

Instructional Design Strategies and Approaches

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Step-Action Table for Instructional Approaches and Evidence-Based Teaching Strategies

Look down the list for what you want students to be able to do, and then see the pages that describe the approach or strategy.

If you want students to...	Consider	See Page(s)
Instructional or Learning Approaches		
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An Explanation... This “catalog” is an overview of many different teaching and learning approaches and is provided to get your cognitive juices flowing. Of course there are many other ideas and approaches: teaching and learning is fundamentally a human experience, there are infinite varieties.

This document draws heavily on the organization and ideas contained in Drummond’s (1995) oft-cited paper, “A Brief Summary of Best Practices in College Teaching.” We used Drummond’s structure as a starting place, and then created a step-action table adding several other approaches. Where practical, we cited leading references on the topic. Our hope is that in this format, you can find what you are looking for easily.

These are all evidence-based approaches and so you may take comfort in the fact that they work; or at least, that at some point in time they worked.

In teaching the next generation we are entrusted with a precious duty, may we fulfill our part with excellence!

Classroom Interactive Approaches

Approach:	Description:	Advantages/Indications:	Disadvantages:
Response Clickers (Caldwell, 2007)	<p>Use response clickers to have students give you their answers for a question.</p> <p>Great for getting a sense for your audience’s current level of knowledge on a topic.</p> <p>Great for gauging audience opinions regarding a topic. This can be a nice starting place to discuss a personal value or a professional choice.</p>	<p>Great for having learners construct responses and getting sense for where the class is.</p> <p>Great for interacting with a large group.</p> <p>Very effective with multiple choice questions.</p>	<p>Only 99% accurate when capturing data. So, care must be taken when using the scores in an accountable way (e.g., attendance, quizzes). Several professors used this approach effectively, but there is some work in making sure records are accurate at the end of the Module.</p>
Solicit Examples (Drummond, 1995)	<p>During the course of a lecture, have students describe examples of the thing you are talking about. This is particularly effective if you are teaching facts or concepts.</p>	<p>Right in line with best-practice for teaching facts or concepts.</p>	<p>Can be trifling or slowing. The art is in keeping the pace going in the class and in picking a moderately difficult example. Too hard: you lose the learners; too easy, you also lose the learners.</p>
Panel Discussions (Carpenter, 2006; Murugan et al., 2016)	<p>Bring in panel members who are either: (a) members of a target community, or (b) experts in a given topic or practice.</p> <p>The instructor serves as facilitator.</p>	<p>Phenomenal for affective objectives and for building compassion.</p> <p>Great for professional values transmission.</p>	<p>Can be inefficient. Doesn’t point to specific performance objectives directly.</p> <p>Can be very non-directional, frustrating achievement-oriented learners. The art is keeping the panel on task.</p>
Turn to Partner and Pause (King, 1990)	<p>Have students turn to the person to their side and briefly discuss the point. Brevity is the keyword here. Give the partners enough time to discuss briefly, then bring the group back to order.</p>	<p>This is one of the easiest interactive approaches to execute.</p> <p>That action of actually talking about a concept between two partners is very powerful.</p>	<p>It is easy to lose control for a few minutes. Care must be taken to define exactly what you want learners to do.</p>
Story Telling (Schank, 1990)	<p>Stories, metaphor, and myth catch people deeply within, so no longer are listeners functioning as tape recorders subject to the above information overload limits. What human beings have in common is revealed in myth; stories allow the listener to seek an experience of being alive in them and find clues to answers within themselves.</p>	<p>Connects with students in two ways: we understand life through stories, and it provides a context for the learned content.</p>	<p>Must be careful to keep the story succinct and relevant. Our students do not suffer bad story tellers lightly. But, a well told short story is excellent.</p>
Google Forms Survey (EVMS, 2013)	<p>This is when the students or a group have a link to a google forms survey. They quickly complete the survey and it can be collated and used later in the session.</p>	<p>This is great for getting students—especially in teams—to construct answers. You can provide feedback on representative answers.</p>	<p>You have to watch the pace, and there is a small amount of complexity to making this work. (Work with your instructional designers to make this work.</p>
Flipped Classroom	<p>Here, the sequence of the classroom experience is changed, students first see a video of the lecture, then the classroom is used for application or practice.</p>	<p>This is novel, and usually interesting.</p> <p>Allows for practice and feedback.</p>	<p>Requires that you develop a quality condensed video prior to class.</p>

