Learning About Learning: What Every New Teacher Needs to Know

Appendices

Appendix A:
Textbooks examined in this report

TEXT	TYPE	Presentation of strategy: Distributing practice	Repeatedly alternating solved and unsolved problems	Pairing graphics with words	Linking abstract concepts with concrete representations	Assessing to boost retention	Posing probing questions	Number of strategies presented accurately
Arends, R. I. (2004). *Learning to teach* (8th ed.). Boston, MA: McGraw-Hill.	General methods	None	None	Partial	Partial	Partial	Accurate	**1**
Bass, J. E., Contant, T. L., & Carin, A. A. (2009). *Teaching science as inquiry* (11th ed.). Upper Saddle River, NJ: Pearson.	Single subject methods	None	None	None	None	None	Accurate	**1**
Black, P., Harrison, C., Lee, C., Marshall, B., & William, D. (2003). *Assessment for learning: Putting it into practice*. New York, NY: Open University Press.	General methods	None	None	None	None	None	Accurate	**1**
Bohlin, L., Durwin, C. C., & Reese-Weber, M. (2009). *EdPsych: Modules*. Boston, MA: McGraw-Hill.	Educational psychology	Accurate	None	None	None	None	Accurate	**2**
Burke, J. (2007). The English teacher's companion: *A complete guide to classroom, curriculum, and the profession* (3rd ed.). Portsmouth, NH: Heinemann.	Single subject methods	Partial	None	None	None	None	Partial	**0**
Cangelosi, J. S. (2003). *Teaching mathematics in secondary and middle school: An interactive approach* (3rd ed.). Upper Saddle River, NJ: Merrill/Prentice Hall.	Single subject methods	Accurate	None	None	Accurate	None	Partial	**2**
Chappuis, J. (2009). *Seven strategies of assessment for learning*. Boston, MA: Allyn & Bacon.	General methods	None	None	None	None	None	None	**0**
Chiappetta, E. L., & Koballa, Jr., T. R. (2010). *Science instruction in the middle and secondary schools: Developing fundamental knowledge and skills* (7th ed.). Boston, MA: Allyn & Bacon.	Single subject methods	Partial	None	Partial	Accurate	None	Accurate	**2**
Cole, P. B. (2009). *Young adult literature in the 21st century*. New York, NY: McGraw-Hill.	Single subject methods	None	None	None	None	None	None	**0**
Dick, T. P., & Hollebrands, K. F. (2011). *Focus in high school mathematics: Technology to support reasoning and sense making*. Reston, VA: National Council of Teachers of Mathematics.	Single subject methods	None	None	None	Accurate	None	Partial	**1**
Donovan, M. S., & Bransford, J. D. (Eds.) (2005). *How students learn: History in the classroom*. Washington, DC: National Academies Press.	Single subject methods	None	None	None	None	None	Partial	**0**
Drake, F. D., & Nelson, L. R. (2005). *Engagement in teaching history: Theory and practices for middle and secondary teachers*. Upper Saddle River, NJ: Pearson.	Single Subject Methods	Partial	None	None	Partial	None	Partial	**0**
Eby, J. W., Herrell, A. L., & Jordan, M. L. (2009). *Teaching in the elementary school: A reflective action approach* (5th ed.). Upper Saddle River, NJ: Pearson.	General methods	None	None	None	None	None	Accurate	**1**

TEXT	TYPE	Presentation of strategy: Distributing practice	Repeatedly alternating solved and unsolved problems	Pairing graphics with words	Linking abstract concepts with concrete representations	Assessing to boost retention	Posing probing questions	Number of strategies presented accurately
Eggen, P. & Kauchak, D. (2010). *Educational psychology: Windows on classrooms* (8th ed.). Upper Saddle River, NJ: Merrill.	Educational psychology	None	None	Accurate	Accurate	Partial	Partial	**2**
Elliott, D. C. (2005). *Teaching on target: Models, strategies, and methods that work*. Thousand Oaks, CA: Corwin.	General methods	Accurate	None	None	None	None	Accurate	**2**
Feinstein, S. (2004). *Secrets of the teenage brain: Research-based strategies for reaching and teaching today's adolescents*. Thousand Oaks, CA: Corwin Press.	Educational psychology	None	None	None	None	None	Partial	**0**
Freiberg, H. J., & Driscoll, A. (2005). *Universal teaching strategies* (4th ed.). Boston, MA: Allyn & Bacon.	General methods	Partial	None	None	Partial	None	Partial	**0**
Guillaume, A. M. (2008). *K-12 classroom teaching: A primer for new professionals* (3rd ed.). Upper Saddle River, NJ: Pearson.	General methods	None	None	Accurate	Partial	None	None	**1**
Guillaume, A. M., Yopp, R. H., & Yopp, H. K. (2007). *Fifty strategies for active teaching: Engaging K-12 learners in the classroom*. Upper Saddle River, NJ: Pearson.	General methods	Partial	None	None	None	None	Partial	**0**
Gunter, M. A., Estes, T. H., Mintz, S. L. (2007). *Instruction: A models approach* (5th ed.). Needham Heights, MA: Allyn & Bacon.	General methods	Accurate	None	Partial	None	None	Partial	**1**
Henniger, M. L. (2009). *Teaching young children* (4th ed.). Upper Saddle River, NJ: Merrill/Prentice Hall.	General methods	None	None	None	None	None	None	**0**
Hill, J. D., & Flynn, K. M. (2006). *Classroom instruction that works with English Language Leaners*. Alexandria, VA: Association for Supervision and Curriculum Development.	General methods	None	None	Partial	Accurate	None	Partial	**1**
Jordan, E. A., & Porath, M. J. (2006). *Educational psychology: A problem-based approach* (6th ed.). New York, NY: Pearson.	Educational psychology	None	None	None	None	None	None	**0**
Joyce, B., Weil, M., & Calhoun, E. (2008). *Models of teaching* (8th ed.). Boston, MA: Pearson.	General methods	None	None	None	None	None	None	**0**
Kellough, R. D., & Carjuzaa, J. (2009). *Teaching in the middle and secondary schools* (9th ed.). Upper Saddle River, NJ: Pearson.	General methods	Accurate	None	Partial	None	Partial	Accurate	**2**
Kellough, R. D., & Kellough, N. G. (2011). *Secondary school teaching: A guide to methods and resources* (4th ed.). Boston, MA: Allyn & Bacon.	General methods	Partial	None	Partial	None	Partial	Accurate	**1**
Lindquist, T. (2002). *Seeing the whole through social studies* (2nd ed.). Portsmouth, NH: Heinemann.	Single subject methods	Partial	None	None	None	None	None	**0**
Llewellyn, D. (2005). *Teaching high school science through inquiry: A case study approach*. Thousand Oaks, CA: Corwin.	Single subject methods	None	None	None	Partial	None	Accurate	**1**

TEXT	TYPE	Presentation of strategy: Distributing practice	Repeatedly alternating solved and unsolved problems	Pairing graphics with words	Linking abstract concepts with concrete representations	Assessing to boost retention	Posing probing questions	Number of strategies presented accurately
Marzano, R. J., Pickering, D. J., & Pollock, J. E. (2001). *Classroom instruction that works: Research-based strategies for increasing student achievement.* Upper Saddle River, NJ: Pearson.	General methods	Accurate	None	None	None	None	Accurate	**2**
Maxwell, R. J,. & Meiser, M. J. (2005). *Teaching English in middle and secondary schools* (4th ed.). Upper Saddle River, NJ: Pearson.	Single subject methods	None	None	None	None	None	Partial	**0**
Moore, K. D. (2012). *Effective instructional strategies: From theory to practice* (3rd ed.). Thousand Oaks, CA: Sage.	General methods	None	None	None	None	None	Accurate	**1**
Orlich, D. C., Harder, R. J., Callahan, R. C., Trevisan, M. S., Brown, A. H. (2010). *Teaching strategies: A guide to effective instruction* (9th ed.). Boston, MA: Wadsworth.	General methods	None	None	None	Accurate	Partial	Accurate	**2**
Ormrod, J. E. (2011). *Educational psychology: Developing learners* (7th ed.). Columbus, OH: Merrill/Prentice Hall.	Educational psychology	Accurate	None	None	Accurate	Partial	Partial	**2**
Parkay, F. W., Hass, G., & Anctil, E. J. (Eds.) (2010). *Curriculum leadership: Readings for developing quality educational programs* (9th ed.). Boston, MA: Pearson/Allyn & Bacon.	General methods	None	None	None	None	None	Partial	**0**
Posamentier, A. S., Smith, B. S., & Stepelman, J. (2010). *Teaching secondary mathematics: Teaching and enrichment units* (8th ed.). Boston, MA: Allyn & Bacon.	Single subject methods	None	None	Partial	Accurate	None	Accurate	**2**
Probst, R. E. (2004). *Response and analysis: Teaching literature in secondary school* (2nd ed.). Portsmouth, NH: Heinemann.	Single subject methods	None	None	None	None	None	None	**0**
Santrock, J. W. (2009) *Educational psychology* (4th ed.). Boston, MA: McGraw-Hill.	Educational psychology	Partial	None	None	Accurate	None	Partial	**1**
Seyedmonir, M. (Ed.). (2010). *Educational Psychology: Guiding Effective Teaching and Learning*. New York: Pearson Learning Solutions. ISBN: 978-0-558-73061-1.	Educational psychology	Accurate	None	Partial	Partial	None	Partial	**1**
Shalaway, L. (2005). *Learning to Teach…not just for beginners*. The Essential Guide for all Teachers. NY: Scholastic	General methods	None	None	None	None	None	Accurate	**1**
Silver, H. F., Strong, R. W., & Perini, M. J. (2007). *The strategic teacher: Selecting the right research-based strategy for every lesson.* Alexandria, VA: Association for Supervision and Curriculum Development.	General methods	Accurate	None	Partial	None	None	Partial	**1**
Slavin, R. E. (2009). *Educational psychology: Theory and practice* (9th ed.) Boston, MA: Allyn & Bacon.	Educational psychology	Accurate	Partial	Accurate	Partial	None	None	**2**
Tate, M. L. (2010). *Worksheets don't grow dendrites: 20 instructional strategies that engage the brain* (2nd ed.). Thousand Oaks, CA: Corwin.	General methods	None	None	None	Partial	None	Accurate	**1**

