by verbs). Call on pairs/groups to share their concept map using a document projector.	*Biology* – "Create a concept map to connect your understanding of the following terms: natural selection, Hardy-Weinberg equilibrium, Mendelian genetics, allele frequencies, and evolution. Include connecting phrases between map items."

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5 min	Think-Pair-Share	Have students answer a question individually, then compare their answers with a partner and synthesize a joint solution to share with the class.	*Physics* - Solve the following problem [given]. Turn to a neighbor and compare your answer, come to a consensus and be ready to share your answer with the full group. [Insert problem here] Which concept applies to the above problem? a. Course concept 1 b. Course concept 2 c. Course concept 3 d. I don't know
5 min	Brainstorming	Introduce a topic or problem and then ask for student input. Give students a minute to write down their ideas, and then record them on the board.	*Mathematics* – "Write down any relevant results that we know, and questions we might need to answer, in order to prove Fermat's little theorem."
5 min	*Set It Up	After providing students with a quantitative problem, ask them to solve it using only variables and units, emphasizing the problem-solving process rather than a specific numerical answer. For example, you could ask students to identify which course concepts are relevant to finding a solution, what assumptions need to be made, or what information is missing and how they might calculate it.	*Physics* – "Using the provided circuit diagram, label the different components (resistors, capacitors, battery, etc.) with variable names. Using Kirchoff's circuit laws, set up the equations you would use to calculate the current through the circuit at the points identified in the diagram using only variables."

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Active Learning Activity Table

Time-frame	Activity Title	Description	Example
1 min	Minute Paper	Students write on a notecard or sheet of paper the key points from the day's lesson.	*Physics* – "This week we discussed statics. In one minute, list as many of the conditions for static equilibrium that you can remember."
1 min	Muddiest Point	Students write on a notecard or sheet of paper the concept or idea they are still struggling with the most	*General* – "On your notecard, write the one concept you are having the most trouble understanding, and which you could use more practice on."
1 min	*Application Card	Students are provided with a task that challenges them to apply a concept or skill to a situation they have not encountered before, or challenged to generate examples that illustrate a concept to demonstrate transfer of knowledge.	*Mathematics* – [Give students graph of $y=sin(x)$.] "On top of this graph, plot the graph of $y=sin(2x)$."
5 min	Self-Assessment Quiz	Students take a quiz (typically ungraded), or complete a checklist of ideas to determine understanding of a concept. This can be used at the beginning of the semester, or the beginning of a chapter for students to gauge prior knowledge and identify misconceptions. This can also help the TA target where to spend the most time.	*Chemistry* - Provide increasingly difficult questions to gauge a student's knowledge of a particular area: 1.) Identify the functional groups present in the Lewis structure shown below [provide these]. 2.) Draw the structure of 2,3-dimethyl-3-ethylcyclohexane. 3.) Identify the intermolecular forces that would govern the characteristics of the following molecules [provide these]. 4.) Predict the products of the reaction between 1-butene and hydronium ion.

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