Group Discussion Triggers

Approach:	Description:	Advantages/Indications:	Disadvantages:
Short Readings (Drummond, 1995)	Have students read before or during the meeting. Use the content as a discussion starter. Particularly effective for presenting contrasting views on an issue.	Frames the group conversation, gives it a quick start.	Can bias the discussion. If an affective objective, make sure to tell the students what it is. There is a risk of felt-manipulation in this approach.
First Person Experience (Tuckman & Monetti, 2011)	Have students tell of their experiences. Particularly effective when discussing LGM or Service Learning experiences. (e.g., "In your Service Learning project, describe the leadership and followership structure. Is it effective? Does the volunteerism aspect change the way leaders lead?")	People love to talk about their experiences, and it is reflection on those experiences, coupled with feedback from a mentor and peers, the results in learning advance.	By definition, these are qualitative impressions. Sometimes, they become too lengthy or emotion can flood the group experience in counter-productive ways. The art here is being able to sense what is valuable and move the discussion appropriately.
Task Review (Morrison, Ross, Kalman, & Kemp, 2011)	Similar to "first person experience", this is reflection on the actual performance of a task: what went well, what didn't go well, what can be improved.	This is perfect when the learned content is procedural. The review cognitively reinforces the stepwise performance.	Not many downsides. Sometimes, if a performance was very poor, the learner cannot bring to mind salient steps. In this case, review just deepens the pain.
Self-Assessment Questionnaire (Keller, 2009)	Have students complete a brief survey. This can be about their perceptions of their confidence in the subject matter, or affective elements, or opinions. This is a great discussion starter. You can use clicker questions effectively in this way, as well.	People love to talk about their opinions or perceptions. This will likely engage your students.	Be careful to include quieter students. When talking about opinions, you will attract your more forceful students to volunteer information. This is a situation where you may want to choose responders at random. One caution here: sometimes students strongly do not want to speak, so there is some risk if you randomly choose.
Case Studies (Dunne & Brooks, 2004)	Case studies are, of course, phenomenal platforms for group discussion. Particularly if the case is relevant to the topic at hand.	We are training students to be physicians, so cases have the value of placing the learning in the context of practice. See all the information about cases provided in InstructorTools.Info.	There aren't many downsides. One important word: Don't attempt to do too much in a case study. If students have a complaint about case studies, it is that they sometime "drag on and on." They can be involved, but you must watch the pace.

Reflective Responses to Learner Contributions

Approach:	Description:
Paraphrase (Grabowski, 2003; Wittrock, 1974)	While remaining alert to both the intellectual and emotional aspects of learner contributions, rephrase the underlying message the learner is sending in one's own words, not the learner's words. This especially applies when the learner says something new, something more than the commonplace. Avoid 'parroting' the learner's words or routinely beginning, 'I hear you saying' Both are irritating and condescending. Example: Student says, 'I am confused. I still don't know what you want from me.' Paraphrase: 'You see no way to start, huh?'
Parallel Personal Comment (Grabowski, 2003)	Without changing the topic or bending it in the slightest, talk about one's own current feelings or a past experience that matches exactly what the learner has said. The intention is to convey parallel aspects of yourself that validate the other's perspective or confirm your understanding of what the other is talking about. Usually statements start with 'I... ' 'I was confused about that myself when I first read it.' 'I want to hear more about that.'
Leading Query on Learner's Topic (Tuckman & Monetti, 2011)	Ask for clarification of aspects of the comment. Dig deeper into the student without bending or shifting it away to one's own agenda. Such responses include, 'Where does it break down?' 'Could you elaborate or give an example?' and references to others, 'Who can build on what she is saying?'