TEXT	TYPE	Presentation of strategy: Distributing practice	Repeatedly alternating solved and unsolved problems	Pairing graphics with words	Linking abstract concepts with concrete representations	Assessing to boost retention	Posing probing questions	Number of strategies presented accurately
Texley, J. & Wild, A. (Eds.). (2004). *NSTA pathways to the science standards: Guidelines for moving the vision into practice* (2nd high school ed.). Arlington, VA: National Science Teachers Association.	Single subject methods	None	None	None	Partial	None	Partial	**0**
Thomas, E. J., Brunsting, J. R., & Warrick, P. L. (2010). *Styles and strategies for teaching high school mathematics: 21 techniques for differentiating instruction and assessment.* Thousand Oaks, CA: Corwin.	Single subject methods	Partial	None	None	Accurate	Partial	Partial	**1**
Tomlinson, C. A. (1999). *The differentiated classroom: Responding to the needs of all learners*. Alexandria, VA: Association for Supervision and Curriculum Development.	General methods	None	None	None	None	None	None	**0**
Wiggins, G., & McTighe, J. (2005). *Understanding by design* (expanded 2nd ed.). Alexandria, VA: Association for Supervision and Curriculum Development.	General methods	Partial	None	None	Accurate	None	Accurate	**2**
Wong, H. K., & Wong, R. T. (2009). *The first days of school: How to be an effective teacher* (4th ed.). Mountain View, CA: Harry K. Wong Publications.	General methods	None	None	None	None	None	None	**0**
Woolfolk, A. (2010). *Educational psychology* (11th ed). Columbus, OH: Pearson.	Educational psychology	None	None	Accurate	None	Partial	Partial	**1**

The presentation of a strategy is "accurate" when at least 75 percent of key information about that strategy is described in a consistent matter that conveys the strategy's general applicability, and "partial" when more than zero and less than 75 percent of key information is discussed.

Appendix B:
Programs Included in this Study

UNIVERSITY	STATE	Programs Included			
		Elementary Graduate	Elementary Undergraduate	Secondary Graduate	Secondary Undergraduate
Austin Peay State University	TN		x		x
Bowling Green State University	OH				x
Cameron University	OK		x		x
Central Washington University	WA				x
Christopher Newport University	VA	x		x	
College of Charleston	SC		x		
Colorado Mesa University	CO		x		x
Lehman College	NY			x	x
Great Basin College	NV		x		x
Minot State University	ND		x		x
Pennsylvania State University	PA		x		x
Stockton University	NJ	x		x	
Southeastern Oklahoma State University	OK				x
Southern Methodist University	TX		x		x
Texas A&M University, Texarkana	TX		x		x
University of Alaska, Fairbanks	AK		x		
University of California, Davis	CA	x		x	
University of Colorado, Denver	CO	x	x	x	x
University of Montevallo	AL		x	x	
University of Nevada, Reno	NV			x	
University of South Dakota	SD		x		
University of Virginia's College at Wise	VA				x
University of Washington, Bothell	WA	x			
University of Washington	WA	x			
Washington State University	WA		x	x	x
West Virginia State University	WV		x		x
Western Michigan University	MI				x
Winthrop University	SC		x	x	

Appendix C:
Methodology of Textbook Evaluations

Textbook Selection

All textbooks assigned in educational psychology, general methods and secondary subject-specific methods courses in the sample of 48 elementary and secondary teacher preparation programs were screened to determine if they address cognitive science and/or instructional strategies in any way.

We note that textbooks unique to subject-specific elementary methods courses were not reviewed in depth. What examination we did of these textbooks indicated that had we reviewed them, none would have received credit for covering the strategies. The reason for this failure to cover the strategy: the textbooks present the strategies as relevant for the subject at hand, not as universally applicable. Because elementary teachers teach across all subjects, this presentation could lead to misunderstandings that adversely affect the teachers' instruction. However, because secondary teachers will only teach a single subject — and the suggestion that strategies have subject-specific applicability has fewer pragmatic implications — we did not require that coursework and relevant textbooks assigned in secondary subject-specific methods courses convey universal applicability.

A textbook was purchased if its title, the publisher's text description, the table of contents, and/or the index mentioned topics such as information processing, cognitive science, memory, metacognition, learning theories, the work of individual theorists (such as Piaget or Bloom), advice on how to plan or deliver instruction, instructional activities, teaching strategies, or assessment.

In total, 48 textbooks were selected for analysis, including 9 from educational psychology courses, 24 from general methods courses, and 15 from secondary subject-specific methods courses (5 math, 4 English/language arts, 4 science, and 2 social studies/history). The texts are listed in Appendix A.

In addition, we searched for evidence that instructors are compensating for weak coverage of the fundamental instructional strategies in textbooks by substituting strong reading packets, but found no such evidence. Of the 10 courses in the sample that don't assign a text but do require other readings, only one set of readings mentions a strategy other than **posing probing questions**. In addition, when courses used both a text and supplementary readings, the readings introduced fundamental instructional strategies that were not already covered in the text in only 7 percent of situations. Credit was given for coverage of fundamental instructional strategies in readings whenever appropriate.

Textbook Scoring

As discussed in the body of this report, the textbooks assigned in the relevant courses in our sample are a major focus of our analyses. The textbooks were examined to determine the accuracy and extent of their coverage of each strategy. As subsidiary issues, we also collected data on whether the textbooks address (a) cognitive science, specifically the information processing model that underlies the fundamental instructional strategies, and (b) modifying instruction to accommodate variation in student learning styles.

Four analysts, all of whom have completed undergraduate and/or graduate coursework or degrees in cognitive and/or educational psychology, comprised the textbook review team. Two analysts independently reviewed each text in full. One of the authors of this study or a third analyst who had not completed one of the two initial reviews prepared a combined review that integrated the initial reviewers' notes and reconciled any differences in evaluations.

The reviews used a combination of summaries and quotes from the text to record every mention of a strategy (or what could be construed as a mention of a strategy), no matter how brief, within the approximately 14,000 pages of text in the books in the sample. A typical review was 5-10 pages in length.

Analysts noted the composite effect on the reader from the often-scattered mentions of each strategy: Did the text consistently support the use of the strategy, or present conflicting recommendations? Did the text convey the strategy's general applicability or recommend its use only with certain types of students or in combination with a particular approach to teaching?

Analysts also used a five-point coding system to note the emphasis given each strategy:

Coverage	Points
None	0
1-2 sentences	1
3-6 sentences/1 small paragraph	2
2-3 small paragraphs/1 large paragraph	3
1 page or more/inclusion in chapter summary	4

See Figure C1 for an example of how a single text was reviewed for the strategy of distributed practice. Similar information was recorded for each of the six strategies in each textbook.

Figure C1. Excerpt from review of Bohlin, L., Durwin, C. C., & Reese-Weber, M. (2009). *EdPsych: Modules*. Boston, MA: McGraw-Hill.

