

The following pages provide a summary of seven "Principles of Teaching" based on scientific research findings, including strategies and methods for implementing them in the university classroom, as presented in the reference:

Principle 1: Students' Previous Knowledge May Facilitate or Obstruct the Learning Process

Students come to our courses with knowledge, beliefs, and impressions they have acquired either from other subjects or through daily life. The presence of previous knowledge influences how they select and interpret what they learn in the classroom. If students' previous knowledge is strong, accurate, and activated at the right time, it provides a solid foundation for building new knowledge. However, if this knowledge is limited and insufficient for the task, or if it is activated inappropriately or inaccurately, it can interfere with or obstruct the learning process.

Methods for Assessing Students' Previous Knowledge	1. Talk to Colleagues
	2. Administer a Diagnostic Assessment
	3. Have Students Assess Their Own Previous Knowledge
	4. Use Brainstorming to Reveal Previous Knowledge
	5. Assign a Concept Map Activity
	6. Look for Patterns of Error in Student Work
Methods for Activating Correct Previous Knowledge	1. Use Exercises to Generate Students' Previous Knowledge
	2. Explicitly Link New Material to Knowledge from Previous Courses
	3. Explicitly Link New Material to Previous Knowledge from Your Own Course
	4. Use Analogies and Examples That Connect to Students' Everyday Knowledge
	5. Ask Students to Reason on the Basis of Relevant Previous Knowledge

Methods for Clarifying Insufficient Previous Knowledge	1. Identify the previous Knowledge You Expect Students to Have
	2. Remediate Insufficient Prerequisite Knowledge
Methods for Assisting Students in Distinguishing (Inappropriate Previous Knowledge)	1. Highlight Conditions of Applicability
	2. Provide Heuristics to Help Students Avoid Inappropriate Application of Knowledge
	3. Explicitly Identify Discipline -Specific Conventions
	4. Show Where Analogies Break Down
Methods to Correct (Incorrect Knowledge)	1. Ask Students to Make and Test Predictions
	2. Ask Students to Justify Their Reasoning
	3. Provide Multiple Opportunities for Students to Use Accurate Knowledge
	4. Allow Sufficient Time

Principle 2: The Way students Organize Knowledge Affects How They learn and Apply What They Have Learned

Students naturally connect pieces of knowledge. When these connections form well-organized and understandable knowledge structures, students can retrieve and apply their knowledge efficiently and effectively. Conversely, if knowledge is linked randomly or inaccurately, students will struggle to retrieve and apply it appropriately.

Strategies for Preparing and Developing Cognitive Structures	1. Create a Concept Map to Analyze Your Own Knowledge Organization
	2. Analyze Tasks to Identify the Most Appropriate Knowledge Organization
	3. Provide Students with the Organizational Structure of the Course
	4. Explicitly Share the organization of each lecture lab or Discussion
	5. Features Use Contrasting and Boundary Cases to Highlight Organizing
	6. Explicitly Highlight Deep Features
	7. Make Connections Among Concepts Explicit
	8. Encourage Students to Work with Multiple Organizing Structures
	9. Ask Students to Draw a Concept Map to Expose Their Knowledge Organizations
	10. Use a Sorting Task to Expose Students' Knowledge Organizations
	11. Monitor Students' Work for Problems in Their Knowledge Organization

Principle 3: Motivation plays an important role in identifying, directing, and reinforcing what students do to learn

As students start studying at the university and gain independence over what, when, and how they learn, motivation becomes pivotal in directing, sustaining, and enhancing the quality of their learning efforts. When students find positive value in a task or educational objective, feel capable of successfully achieving the desired learning outcomes, and receive supportive input from their surroundings, their motivation toward learning is significantly strengthened.

Strategies to Instill the Value of Learning	1. Connect the Material to Students’ Interests
	2. Provide Authentic Real-World Tasks
	3. Show Relevance to Students’ Current Academic Lives
	4. Demonstrate the Relevance of Higher-Level Skills to Students’ Future Professional Lives
	5. Identify and Reward What You Value
	6. Show Your Own Passion and Enthusiasm for the Discipline
Strategies to Help Students Build Positive Expectations	1. Ensure Alignment of Objectives, Assessments, and Instructional Strategies
	2. identify an Appropriate Level of Challenge
	3. Create Assignments That Provide the Appropriate Level of Challenge
	4. Provide Early Success Opportunities
	5. Articulate Your Expectations
	6. Provide Rubrics
	7. Provide Targeted Feedback
	8. Be Fair
	9. Educate Students About the Ways We Explain Success and Failure

	10. Describe Effective Study Strategies
Strategies for Highlighting the Value of Learning and Setting Expectations	1. Provide Flexibility and Control
	2. Give Students an Opportunity to Reflect

Principle 4: How Students Achieve Perfection Stage

In order for students to reach perfection stage, they must acquire a set of complex skills, practice how to combine and integrate these skills in order to develop their ability and spontaneity to learn, and then understand the conditions and contexts in which they can apply what they have learned. Students need to learn and reinforce these three elements of perfection through practice.