Modeling Desired Attributes for Students

Approach:	Description:
Openness to Experience (Ambrose, Bridges, Lovett, DiPietro, & Norman, 2010)	Openness to Experience in the Here and Now: Being truthful, personally in touch with one's own feelings and current experience.
Being Part of Change (Ambrose et al., 2010)	Incorporation into Oneself of the Process of Change: Openness to learning opportunities, belief in oneself as an effective learner, and modeling learning, and its accompanying mistakes, visibly to learners.
Unconditional Positive Regard (Ambrose et al., 2010; Keller, 2009)	Unconditional Positive Regard for Others: Deep trust in the underlying goodness of each person, despite how they appear, and the explicitly expressed belief in each learner's ability to learn and grow.

Generative/Active Learning Approaches

Approach:	Description:	Advantages/Indications:	Disadvantages:
Describe (Grabowski, 2003; Wittrock, 1974)	Use response clickers to have students give you their answers for a question.	Great for having learners construct responses and getting sense for where the class is. Great for interacting with a large group. Very effective with multiple choice questions.	Only 99% accurate when capturing data. So, care must be taken when using the scores in an accountable way (e.g., attendance, quizzes).
Reflect and Respond (Grabowski, 2003; Wittrock, 1974)	Ask students what was interesting, surprising, important.	Simple to execute, gets students manipulating the new information cognitively.	Sometimes students see generative strategies as a waste of time—unnecessary work. Be careful how you employ them and make sure they understand the goal of the activity.
Counter (Drummond, 1995)	Get students to consider arguments or reasons why a presented fact, concept or practice may not be optimal.	Creating a counter argument requires a learner to process the affirmative argument or fact at a deep level. Great for affective objectives or controversial procedures.	There is an art to this, but done thoughtfully, this is a powerful approach.
Analogy (Grabowski, 2003; Wittrock, 1974)	Have students describe how the new concept, process, or fact is similar to one they already know and apply.	Again, this is an effective generative learning approach. It requires learners to deeply process the presented material and then search for analogous concepts.	Students may not feel up to the task. This may be best assigned to teams.
Procedure (Morrison et al., 2011)	Have students describe a procedure that would get at the challenges implicit in the content.	Can be a great lead-in to a procedural activity physicians commonly employ.	This only works when it is appropriate and relevant.
Justify (Drummond, 1995)	Have students defend a theory or an action against obvious criticism.	Excellent when you are attempting to get students to buy a new theory or to adopt an affective stance. Very effective in affective instruction.	Students may not feel up to the task. This may be best assigned to teams.
Define (Grabowski, 2003; Wittrock, 1974)	Have students define—not just name—a process or fact they have seen demonstrated. Have them do it in their own words, that is, define the real meaning to them.	Great for concepts or facts.	Can be seen as make-work. The art is making this interaction meaningful.
Generalize (Morrison et al., 2011; Perkins, 1992)	Ask students how they might generalize the learned process or content to other areas. Especially effective with diagnostics or process learning.	This activity is powerful in facilitating learning transfer to other situations.	May not be helpful of generalizations are not fairly obvious. Asking learners to do something they will not successfully accomplish is most often counter-productive.
Theorize (Morrison et al., 2011)	Have students articulate a theory that encompasses a relationship they have witnessed.	Forces students to observe phenomena, and then do the deep cognitive work of placing predictive hypotheses on them.	Could be off-putting if a theory does not come to mind.