TOPIC/STRATEGY	Text mentions	Coverage code	Summary of coverage
Distributing practice	**p. 118** (Learning goals, Module 7) – Refers to five principles of effective instruction; "Provide multiple exposures to content" is one of the principles, specified on p. 129. **p. 129** (Module 7) – "Applications: Principles for effective teaching" (one short paragraph) – Emphasizes returning to same topic over time: *'Provide multiple exposures to content.* Returning to content at different times, in different contexts, for different purposes, and from different perspectives will enhance students' knowledge acquisition.' (Haskell, 2001; Spiro, Feltovich, Jacobson, & Coulson, 1991). 'Examining content from different perspectives…may lead students to restructure or modify their existing knowledge. Revisiting content over time and in different contexts also encourages transfer of knowledge by preventing learned information from being tied to specific situations or contexts' (Salomon & Perkins, 1989)." **p. 130** (Module 7) – "Summary…Discuss five principles of effective instruction based on constructivist theories" (two sentences) – "(4) Provide multiple exposures to content." [Next sentence restates the rest of the excerpt from p. 129.] **p. 200** (Module 11) – "Helping students store and retrieve information effectively" (two sentences – third bullet point) – "Distribute practice opportunities over time within a single unit, and strive to cover the same material several times in different contexts over the course of the semester or year. This additional processing leads to elaboration, building stronger connections to other information and increasing the likelihood that students will be able to transfer their knowledge effectively to new situations (Murray, 2006)." **p. 363** (Module 20) – "Direct instruction" (one short paragraph – third bullet point on page) – "Teachers provide weekly and monthly reviews and reteaching as necessary in order for long-term learning to occur. Students also need to engage in distributed practice once they have achieved mastery at independent practice. These short and frequent practice periods are more effective than fewer but longer practice opportunities, especially for children in early elementary grades."	**4**	Text includes multiple recommendations for use. P. 363 quote is not relevant for analysis because it describes distributed practice only in the context of direct instruction. However, this mention does not contradict other places in the text where distributed practice is presented as a universally useful strategy.

Finally, Dr. John Dunlosky, a professor in the Department of Psychological Sciences at Kent State University whose research focuses on learning strategies, was provided with the combined review and all relevant pages of the texts to provide feedback.

Dr. Dunlosky's comments often clarified situations in which we were unsure whether the ideas conveyed in a particular excerpt were sufficiently accurate to receive credit. He also helped us understand how a text's multiple references to a strategy might or might not fit together. For example, was a recommendation for massed practice while learning a new idea contradictory to the concept of distributed practice?

To "accurately teach" a strategy, a textbook's coverage had to satisfy three criteria:

First, it had to convey 75 percent of the *key elements* of each strategy. These key elements were taken directly from the description of the strategies in the IES practice guide. For each strategy, the key elements included at minimum 1) a definition of the strategy and 2) a statement of the primary cognitive purpose for the strategy. For most strategies, the key elements also included one to three more important guidelines which explain how to best implement the strategy.

Each key element was worth 1-2 points, with a total of 3-7 points possible per strategy. For each strategy in each text, points awarded were divided by total possible points and the strategy was judged to meet the first criteria for accuracy if the score was 75 percent or greater. The key elements for all of the strategies, and their point values are listed within Figure C3 below.

Second, the text had to convey the strategy in a *consistently accurate manner*. Using the example of distributed practice, a textbook may have several scattered references about the importance of practice that total a page or more. However, in two references, the discussion implies that practice is most productive when it immediately follows instruction, whereas in subsequent discussion several pages later, discussion implies that practice should be spaced at greater intervals. In this case, the textbook has not consistently conveyed the strategy in an accurate manner.

Third, the text had to convey the *general applicability* of the standard. Strategies should be described as having broad applicability or — if the text presents strategies in the context of a particular type of instruction, such as teacher-directed instruction, cooperative learning, reciprocal peer teaching, and so on — they should be re-emphasized in all such contexts. A large proportion of texts do not convey general applicability. For example, 90 percent of texts that mention distributed practice do so only within the context of teacher-directed instruction and make no mention of how it can improve retention of material learned in any type of instruction.

Figure C2 shows a key element scoring overlay onto the information already presented in Figure C1. Because all of the key elements were addressed in this example, the textbook's score on the strategy was 100 percent.

Furthermore, because the strategy is presented in a manner that is consistently accurate and its general applicability is conveyed, this textbook is deemed to "accurately teach" the strategy.

Figure C2. Excerpt from review of Bohlin, L., Durwin, C. C., & Reese-Weber, M. (2009). *EdPsych: Modules*. Boston, MA: McGraw-Hill.

TOPIC/STRATEGY	Text mentions	Coverage code	Summary of coverage
Distributing practice	**p. 118** (Learning goals, Module 7) – Refers to five principles of effective instruction; "Provide multiple exposures to content" is one of the principles, specified on p. 129. **p. 129** (Module 7) – "Applications: Principles for effective teaching" (one short paragraph) – Emphasizes returning to same topic over time: *'Provide multiple exposures to content.* Returning to content at different times, in different contexts, for different purposes, and from different perspectives will enhance students' knowledge acquisition.' (Haskell, 2001; Spiro, Feltovich, Jacobson, & Coulson, 1991). 'Examining content from different perspectives…may lead students to restructure or modify their existing knowledge. Revisiting content over time and in different contexts also encourages transfer of knowledge by preventing learned information from being tied to specific situations or contexts' (Salomon & Perkins, 1989)." **p. 130** (Module 7) – "Summary…Discuss five principles of effective instruction based on constructivist theories" (two sentences) – "(4) Provide multiple exposures to content." [Next sentence restates the rest of the excerpt from p. 129.] **p. 200** (Module 11) – "Helping students store and retrieve information effectively" (two sentences – third bullet point) – "Distribute practice opportunities over time within a single unit, and strive to cover the same material several times in different contexts over the course of the semester or year. This additional processing leads to elaboration, building stronger connections to other information and increasing the likelihood that students will be able to transfer their knowledge effectively to new situations (Murray, 2006)." **p. 363** (Module 20) – "Direct instruction" (one short paragraph – third bullet point on page) – "Teachers provide weekly and monthly reviews and reteaching as necessary in order for long-term learning to occur. Students also need to engage in distributed practice once they have achieved mastery at independent practice. These short and frequent practice periods are more effective than fewer but longer practice opportunities, especially for children in early elementary grades."	**4**	Text includes multiple recommendations for use. P. 363 quote is not relevant for analysis because it describes distributed practice only in the context of direct instruction. However, this mention does not contradict other places in the text where distributed practice is presented as a universally useful strategy.

Key element A: Teacher should provide at least two exposures to content.

Key element B: There should be a delay of several weeks to several months between exposures.

Key element C: Delayed re-exposure to content promotes retention.

Complete scores for all texts on all strategies are found in Appendix A.

Figure C3 depicts the key elements for each of the six fundamental instructional strategies, and notes issues that had to be addressed in evaluation, points given for the key element, and examples from textbooks of statements that did and did not receive credit on each key element.

Figure C3. Key elements of the six fundamental strategies and their evaluation

STRATEGY	Key element taken from IES guide	Points	Example(s) that meet standard (credit awarded). Key aspects of each strategy are underlined.	Example not sufficiently comprehensive, explicit or on-target (no credit)
1) Pairing graphics with words	1a) Teachers should provide both graphics that convey information (not just engaging pictures) and verbal description (spoken or written) when presenting key processes or concepts.	**2**	Explains that dual code theory states that "information represented both visually and verbally is recalled better than information represented only one way." *– from Slavin (2009, Ch. 6, pg. 167)*	"Pictures, concrete aids, films, and other audiovisual materials are especially useful because they enhance the sensory richness of the associations." *– from Elliott (2005, Ch. 4, p. 66)* *What's missing*: A specific recommendation to combine graphic and verbal information or to have visuals convey information.
	1b) These combinations promote learning. (Must be an explicit statement of the purpose of the strategy.)	**1**	The authors describe the visual-spatial sketchpad, a "short-term storage system for visual and spatial information" (p.200) and the phonological loop, "a short-term system for words and sounds" (p.199) and conclude that, "This suggests that students learn more if verbal explanations are combined with visual representations (Clark & Mayer, 2003; Moreno & Duran, 2004). The visual processor supplements the verbal processor and vice versa" (p.201). *– from Eggen & Kauchak (2010, Ch. 7, p.201)*	"The brain remembers images more easily than words, which makes graphic organizers, pictures, charts, and graphs effective tools for organizing patterns." *– from Feinstein (2004, Ch. 2, p. 45)* *What's missing*: A focus on a combination of visual and verbal information.
2) Linking abstract concepts with concrete representations	2a) Teachers should present both abstract and concrete representations when teaching a concept.	**2**	"Students need to have abstract ideas illustrated with concrete examples, and this is true for older as well as younger students." *– from Eggen & Kauchak (2010, p.7)*	In discussing "discovery learning" the text states: "…the teacher's role is to gather and provide equipment and materials related to a concept that the students are to learn…the teacher's role is to monitor and observe as the students discover the properties and relationships inherent in the materials, asking occasional questions or making suggestions that will guide the students in seeing the relationship and understanding the concepts." *– from Eby, Herrell, & Jordan (2009, Ch. 7, p. 248)* *What's missing*: Discussion limits applicability to one activity (discovery learning) rather than general applicability, and emphasizes students finding connections rather than the teacher designing the activity to ensure that students see relationships between the materials provided and the abstract principles that connect them.
	2b) Connecting abstract and concrete representations promotes learning. (Must be an explicit statement of the purpose of the strategy.)	**1**	At the end of a case study, "[The teacher]…provided the specific, concrete experiences [her students] needed to understand the concept and ultimately advance their development. " *– from Eggen & Kauchak (2010, p.36)*	"Students' understanding of mathematical ideas is broadened when concrete representations are used." (Coggine et al, 2007) *– from Tate (2010, Strategy 7, p. 56)* *What's missing*: The discussion is limited to the subject of math. The general applicability of the strategy is not conveyed.