Strategies for Learning and Understanding Skill Components	1. Push Past Your Own Expert Blind Spot
	2. Enlist a Teaching Assistant or Graduate Student to Help with Task Decomposition
	3. Talk to Your Colleagues
	1. Enlist the Help of Someone Outside Your Discipline
	2. Explore Available Educational Materials
	3. Focus Students' Attention on Key Aspects of the Task

	7. Diagnose Weak or Missing Component Skills
	8. Provide Isolated Practice of Weak or Missing Skills
Strategies for Building Integrated Perfect Performance	1. Give Students Practice to Increase Fluency
	2. Temporarily Constrain the Scope of the Task
	3. Explicitly Include Integration in Your Performance Criteria
Strategies to Facilitate the Transfer of Learning Impact	1. Discuss Conditions of Applicability
	2. Provide students with opportunities to apply skills and knowledge in diverse areas.
	3. Ask Students to Generalize to Larger Principles
	4. Use Comparisons to Help Students Identify Deep Features
	5. Specify Context and Ask Students to Identify Relevant Skills or Knowledge
	6. Specify Skills or Knowledge and Ask Students to Identify Contexts in Which They Apply
	7. Provide Prompts to Relevant Knowledge

Principle 5: Goal-Directed Practice Along with Feedback Enhances the Quality of the Learning Process for Students

The best learning and performance are achieved when students engage in practices that focuses on specific standards or objectives, targets an appropriate level of challenge, by sufficient quantity and frequency to achieve the performance standards. Practice should be accompanied by

feedback that relates directly to some aspects of student performance related to the specific standards of the objective, provides information that help students achieve those standards, and provided at a time that is most useful to them.

Strategies to Meet the Need for Goal-Oriented Practice	1. Conduct a previous Knowledge Assessment to Target an Appropriate Challenge Level
	2. Be More Explicit About Your Goals in Your Course Materials
	3. Use a Rubric to Specify and Communicate Performance Criteria
	4. Build in Multiple Opportunities for Practice
	5. Build Scaffolding into Assignments
	6. Set Expectations About Practice
	7. Give Examples or Models of Target Performance
	8. Show Students What You Do Not Want
	9. Reine Your Goals and Performance Criteria as the Course Progresses
Strategies to Meet the Need for Targeted Feedback	1. Look for Patterns of Errors in Student Work
	2. Prioritize Your Feedback
	3. Balance Strengths and Weaknesses in Your Feedback
	4. Design Frequent Opportunities to Give Feedback
	5. Provide Feedback at the Group Level
	6. Provide Real-Time Feedback at the Group Level
	7. Incorporate Peer Feedback
	8. Require Students to Specify How They Used Feedback in Subsequent Work

Principle 6: The learning Process is Affected by the Interaction of Students’ Current Level of Development with the Social, Emotional and Intellectual Environment of the Classroom

Students are not just mental beings; they are social and emotional beings, and they are still developing a number of intellectual, social, and emotional skills. Although we cannot control the process of growth, we can shape the intellectual, social, intellectual, emotional, and physical aspects of the learning environment in ways that are appropriate for the growth process. In fact, several studies have shown that the environment we create affects our students. A negative environment can obstruct students’ learning and performance, while a positive environment can energize them.

Strategies to Foster Student Development in a Productive Environment	1. Make Uncertainty Safe
	2. Resist a Single Right Answer
	3. Incorporate Evidence into Performance and Grading Criteria
	4. Examine Your Assumptions About Students
	5. Be Mindful of Low-Ability Cues
	6. Do Not Ask Individuals to Speak for an Entire Group
	7. Reduce Anonymity
	8. Model Inclusive Language, Behavior, and Attitudes
	9. Use Multiple and Diverse Examples
	10. Establish and Reinforce Ground Rules for Interaction
	11. Make Sure Course Content Does Not Marginalize Students

	12. Use the Syllabus and First Day of Class to Establish the Course Climate
	13. Set Up Processes to Get Feedback on the Climate
	14. Anticipate and Prepare for Potentially Sensitive Issues
	15. Address Tensions Early
	16. Turn Discord and Tension into a Learning Opportunity

Principle 7: For Students to Become Self-learners, they must learn to Monitor and Adjust Their Learning Strategies

Students may engage in many metacognitive processes in order to monitor and control their learning; for example, they may evaluate their tasks, assess their strengths and weaknesses, plan their strategies, monitor multiple strategies, and then reflect on the effectiveness and benefits of their theories. Unfortunately, students do not tend to engage in these processes on their own. As students develop the skills to engage in these processes, they acquire habits of mind that improve not only their performance but also their effectiveness as learners.

Evaluating the Current Task	1. Be More Explicit Than You May Think Necessary
	2. Tell Students What You Do Not Want
	3. Check Students' Understanding of the Task
	4. Provide Performance Criteria with the Assignment

Assessing the Student's Strengths and Weaknesses	1. Give Early, Performance - Based Assessments
	2. Provide Opportunities for Self – Assessment
Planning to Choose a Suitable Method	1. Have Students Implement a Plan That You Provide
	2. Have Students Create Their Own Plan
	3. Make Planning the Central Goal of the Assignment
Implementing Strategies and Monitor Performance	1. Provide Simple Heuristics for Self–Correction
	2. Have Students Do Guided Self–Assessments
	3. Require Students to Reflect on and Annotate Their Own Work
	4. Use Peer Review/Reader Response
Allowing Time to Reflect and	1. Provide Activities That Require Students to Reflect on Their Performances
	2. Prompt Students to Analyze the Effectiveness of Their Study Skills

Adjusting each Approach	3. Present Multiple Strategies
	4. Create Assignments That Focus on Strategizing Rather Than Implementation
Paying Attention to Perceptions of Intelligence and learning	1. Address Students' Beliefs About Learning Directly
	2. Broaden Students' Understanding of Learning
	3. Help Students Set Realistic Expectations
General Strategies for Stimulating Metacognitive Processes	1. Modeling Your Metacognitive Processes
	2. Scaffold Students in Their Metacognitive Processes