Other Generative/Active Learning Approaches

Approach:	Description:	Advantages/Indications:	Disadvantages:
Construction Spiral <i>(Smilkstein, 2002)</i>	Pose problem questions in a three-step cycle: (1) each individual writes down their own thoughts, (2) all share in small groups of three, (3) compile their answers in an online Google Form that may be displayed and discussed as a class.	Encourages individual effort. Gets the benefits of small group interaction. Allows for feedback on answers.	Takes work to coordinate presentation and synthesize Google Form responses. May not benefit from the discipline of set teams.
Round <i>(Drummond, 1995)</i>	Each person is given a 2-3 minute opportunity to share with a small group. A member may pass.	Let's learners hear others' thoughts while processing own. Allows learners opportunity to formulate as the group processes. Also, allows students who are more retiring to be heard.	If students don't have anything to say, the experience can be painful.
Brainstorm <i>(Tuckman & Monetti, 2011, p. 342)</i>	Can be done in large group (with difficulty) or small group. Solicit and compile alternative possibilities without judgements.	Gets groups working together, encourages synergistics creativity. Usually energizes a group.	If the topic isn't worthy, or has been hashed over too many times, or the students aren't in the mood; the brainstorming session can go terribly.
Concept Models <i>(Jonassen, Howland, Marra, & Crismond, 2008, pp. 62-64)</i>	Given handouts that ask a series of leading questions, students work in small groups to figure out how something works or build a conceptual model. They make their own diagrams and record their own observations.	It is a powerful generative strategy to have students construct models of phenomena. Typically, it is thought that the creation of working models demonstrate a deep level of understanding of concepts or problems.	If the conceptual problem is outside the range of the student or team, such an exercise can be very frustrating. So it is important that the concept be within grasp. Alternatively, it must be difficult enough to excite energetic problem solving. Key: choose a moderately difficult concept.
Use Simulations and Games <i>(Alessi & Trollip, 2005; Gee, 2007)</i>	By creating circumstances that are momentarily real, learners can practice coping with stressful, unfamiliar or complex situations. Simulations and games, with specific guiding principles, rules, and structured relationships, can last several hours or even days.	These are active by definition. Provides students opportunities to interact with complex models in a safe or enjoyable way.	Not indicated for simple fact or conceptual knowledge. Except when the game provides an enjoyable way to repeatedly interact with important facts.

<p>Use Games (Gee, 2007)</p>	<p>Games may be used to help practice facts, concepts, or principles and rules.</p>	<p>Games provide an opportunity to get students into situations in which they can imagine themselves in a desired future (and so is motivational), or can interact with procedural skills in an enjoyable way.</p>	<p>If a game is seen as “beneath” the learners or irrelevant, it will be seen as a waste of time.</p>
<p>Peer Teaching (Bonwell & Eison, 1991; King, 1990)</p>	<p>By explaining conceptual relationships to others, tutors define their own understanding.</p>	<p>Can be used during clicker sessions when several get the wrong answer. Have students interact with each other and generally consensus will build around the right answer.</p>	<p>May not get to the right answer, carrying the risk of solidifying the wrong answer. In this case, rapid correct feedback is essential.</p>
<p>Learning Cells (Bonwell & Eison, 1991; King, 1990)</p>	<p>Each learner reads different selections and then teaches the essence of the material to his or her randomly assigned partner.</p>		
<p>Exams (Bonwell & Eison, 1991; King, 1990)</p>	<p>Scheduling an exam stimulates learners to study. Completion, true-false, and multiple choice force memorization of facts and statements. Essay examinations force an overall general concept of the material. It is a rather obvious way to involve learners in doing something and getting them to think about what they are doing.</p>	<p>Interestingly, it is the learner’s response on the exam—not the correct answer—that is remembered months later.</p>	<p>Obvious...</p>

Encouraging Self-Responsibility and Problem Solving

Approach:	Description:
<p><i>Involve Learners in Mutual Planning</i> (Bransford, Brown, & Cocking, 2000)</p>	<p>People tend to feel committed to any decision in proportion to the extent to which they have participated in making it.</p>
<p><i>Involve Learners in Diagnosing Their Own Needs for Learning</i> (Bransford et al., 2000)</p>	<p>A problem to solve is meshing the needs the learners are aware of (felt needs) with the needs their organizations, vocation, or society has for them (ascribed needs). One method is to present a model of competencies, which reflects both personal and organizational needs, so that the learners can identify the gaps between their current performance and where the model specifies they need to be. Another method is to compile the totality of learner understandings (and misunderstandings) about the current topic, have them represent their experience in some tangible form, and then develop questions that come to mind. These questions then can guide further inquiry.</p>
<p><i>Involve Learners in Formulating Their Learning Objectives</i> (Bransford et al., 2000)</p>	<p>Promote attainment of at least a portion of the course requirements through flexible contracts by which the learner:</p> <ol style="list-style-type: none"> 1. translates a diagnosed learning need into a learning objective, 2. identifies, with help, the most effective resources and strategies for accomplishing each objective, 3. specifies the evidence that will indicate accomplishment, and 4. specifies how this evidence will be judged or evaluated.
<p><i>Involve Learners in Evaluating Their Learning</i> (Bransford et al., 2000)</p>	<p>Teachers and learners together work to find out what learning occurs within the unique context every course presents. Classroom Assessment Techniques gather information to guide the adjustments both teachers and learners need to make to improve learning. (32) In the end, if people are to become independent, lifelong learners, they must learn to take full responsibility for their learning.</p>