STRATEGY	Key element taken from IES guide	Points	Example(s) that meet standard (credit awarded). Key aspects of each strategy are underlined.	Example not sufficiently comprehensive, explicit or on-target (no credit)
3) Posing probing questions	3a) Teachers should ask deep questions once students have basic topic knowledge.	**2**	"We teachers ask a lot of questions … but far too often, our questions simply require factual recall and only a literal level of comprehension – the lowest level of cognitive functioning…. To elicit thought, ask questions such as why? What if …? How do you know that? Are there other ways of looking at this?" *– from Shalaway, L. (2005).p. 123*	"[Questions] support inquiry in a classroom; poor questions create an atmosphere that stifles risk-taking. Good questions provide ongoing assessment, helping our decisions about instruction be more effective. And as questioning teachers, we become valuable models for our students." *– from Texley, J. & Wild, A. (Eds.). (2004). p. 17* *What's missing*: The purpose of questions is to promote engagement and serve as a formative assessment, not to deepen student thinking.
	3b) Text defines deep questions, describes at least three types, and gives multiple examples of deep questions. (Deep questions include questions such as why, why-not, how, what-if, how does X compare to Y, and what is the evidence for X?)	**2**	Text includes two "resource pages" with eight strategies for asking "good questions" – questions that "help your students become better thinkers…[by] convert[ing] simple questions into more challenging ones." The suggestions relate to asking "why" and "what if" questions, asking for evidence, comparing and contrasting, as well as prompting for creative answers. For example, one strategy is to ask for proof of an answer; doing so "requires that the student both formulate the answer and offer support of it" – e.g., "Does the formula you are using to find the area of a triangle always work? Why?" (Essentially, eight types of higher-order questions are described, with several examples for each). *– from Shalaway (2005, Ch. 3, pp. 127-128)*	In thinking-based questioning, the teacher asks questions that stimulate thinking and discussion. For example, the teacher may ask "Compare the French and American revolutions. How were they similar? How were they different? Make a point to include thinking-based questions in your teaching. They will help your students construct a deeper understanding of a topic". *– from Santrock (2009, p. 322)* *What's missing*: A few examples of appropriate questions are given, but they are not categorized or defined in a way that would help the reader to understand what makes them appropriate.
	3c) Answering deep questions helps students build understanding and promotes learning. (Must be an explicit statement of the purpose of the strategy.)	**1**	"It is through this process [of questioning and discussion] that students integrate new knowledge with prior knowledge, build more complete knowledge structures, and come to understand more complex relationships." *– from Arends (2004, Ch. 7, p. 283)*	"Posing questions is an effective instructional tool for stimulating students' thinking….it's important to consider the kind of questions, both oral and written, that serve to provide insights into how students think." The text gives an example of a student who answers a question on fractions correctly, but his reasoning is incorrect. This suggests that asking the right questions can help in uncovering the mistake. *– from Burns (2007, Part 1, p. 47)* *What's missing*: Questions are asked in order to reveal students' thinking and serve as a form of formative assessment, instead of deepening students' understanding.
4) Repeatedly alternating solved and unsolved problems	4a) During problem-solving sessions and assignments, worked examples should be alternated with problems to be solved.	**2**	"Research on worked examples generally finds that they are effective if they alternate with problems students do on their own (e.g. one worked example followed by several problems of the same type)" *– from Slavin (2009, Ch. 7, p. 206)*	Use worked-out examples for practice at problem solving…." *– from Bohlin, Durwin, & Reese-Weber (2009, Module 13, p. 237)* *What's missing*: This recommends providing worked examples, but does not mention interleaving them with problems to solve.

STRATEGY	Key element taken from IES guide	Points	Example(s) that meet standard (credit awarded). Key aspects of each strategy are underlined.	Example not sufficiently comprehensive, explicit or on-target (no credit)
	4b) Alternating worked examples and problems to be solved promotes learning. (Must be an explicit statement of the purpose of the strategy.)	**1**	"…But when students were given 'worked examples' (such as presolved problems) interspersed with problems to solve, studying the worked examples freed up cognitive resources that allowed students to see the key features of the problem and to analyze the steps and reasons behind problem-solving moves…." – *from Ambrose, Bridges, DiPietro, Lovett, & Norman (2010, Ch. 4, pp. 105-106)* *Note*: No text in the sample explained why worked examples should be alternated with problems to be solved, so this example is taken from another book.	"Phase three, structured practice, comes next. The teacher leads students through practice examples, working through each step…. A good way to accomplish the lockstep technique is to use an overhead projector, doing practice examples on a transparency so that all students can see the generation of each step…. By referring to it while working the practice examples, the teacher is ensuring that students understand it so that they can use it as a resource during their semi-independent practice phase." – *from Joyce, B., Weil, M., & Calhoun, E. (2008). P. 363* *What's missing*: This explains why it's useful for the teacher to problem-solve before students solve problems on their own, but does not recommend that students' problem sets incorporate worked examples.
5) Distributing practice	5a) Teacher should provide for at least two exposures to important content.	**2**	"Provide multiple exposures to content. Returning to content at different times, in different contexts, for different purposes, and from different perspectives will enhance students' knowledge acquisition (Haskell, 2001; Spiro, Feltovich, Jacobson, & Coulson, 1991)." – *from Bohlin et al. (2009, Module 7, p. 129)*	"…A spiral curriculum acknowledges that concepts are revisited periodically during the period of formal schooling, with each new exposure incorporating and building on the previous one, while moving to a more sophisticated understanding." – *from Jordan, A.J, & Porath, M.J. (2005). p. 46* *What's missing*: Recommendation of multiple exposures by the teacher who introduced the content.
	5b) There should be a delay of "several weeks to several months" between exposures.	**2** (Half credit is given when a shorter delay is suggested)	A sample schedule of practice covers the whole school year and shows month-by-month practice opportunities for specific skills, such as "Nov: Three practices with feedback during unit on photosynthesis" for the skill of using a microscope. – *from Dean et al. (2012)*	"To minimize memory loss, you can…frequently review to encourage automaticity (rapid automatic response)." – *from Shorall, C. (2009). Chapter 5, p.28.* *What's missing*: There is no mention that delay between reviews is often appropriate.
	5c) Delayed re-exposure to key content promotes retention. (Must be an explicit statement of the purpose of the strategy.)	**1**	"…This additional processing [from distributed practice] leads to elaboration, building stronger connections to other information and increasing the likelihood that students will be able to transfer their knowledge effectively to new situations (Murray, 2006)." – *from Bohlin et al. (2009, Module 11, p. 200)*	"Implications for Planning" – "…If two topics are taught at each grade, it follows that each second-order concept will be revisited at least once each year and that planning for systematic progression across grades is possible." – *from Donovan & Bransford (2005, Ch. 3, p. 171)* *What's missing*: There is no mention of the fact that re-exposure promotes retention.