Case-Based Learning

Approach:	Description:	Advantages/Indications:	Disadvantages:
Worked Cases (Qiao et al., 2014)	Provide students with (typically) a paper-based description of a case that includes all the relevant dimensions, including how the case was solved.	Great for getting students to focus on the foundational science required to work the case.	Not best for eliciting student medical responses during the course of a case.
Interactive Cases (Berman, Durning, Fischer, Huwendiek, & Triola, 2016)	Provide students with the beginnings of a case and have them make decisions about diagnostic, treatment, and follow-up actions. You can provide feedback as often or as infrequently as necessary depending on the developmental stage of the learners and the objectives of the case.	Great for having students perform some of the functions of a physician in problem solving.	Not best for novice students, though a carefully constructed case targeting students' development level can be effective.
Parenthetical Cases	Here, you simply mention a case as an illustration of a point. This may or may not include virtual family members.	Good for tying into prior extensive discussion of a case relevant in the current context. Good for placing a particular lecture point in a clinical context.	Not good for involved cases or where discussion is important. Not good for eliciting physician responses, except as short answers.
Mini-Cases	These are small cases that illustrate a point. Again, may or may not include virtual family members.	Great for relatively simple clinical phenomena.	Not good for involved cases or where discussion is important.
Authentic Integrated Experiences*	Here, students interact with limited-scope real world challenges. The goal is to get students solving problems from a multidisciplinary perspective, matching the context of job challenges.	Great for having students practice discrete skills in the context of authentic problems. These are inherently motivating experiences, particularly when students are interacting with potential future employers.	These experiences are not good for assessment of pre-identified skills since the skills may not be required in the particular challenge.

*UVA's McIntire School calls these 'Integrated Core Experiences.'

Reflective Learning Approaches

Approach:	Description:	Advantages/Indications:	Disadvantages:
<p>Journaling (Barksdale & Nasir, 2009)</p>	<p>Typically, journals are set up in Blackboard and students record their perceptions related to experiences or to structured questions.</p>	<p>These are active by definition, and are great for helping students solidify their opinions or perceptions.</p> <p>These do not take much labor to set up.</p> <p>Can be used to qualitatively study group responses to a phenomenon.</p>	<p>Very difficult to grade... In fact, few try. A student's perceptions are generally thought to be their perceptions.</p>
<p>First Impression (Menard & Ratnapalan, 2013)</p>	<p>This is a journaling technique in which students describe their first impressions of an experience without deep processing.</p> <p>Typically, the instructor will prompt students to revisit the first impression after having greater exposure to the topic. Students are encouraged to note differences in perspective.</p>	<p>Particularly effective when dealing with attitudinal objectives.</p> <p>Helpful in having students either:</p> <ul style="list-style-type: none"> • Notice how perspectives have changed over time • Or, revisit more idealistic perspectives recorded earlier. 	<p>First impressions are the product of many things... Students may not always respond in expected ways. Care must be taken if a particular outcome is desired.</p>
<p>Small Group Response (Walton, 1997)</p>	<p>Here, learners are give an issue or problem to respond to in a small group setting.</p>	<p>These are pretty easy to execute and small groups have a way of making most useful things work, even if they are not well designed.</p>	<p>Sometimes, small group responses are too personal. Care must be taken to make the things that are said in small group to stay in small group. It must be seen as a safe place to share.</p> <p>Small groups are also more capable than large groups at arriving at a shared opinion that does not reflect reality.</p>
<p>Paired Response (King, 1990)</p>	<p>Students are told to speak to their partner about some issue. This is usually done in large group activities, but offers a moment to stop and contemplate.</p>	<p>Easy to execute. Great for initial processing.</p>	<p>Not indicated when deep reflection or extended processing is required.</p>