STRATEGY	Key element taken from IES guide	Points	Example(s) that meet standard (credit awarded). Key aspects of each strategy are underlined.	Example not sufficiently comprehensive, explicit or on-target (no credit)
6) Assessing to boost retention	6a) Teachers should give closed-book quizzes or tests to re-expose students to key material.	**2**	Section entitled "Guidelines: Helping students understand and remember" includes "Provide for repetition and review of information," with one example being, "Give frequent, short tests." *– from Woolfolk (2010, Ch. 7, p. 260)*	The purposes of assessment included "to help educators determine the strengths, weaknesses, and overall progress of students…to provide documented results that teachers need to explain their actions…to improve instruction, and to provide accurate reports to students, parents, and school officials." *- from Manning, M.L., & Bucher, K.T. (2009) p. 201* *What's missing*: Retention is not noted as a purpose of assessment.
	6b) Quizzes and tests that require active recall of correct answers are preferable to those that just require recognition of correct answers.	**2**	"…Tests that require the learner to supply the answer, like an essay or short-answer test, or simply practice with flashcards, appear to be more effective than simple recognition tests like multiple choice or true/false tests…the implication seems to be that where more cognitive effort is required for retrieval, greater retention results." *- from Brown et al. (2014, Ch. 2, pp. 40-41)* *Note*: No text in the sample received credit for this point, so this example is taken from another book.	"Learning is supported by frequent testing using cumulative questions that ask students to apply and integrate knowledge." *– from Woolfolk (2010, Ch. 7, p. 532)* *What is missing*: There is no explicit statement that questions should require recall as well as asking for application and integration.
	6c) Feedback including the correct answers is essential when using quizzes or tests to cement learning.	**2**	"…providing feedback from either formal or informal assessments increases student motivation and learning (Brookhart, 1997; Brookhart & Durkin, 2003; Dempster, 1991). As will be described in detail in Chapter 8, to be most effective, feedback must be clear and direct rather than general and ambiguous." [Note: follows comment about positive impact of frequent, brief assessment on learning.] *– from Arends (2004, p. 218)*	"An assessment activity can help learning if it provides information to be used as feedback by teachers, and by their students in assessing themselves and each other, to modify the teaching and learning activities in which they are engaged" *– from Black et al. (2003, Ch. 1, p. 2)* *What's missing*: This statement conveys that feedback to students can suggest changes in learning activities, but not that it helps students cement learning.
	6d) Practice in actively recalling information promotes retention. (Must be an explicit statement of the purpose of the strategy.)	**1**	"Fourth, frequent testing aids retention." *– from Orlich (2010, p. 327)*	"The caution is that it may not be the frequency of test taking but that frequent test taking made the learning intentions and success criteria more specific and transparent…" *– from Hattie (2009, Ch. 9, pp. 178-179)* *What's missing*: There is no accurate information on "test effect" and this suggests that something other than recall is promoting learning.

Appendix D:
Additional Findings on Textbook Coverage of Strategies

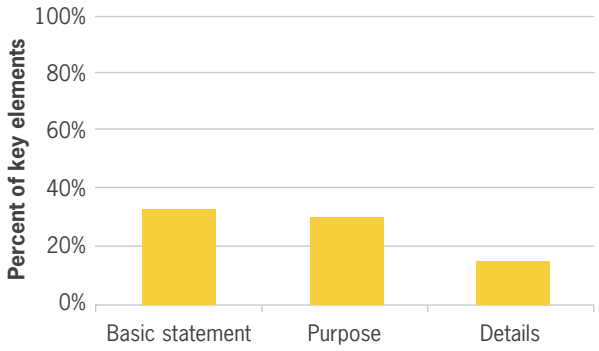
Reviews of 48 textbooks assigned by programs in the sample are a central part of this report. The primary purpose in examining textbooks was to determine the *fidelity* with which each strategy was presented, by looking for evidence that the texts convey the majority of key elements that are essential to understanding each strategy. Appendix C provides more information on the methodology of textbook evaluation.

As noted in the report, no strategy was covered by more than 41 percent of texts.[1]

What key elements are taught?

A breakdown of the key elements of each strategy helps to explain how descriptions of the strategies typically fall short. Figure D1 shows that a basic statement describing a given strategy is included in the average text about 30 percent of the time, and the purpose of the strategy (to improve learning, retention, etc.) is described with approximately the same frequency. However, texts are much less likely to include the details important for effective classroom use, such as the fact that the delay between sessions of **distributing practice** should be weeks and months long instead of just a few days.

Figure D1. Percent of key elements for all strategies included in average text (n = 816 possible key elements)



Texts often allude to strategies without describing the nuts and bolts of their use.

How does coverage of the strategies differ by type of textbook?

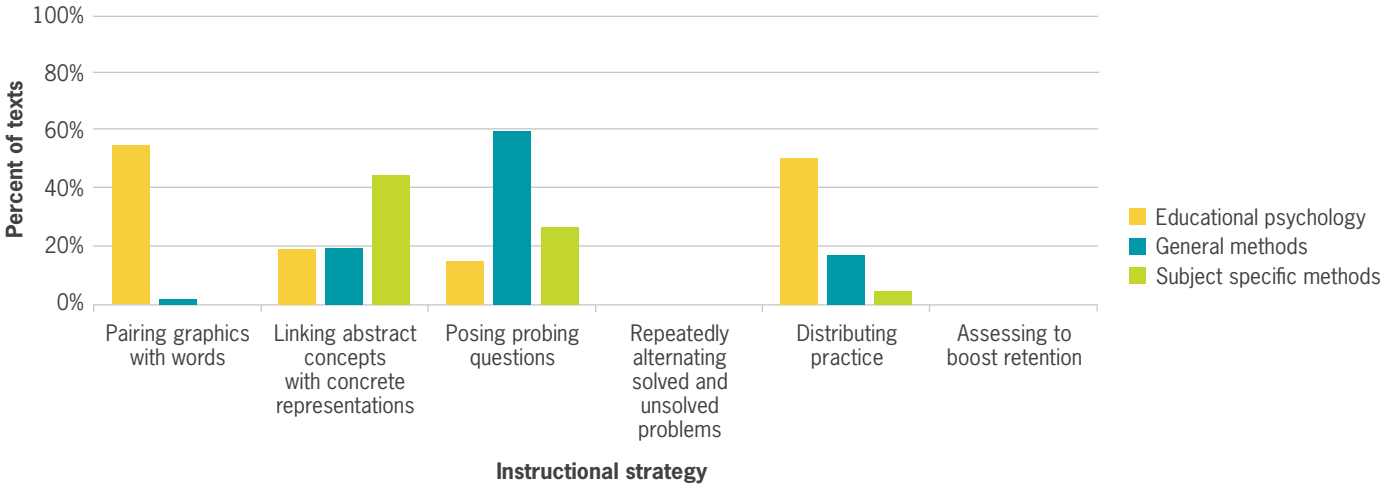
The texts that we examined can be sorted into three basic types: (1) texts focused on educational psychology that cover a range of topics but have significant sections on instruction, (2) texts only addressing instruction and doing so in a way that is applicable to any subject, and (3) texts only addressing instruction in the context of teaching a single subject.

The different types of texts tend to emphasize different instructional strategies, as shown in Figure D2. The strategy of **distributing practice** is almost three times more likely to be taught in educational psychology texts than in other types of texts, while general methods texts are twice as likely to teach **posing probing questions** as educational psychology or subject-specific methods texts.

1 Data related to textbooks in this appendix, and in other parts of this report, were weighted to take into account the number of programs in the sample in which each textbook was assigned.

In addition, educational psychology texts tend to cover the largest number of strategies, an average of 1.22 strategies, followed by an average of 0.88 strategies for general methods texts and 0.67 strategies for subject-specific methods texts.

Figure D2. Coverage of fundamental instructional strategies, by type of textbook (n = 48)



Different types of courses assign textbooks that cover different strategies.

As figure D2 points out, each strategy is likely to appear in textbook readings in at most one type of course. In other words, it is entirely possible that a teacher candidate will read about **distributing practice** and **pairing graphics with words** in an educational psychology class, **posing probing questions** in a general methods class, and (for secondary candidates only) **linking abstract concepts with concrete representations** in a subject-specific methods class, *but those topics will not be reinforced in textbooks for other courses.*[2] While our analysis gives credit to programs for teaching a strategy even if it is included in only a single class, the fundamental instructional strategies are so important that they should be practiced and reinforced repeatedly throughout coursework and student teaching.

The fact that different types of texts tend to teach different strategies, and the influence that texts have on the content of the courses in which they are assigned, reduce the likelihood that teacher candidates will have sufficient opportunities to learn about and practice any given strategy — much less all of them — throughout their preparation.

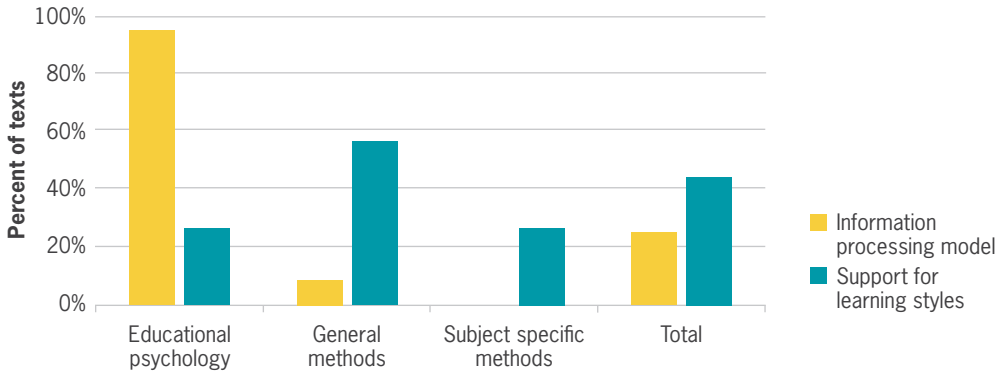
What do texts say about the cognitive processes underlying learning?