Team Learning Approaches

Approach:	Description:	Advantages/Indications:	Disadvantages:
<p>Official TBL (Michealson & Sweet, 2008)</p>	<p>Team-Based Learning is an evidence based collaborative learning teaching strategy designed around units of instruction, known as “modules,” that are taught in a three-step cycle: preparation, in-class readiness assurance testing, and application-focused exercise. A class typically includes one module. See http://www.teambasedlearning.org/definition/</p> <p>Four principles underlying Team-Based Learning Team-Based Learning implementation is based on four underlying principles (Michaelsen & Richards 2005):</p> <ol style="list-style-type: none"> 1. Groups should be properly formed (e.g. Intellectual talent should be equally distributed among the groups). These teams are fixed for the whole course. 2. Students are accountable for their pre-learning and for working in teams. 3. Team assignments must promote both learning and team development. 4. Students must receive frequent and immediate feedback. 	<p>This is a proven and reliable way to conduct team learning, and the literature supporting it is strong.</p> <p>Further, the detailed directions for conducting these experiences is clear.</p> <p>The formal methodology for constructing questions (IRAT and TRAT) results in a high level of student engagement. (NOTE: The IRAT and TRAT scores are supposed be used in student grading)</p>	<p>There is a limited cost associated with running a true TBL session.</p> <p>Sometimes, the experience can be perceived by learners as “contrived.”</p> <p>The use of Google Forms to capture group responses is not part of the process.</p> <p>Question construction must be precise, and you must provide for time for appeals.</p>
<p>Team Centered Learning (Robison, 2013)</p>	<p>Research on group learning goes back much further than TBL, and there are several ways to do it effectively. Using many of the principles of TBL, we have effectively implemented team experiences that utilize Google Forms to collect team responses and then the class may interact with them as they see them. There are an infinite number of ways to do this. Coordinate with the instructional designers for the approach that best suits your vision.</p>	<p>These do not have costs associated with them, and students typically enjoy the sessions.</p> <p>The use of the Google Forms provides a ready resource for feedback that the whole class benefits from.</p>	<p>In practice, these have been less disciplined than the formal TBLs, and this lack of discipline reduces the learning effectiveness.</p>

Evidence-Based Strategies for Teaching Different Types of Performance

Strategies for Teaching Facts (Morrison et al., 2011, p.155)

A fact is a statement of the relationship of two things (e.g., “A day is 24 hours long”). Facts can only be recalled, they have no specific application.

Factual Content	Example	Initial Presentation and Generative Strategy
Concrete facts	McIntosh apples are red.	Show a McIntosh apple and ask for the color. Allow for practice/rehearsal by showing the color and asking which apple is that color, or by naming the apple and asking for its color.
Abstract facts	The airport code for Memphis is MEM.	Show luggage tag with MEM and explain that it indicates “Memphis.” Allow for practice/rehearsal by showing the tag or the word Memphis and asking for the city or code.
Abstract facts	It’s best to wear safety goggles when hammering.	Show students a picture or model of someone hammering and wearing safety goggles. Have student explain why this safety rule is important.
Lists	The lines of the musical staff are EGBDF.	Show a musical staff with each line labeled. Provide students with the mnemonic to practice, “Every Good Boy Does Fine.”

Strategies for Teaching Concepts (Morrison et al., 2011, p.157)

A concept is a category used to group similar ideas or things (e.g., needles) to organize knowledge. They are representations that reflect the structure of the real world. There are two things learners do with concepts: a) recall (e.g., “state the definition of...”), or b) application, such as identifying new examples that fit in the category. You can see this application idea in identifying disease conditions within categories.