The fundamental instructional strategies are not cookbook formulas; instead, they are lesson-design approaches that can used to teach myriad topics across all grade levels and subjects. Understanding basic principles of how people learn will help teachers to make better choices as they incorporate the strategies into their lessons. To provide a snapshot of what texts teach about how the brain works, we tracked coverage of two topics related to how people learn — the information-processing model and learning styles. The first is science, the second is pseudo-science.

As Figure D3 shows, the average text is more likely to encourage teacher candidates to adapt their instruction to students' "learning styles" (auditory, visual, kinetic, etc.) — an idea which has no support in research — than to explain the information-processing model, which explicates learning processes.

2 Elementary textbooks did not meet our standard for accurate presentation of strategies because they do not convey that the strategies are effective in all subject areas.

Figure D3. Information-processing model or learning styles? What's discussed when texts address cognitive processes? (n = 48)



Texts are more likely to teach pseudoscience than science when explaining how people learn.

Do newer editions of texts contain more information about the fundamental instructional strategies?

The fundamental instructional strategies identified by the IES rest on research dating back, in some cases, for more than a hundred years. The majority of the research cited in *Organizing Instruction and Study to Improve Student Learning* dates from 2000 and before, early enough that the information gained from this research, and the work that proceeded it, should have been prominently featured in our original sample of textbooks, which were published from 2001-2011. However, to understand whether authors have incorporated more information about the six fundamental instructional strategies into more recent editions of their work, we examined the newest versions of six of the most commonly used texts in our sample, as well as any accompanying online videos and exercises that appeared relevant.

We found that three textbooks made minor changes in their presentation of one of the fundamental strategies, although the information still was not sufficient to deem the strategy "covered." Two of the three texts added less than a page of new content relevant to the strategies. Two texts made no significant changes related to the strategies. The last text, giving the findings of a single study as support for the change, significantly downgraded its former endorsement in previous editions of the strategy of **pairing graphics with words**.

The videos and other media did not add any information about the strategies that were not already available in the text, and questions and exercises accompanying the videos did not directly address the fundamental strategies even when it would have been easy to do so. For example, **distributing practice** was not addressed in the questions for viewers accompanying a video demonstrating the use of various types of practice within a lesson.

Figure D4. Changes in recent editions of texts in our sample

Three texts slightly improved their coverage of one of the strategies:

Comparing the 2nd ed. of Dean et al.'s *Classroom instruction that works* (2012) with the 1st ed. (2001) by Marzano *et al.*

Fundamental Instructional Strategy	Discussion in 2001 edition	Change in discussion in 2012 edition?	Reader's take-away on the importance of use?
Pairing graphics with words	Not mentioned	↔	↔
Linking abstract and concrete representations	Not mentioned	↔	↔
Posing probing questions	**Covered**	↔	↔
Repeatedly alternating solved and unsolved problems	Not mentioned	↔	↔
Distributing practice	**Covered**	↔	↔
Assessing to boost retention	Not mentioned	↑*	↑**

Comparing the 5th ed. of Guillaume's *K-12 Classroom Teaching: A Primer for New Professionals* (2015) with the 3rd ed. (2008)

Fundamental Instructional Strategy	Discussion in 2008 edition	Change in discussion in 2016 edition?	Reader's take-away on the importance of use?
Pairing graphics with words	**Covered**	↔	↔
Linking abstract and concrete representations	Mentioned	↔	↔
Posing probing questions	Not mentioned	↑*	↑**
Repeatedly alternating solved and unsolved problems	Not mentioned	↔	↔
Distributing practice	Not mentioned	↔	↔
Assessing to boost retention	Not mentioned	↔	↔

Comparing the 11th ed. of Slavin's *Educational Psychology: Theory and Practice* (2015) with the 9th ed. (2009)

Fundamental Instructional Strategy	Discussion in 2009 edition	Change in discussion in 2015 edition?	Reader's take-away on the importance of use?
Pairing graphics with words	**Covered**	↔	↔
Linking abstract and concrete representations	Mentioned	↔	↔
Posing probing questions	Not mentioned	↔	↔
Repeatedly alternating solved and unsolved problems	Not mentioned	↔	↔
Distributing practice	**Covered**	↔	↔
Assessing to boost retention	Not mentioned	↑*	↑**

* Discussion is more accurate, but does not constitute coverage of the strategy.
** While there is discussion of the strategy, it is still minor.

Two texts made no significant changes:

Comparing the 10th ed. of Kellough and Carjuzaa's *Teaching in the Middle and Secondary Schools* (2013) with the 9th ed. (2008)

Fundamental Instructional Strategy	Discussion in 2008 edition	Change in discussion in 2013 edition?	Reader's take-away on the importance of use?
Pairing graphics with words	Mentioned	↔	↔
Linking abstract and concrete representations	Not mentioned	↔	↔
Posing probing questions	**Covered**	↔	↔
Repeatedly alternating solved and unsolved problems	Not mentioned	↔	↔
Distributing practice	**Covered**	↔	↔
Assessing to boost retention	Mentioned	↔	↔

Comparing the 5th ed. of Santrock's *Educational Psychology* (2011) with the 4th ed. (2009)

Fundamental Instructional Strategy	Discussion in 2009 edition	Change in discussion in 2011 edition?	Reader's take-away on the importance of use?
Pairing graphics with words	Not mentioned	↔	↔
Linking abstract and concrete representations	**Covered**	↔	↔
Posing probing questions	Mentioned	↔	↔
Repeatedly alternating solved and unsolved problems	Not mentioned	↔	↔
Distributing practice	Mentioned	↔	↔
Assessing to boost retention	Not mentioned	↔	↔

One text made changes for the worse:

Comparing the 13th ed. of Woolfolk's *Educational Psychology* (2016) with the 11th ed. (2010)

Fundamental Instructional Strategy	Discussion in 2010 edition	Change in discussion in 2016 edition?	Reader's take-away on the importance of use?
Pairing graphics with words	**Covered**	↓	↓
Linking abstract and concrete representations	Not mentioned	↔	↔
Posing probing questions	Mentioned	↔	↔
Repeatedly alternating solved and unsolved problems	Not mentioned	↔	↔
Distributing practice	Not mentioned	↔	↔
Assessing to boost retention	Mentioned	↔	↔

Appendix E:
Methodology of Program Evaluations

The program sample

This study analyzes coursework from 48 teacher preparation programs located within 28 institutions of higher education (IHEs) in 19 states. The programs are listed by name in Appendix B.

Programs in the sample were randomly selected from approximately 490 for which NCTQ had obtained full sets of syllabi for professional coursework and student teaching materials. These documents were screened to ensure that sufficient information was provided in syllabi for relevant coursework to ascertain the nature of lectures/class discussion, assignments and required readings, and that program documents included observation forms and lesson/unit plan guidelines used during student teaching. Nothing in the selection or screening process should bias results. The syllabi and other materials used in the report are dated between 2009 and 2012.

The sample includes approximately equal numbers of undergraduate elementary and secondary programs (16 and 17, respectively), as well as approximately equal numbers of graduate programs at each level (6 elementary, 9 secondary). The sample is generally representative of the national population of teacher preparation programs, except that the proportion of public IHEs is greater than the national average because only public IHEs are obligated to comply with NCTQ's open records requests for data.

Selection of relevant coursework

Courses of three types were included in analysis: 1) educational psychology, 2) general methods, and 3) methods specific to teaching in the four core subjects (English/language arts, math, science, history/social studies). Course titles, descriptions, class topics, and assigned readings were considered when judging course relevance.

Educational psychology courses

Courses selected focus on the application of psychology to learning. The titles, descriptions, or objectives of these courses include phrases such as "educational psychology," "cognitive science," "learning theories," "information processing," or "memory."

General or introductory psychology courses were not analyzed: Even if they include topics relevant to instructional strategies or cognitive science, as broad survey courses they would not be able to do so with the requisite depth or emphasis necessary for prospective teachers. Likewise, developmental psychology and human development courses (which might address relevant topics to a small degree) were not included unless there was a clear, strong connection in the course between development and learning — as indicated, for example by course titles such as *Educational Psychology Applied to Adolescent Development and Human Development and the Learner*.

General methods courses

Courses selected focus on instructional or teaching strategies relevant to all subject areas. These courses often cover topics related to designing and delivering instruction, writing lesson plans, and designing and using assessment. Courses in this category are relevant if instruction is a major focus, although they may also devote considerable time to another aspect of teaching, such as classroom management.

Introductory education courses that may only briefly cover instructional methods among areas of major focus, such as philosophies of education and the history of education in the U.S., were not included. (Such courses typically have titles like *Foundations of Education and Orientation to Teaching*.) General methods courses could focus on the elementary or secondary grade span, but could not address instructional methods only for a specific group of students, such as students receiving special education services or English language learners. Courses with titles referring to specific environments (such as *Teaching in Culturally Diverse Environments and Teaching in Urban Settings*), were included if close inspection indicated that they address general methods and that there was not a more appropriate general methods course required in the program.

Subject-specific methods courses

Subject-specific methods courses cover topics similar to general methods classes, but focus on one or more subject-areas. Methods courses analyzed for this study address core subjects such as math, English/language arts, social studies, and science. The fact that teacher candidates should learn that the fundamental instructional strategies are not subject specific but of general applicability led us to consider subject-specific methods courses in elementary and secondary programs differently:

- An elementary teacher who learns a particular strategy in the context of a math methods course is unlikely to understand that the same strategy can be applied to English instruction. We therefore examined single-subject methods courses in elementary programs with a careful eye to discern how strategies were presented, and did not evaluate subject-specific methods texts.
- However, because secondary teachers will only teach the single subject covered by the subject-specific course, we gave credit to strategies taught in the context of a single subject within secondary programs, and reviewed relevant texts assigned in secondary subject-specific methods courses.

In general, subject-specific methods courses covered the fundamental strategies so infrequently that, if they had been ignored entirely, all but seven of the forty-eight programs in this report would have been judged to prepare teacher candidates on the same number of fundamental strategies.

Courses that focus solely on imparting subject-area content to prospective teachers were not included; however, classes that combine instruction in both methods and content were.

In the domain of English/language arts, methods courses focused specifically on *literacy* or *reading* were not included unless no other English/language arts methods course was required: Literacy/reading courses generally address instruction in the processes involved in reading (e.g., decoding, fluency, comprehension), rather than in more general instructional strategies for fostering understanding and retention of content.

Figure E1 provides examples of typical courses deemed relevant and irrelevant.

Figure E1. Examples of Titles of Courses Relevant and Not Relevant to Analysis

Course category	Course titles relevant to analysis	Course titles not relevant to analysis
Educational psychology	Educational Psychology Learning Theory in Elementary Schools Psychological Foundations of Education Psychology of the Learner Human Development and the Learner	Introduction to Psychology Human Development Child and Adolescent Development
General methods	Designing Instruction and Evaluation in the Secondary Classroom Integrating Teaching and Learning Methods and Media in Middle/High School Principles and Techniques of Teaching Introduction to Elementary Teaching	Foundations of Education Management Principles for Elementary Teachers Classroom Management and Organization
Subject-specific methods	Curriculum, Instruction, and Assessment in Secondary and Middle Level Mathematics Knowing, Teaching, and Assessing in: Earth, Physical, and Life Sciences Teaching and Learning in Social Studies Teaching Secondary English Teaching Language Arts in Elementary Schools	Mathematics for Secondary Teachers English Grammar and Usage Processes and Acquisition of Reading

Other courses

Teacher preparation programs almost always include both classroom-based coursework and clinical coursework (practica, field experiences, student teaching). Classroom-based coursework was our focus; the only clinical courses included were linked with courses already identified for inclusion. For instance, a general methods course, *Teaching and Learning,* might have an included co-requisite of *Field Experiences in Teaching and Learning*, or a subject-specific methods course like *Science Teaching Methods* might have an included co-requisite of *Practicum in Science Teaching Methods*.

Summary of courses

In total, 195 distinct courses were selected for analysis. Because some of these courses are required in multiple programs at the same institution, the total number of courses examined was 219. Taking into account that some are part of multiple programs within the same IHE, 14 percent of courses were educational psychology courses, 24 percent were general methods courses, and 62 percent were single-subject methods courses. A typical elementary program included one educational psychology course, one general methods course, and four subject-specific methods courses focused on the core subjects of math, English, social studies, and science.[3] A typical secondary program included one educational psychology course, one general methods course, and one subject-specific methods course.[4]

3 Elementary teacher candidates often take additional subject-specific methods courses focused on health, physical science, art, or music. However, we did not evaluate these courses because the instructional strategies they taught were even less likely to be presented as universally applicable than material taught in courses focused on core subjects.

4 A typical secondary program offers licensure in multiple subjects, and different subject-specific courses are required for candidates in each subject. The average coverage of the fundamental strategies across all pathways offered at a sample of five programs was compared with corresponding results for courses which were part of a single randomly chosen pathway. Results from both approaches were extremely similar, and as a result the methodology of this report specifies that the subject-specific courses for one randomly chosen subject will be evaluated for each secondary program.

Student teaching documents

Two types of student teaching documents capture instruction-related guidance and feedback: 1) forms for observation and evaluation of teaching episodes, and 2) lesson and unit planning guidelines.

Observation and evaluation forms are used by both university personnel and cooperating teachers to give feedback to student teachers on their instructional skills. By choosing the indicators on these instruments, the program signals which skills are most essential to teaching and mandates the areas in which student teachers must, at minimum, receive feedback. In addition, scores on observation and evaluation forms are generally a major part of the grade for student teaching.

During student teaching, candidates complete a variety of instructional assignments, such as daily lesson plans and/or a teacher work sample that includes a unit plan. Although the parameters of each assignment may vary, all involve some degree of lesson planning, which generally must follow specific guidelines established by the candidate's program. Like observation and evaluation instruments, these guidelines indicate which instructional strategies teacher candidates are required to know and practice.

Program analysis

Programs were analyzed by combining information from syllabi, textbooks assigned in the course,[5] and student teaching documents. A program was considered to "prepare a candidate" in a strategy if 1) evidence was found with respect to at least one course that candidates are exposed to the strategy during class time through lecture or discussion, *and* 2) candidates practice the strategy at least once. (Credit for "practice" requires only that candidates are either given an assignment related to the strategy during any course or are required to use the strategy during student teaching.)

Syllabus and student teaching document analysis

Analyses of syllabi have long been an accepted part of the evaluation of teacher preparation. State agencies, accrediting organizations, and multiple research studies use syllabi for the same purpose for which these documents are distributed to students: to identify key topics covered by a course. NCTQ's methodology follows this approach, treating a syllabus as an outline of the broad topics considered essential. In addition, syllabi provide a host of other data, such as textbooks and other required and recommended reading, descriptions and grade weights of assignments and bibliographies on which coursework is based.

In addition to identifying required textbooks and which chapters of those textbooks were assigned for reading, syllabi were used to determine if the six fundamental instructional strategies are discussed during class time or practiced in assignments. When syllabi were vague or unclear about lecture topics, readings or assignments, we used contextual clues from other parts of the syllabus to provide information. If language could not be clarified, credit was given for the broadest and most generous interpretation of its content.

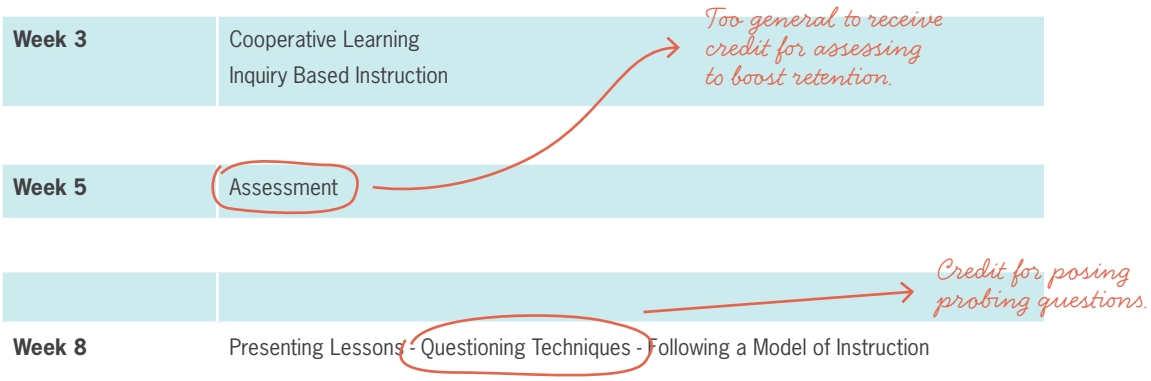
5 See Appendix C for a full explanation of how textbooks were selected and evaluated.

Coding of syllabi for instruction

The following example of a real syllabus shows coding for the fundamental instructional strategies.

Figure E2. Coded Syllabus

Date	Topics
Week 1	Introduction/Overview Role of the Teacher Considering All Learners' Needs: Learning Styles/Multiple Intelligences
Week 2	Introduction to Models of Instruction Direct Instruction
Week 3	Cooperative Learning Inquiry Based Instruction
Week 5	Assessment
Week 8	Presenting Lessons - Questioning Techniques - Following a Model of Instruction



Note: This is part of a longer schedule. The empty lines show where weeks were omitted.