Concept Example	Strategy	Initial Presentation and Generative Strategy
Open-end Wrench	Integration	Present the student with concept name, definition, and best example of concept. Provide the student with a catalog of tools and ask the student to identify examples of open-ended wrenches.
Box wrench	Organizational	Present the student with the concept name, definition, and best example of concept. Ask the student to list the characteristics of a box wrench and compare the box wrench to other wrenches and pliers.

Strategies for Teaching Principles and Rules (Morrison et al., 2011, p.159)

A principle or rule is a statement that expresses a relationship between concepts, such as “The sum of the angles of a triangle is 180 degrees.” Performance with a principle or rule involves either recall or application.

There are two approaches to principle and rule learning. First, RULEG, is stating the rule and then providing an example. The second, is EGRUL, in which you provide an example and then ask the learner to generate the rule. Generally speaking, EGRUL requires more active processing on the part of the learner.

Rule Example	Strategy	Initial Presentation and Generative Strategy
Brush painting requires 1/3 more labor than spray painting	RULEG and integration	State the rule and show examples. Have the learner complete a table illustrating the required time to paint using each method.
A higher gear-ratio is harder to pedal	EGRUL and integration	Have students try pedaling three different gear ratios. Ask the student the relationship between the three gears. Have the learner complete a table indicating the relative effort needed to pedal each gear ratio.
Fusion welding is used when the base metal and weld metal colors must match.	EGRUL and organizational	Show examples of fusion welding and bronze welding. Ask the student to generate the rule. Ask the student to identify the visual differences between the two. Have the student develop a decision tree for selecting the welding process.
Metal expands when heated.	EGRUL and elaboration	Show an example of a cookie sheet warping in an oven. Ask the student to explain what happened. Have the student explain why a bridge has expansion joints. Have the student predict the effect of temperature on the expansion joints.

Strategies for Teaching Procedures (Morrison et al., 2011, p.161) (Morrison et al., 2011)

A procedure is a series of steps to accomplish a specific task. Here the learner will either recall the steps or perform the procedure.

Procedure Example	Strategy	Initial Presentation and Generative Strategy
Removing and installing piston rings.	Demonstration, organization, elaboration, practice	While watching a video recording of the process, students are encouraged to take notes on each step. After viewing the video, students are encouraged to develop a mental image of the positioning of the piston ring expander for removing and installing the rings. Then they are encouraged to practice the procedure on an engine.
Calculating the amount of paint needed to paint a house.	Demonstration, organization, elaboration, practice	Students are presented with a worked example that illustrates how to calculate the amount needed using the square footage of the house and coverage of the paint. Learners are then encouraged to paraphrase the steps for doing the calculation. Last, they are given three examples and asked to calculate the amount of paint needed. When they complete an example, they compare their work against a worked example of the problem.

Strategies for Teaching Interpersonal Skills (Morrison et al., 2011, p.164)

Interpersonal skills involve with communication skills primarily. The primary emphasis is on application—can the student perform the skill?

Interpersonal Skill Example	Strategy	Implementation
Facilitate a group problem-solving meeting.	Model	Show students a video of a facilitator demonstrating the appropriate behaviors for a group. Have students identify the key behaviors and when they are used.
	Verbal and imaginal models (organization)	Provide students with several instances that require the application of a facilitative behavior, and ask them to imagine how they would react to these.
	Mental rehearsal (elaboration)	Provide opportunities for each student to facilitate a group as part of a role play.
	Overt practice	

Prescriptions for Teaching Attitudes (Morrison et al., 2011, p.164)

An attitude is a belief or value associated with a behavior or response. Here we help learners develop mental or imaginal models, we also expose them to like-respected role models exemplifying the desired attitude.

Attitude Example	Strategy	Implementation
Discussion of work projects with others may be giving away proprietary information.	Model	Have two students role-play a casual conversation between two individuals from two different companies in which each describes a problem he or she is having with a work project.
	Verbal and imaginal models (organization)	Have students identify the type of information exchanged.
	Mental rehearsal	Provide students with several instances in which (elaboration) they might inadvertently give information away, and ask them to imagine how they would react.
	<u>Overt practice</u>	Provide opportunities for each student to practice the appropriate behaviors.

Peer Teaching References

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