Course schedules, which list the main topics to be addressed at each course meeting, provided the primary window into the topics covered in each course. If a syllabus did not contain a course schedule, the list of goals or outcomes for the course was examined to see if they described specific strategies to be taught in the class. If the list of goals was too broad (or simply reproduced standards established by a university or national organization), the syllabus — and therefore the program — could not be evaluated and the program was removed from the sample.

Determination of whether candidates read from texts that cover the fundamental instructional strategies was specific to assigned readings. If a syllabus did not indicate which portions of a text were read, it was assumed that the entire text was read.

Coding of syllabi and student teaching documents for practice

Coding for practice in assignments or student teaching documents was similar. If assignments were not listed, or were not described in detail, the program could not be evaluated and it was removed from the sample.

Figure E3 illustrates coding of a form used to evaluate teaching episodes in a field experience that is associated with a general methods course.

Figure E3. Coded Assignment

Supervising Teacher Lesson Evaluation

Candidate _____ Student ID No. _____

Content Specialization _____ Semester _____ Year _____

I. Evidence of Planning	Distinguished	Accomplished	Emerging	Unsatisfactory	N/A
1. Evidence of appropriate planning for instruction, including thorough lesson plan aligned with state and national standards.					
2. Knowledge of and appropriate use of content					
3. Selects strategies to accommodate individual difference. (developmental and skill levels, cultural, and exceptionalities).					
4. Plans appropriate assessment(s)					
5. All materials including appropriate technology were ready for use.					
6. Strategies encouraged creativity, innovation and problem solving					

II. Evidence of Teaching					
1. Maintains a positive, supportive classroom climate					
2. Communicated with students in a variety of ways					
3. Used quality questioning techniques and engaged students in discussion					
4. Strategies motivated and engaged students in a deep understanding of the content					
5. Demonstrated ability to adjusted instruction based on the students' responses and needs of students with diversities.					
6. Used assessment data to make instructional decisions					
7. Exhibits good communication skills (speaking, writing, listening), including consistent use of Standard English Grammar					

Credit for posing probing questions.

No credit for assessing to boost retention because does not mention improving retention as a purpose for assessment.

Figure E4 includes additional examples of language drawn from syllabi and student teaching documents of programs in the sample that did or did not receive credit for any given each strategy.

Figure E4. Examples of Language Given Credit or Not Given Credit for Each Strategy

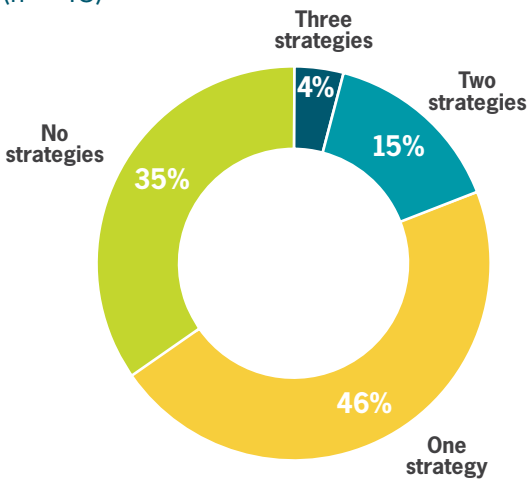
Strategy	Credit awarded	No credit awarded: not sufficiently comprehensive, explicit, or on target
Pairing graphics with words	Class schedule: Topic is "Cognitive perspectives on learning," which is also the chapter subheading under which the text accurately teaches the strategy. The class meeting is assumed to cover the topics in the chapter section. Class assignment: The class takes three exams, including the final exam. Topics on the exams are listed according to textbook chapters, and the second exam covers the chapter in which the strategy is taught. *Not found in student teaching documents*	Class schedule: "Visuals" Class assignment: Instructions for writing a lesson plan say "Use visuals and other means to engage student attention" Student teaching document: Observation form has an indicator which says "Uses visuals appropriately"
Linking abstract concepts with concrete representations	Class schedule: All of the course topics correspond to chapter subheadings of the textbook. Two of the course topics are the same as headings of sections of the text in which the strategy is taught. Class assignment: The class takes three exams, including the final exam. Topics on the exams are listed according to textbook chapters, and the first exam covers a chapter in which the strategy is taught. In the list of goals for the course (because the syllabus did not include a class schedule): "Selects and uses appropriate concrete materials for learning mathematics. "Acceptable despite specification of math because this was a subject-specific methods course for secondary math teachers, who would only be teaching math. *Not found in student teaching documents.*	*This topic was completely absent from syllabi and student teaching documents.*
Posing probing questions	Class schedule: "questioning techniques" Class schedule: "questioning strategies" Class schedule: "questions/discussion/closure" Class schedule: During class time, groups of students are assigned to present all of the chapters, in turn, of a text that accurately teaches the strategy. Class schedule: "Learning and cognitive processes" and the reading assigned for this class meeting accurately teaches the strategy (otherwise the language in the class schedule would be too broad to parse) In list of class goals (because syllabus did not include a class schedule): "Incorporate the use of higher level thinking and questioning skills" Class assignment: Lesson Plan #3 – "Design a complete lesson plan (all sections are included) for a discussion/closure lesson that will be used with the questioning/discussion and closure microteaching assignment." Class assignment: "Scoring Criteria for Lessons 1 and 2" says "Includes at least 6 open-ended questions written in question form." Class schedule and assignment credit: Description of "Mini-lesson" assignment notes that it will be evaluated on "Effective use of questioning." Because the topic is included in an assignment, we assume that it is also covered during class time. Class schedule and assignment credit: As part of the course, students are assessed using the ADEPT observation form. One of the indicators on the form is "Uses appropriate questioning techniques." Because the topic is included in an assignment, we assume that it is also covered during class time. Student teaching document: Midterm evaluation has an indicator that measures whether candidates "use appropriate questioning techniques." Student teaching document: Lesson plan guidance requires candidate to "write six open-ended questions for each goal."	Class schedule: "Socratic discussion" Class schedule: "Motivating students through discussion" Class assignment: "Introduction" section of lesson plan says "Use questions, KTW chart, etc to engage prior knowledge."
Repeatedly alternating solved and unsolved problems	*Not found in class topics, assignments, or student teaching documents.*	Class schedule: "Guided Practice" Class assignment: Lesson plan template includes section for "guided and independent practice" but does not provide any additional instructions on how practice should be structured. Student Teaching Document: Observation form has indicator for "Guided Practice"

Strategy	Credit awarded	No credit awarded: not sufficiently comprehensive, explicit, or on target
Distributing practice	From a class schedule: The topic for the week is "Learning and Cognitive Processes" which is the also the title of the chapter of the text which is assigned that week. The text chapter accurately teaches the strategy, and the class meeting is assumed to cover the topics in the chapter. Class schedule: "Assessment-based instruction: remediation, extension, reinforcement" Class assignment: The professor gives a weekly quiz. Our analysis has shown that the strategy is accurately taught during the week, and we assume that the quiz covers all topics taught that week. Class assignment and class schedule credit: The class takes three exams. The content of the exams is described by chapter numbers. Exam 2 covers a chapter which accurately describes the strategy. Because the topic is included in an assignment, we assume that it is also covered during class time. *Not found in student teaching documents.*	Class schedule " Lesson Planning" Class schedule: "Effective lessons" Class schedule: Text that accurately covers the strategy is assigned, but corresponding class topic is "Piaget/Vygotsky" Class assignment: Lesson plan template includes section for "guided and independent practice" Student Teaching Document: Lesson plan template includes "practice" section
Assessing to boost retention	*Not found in class topics, assignments, or student teaching documents.*	Class Schedule: "Designing assessment for instruction" Class schedule: "Formative and Summative Assessment" Class Schedule: " Using assessment to inform instruction" Class assignment: Lesson plan template asks "How will you measure what students have learned?" Student Teaching Assignment: Lesson plan template includes space for "Diagnostic, Formative, Summative" assessments.

Appendix F:
Additional Findings on Program Preparation on Strategies

This report combines information gleaned from assigned textbooks, course topics, coursework assignments and student teaching assignments to understand which of the fundamental instructional strategies teacher candidates in the sample's programs are exposed to and required to practice.[6] Almost half of the programs in the sample prepare candidates on only one strategy, and that strategy is almost always **posing probing questions**; one-third prepare candidates in none of the strategies; two prepare candidates in three strategies; none prepare candidates in more than three. See Figure 1F below.

Figure F1. Number of strategies in which candidates are prepared by programs (n = 48)



In eighty percent of programs in the sample, teacher candidates are prepared in at most one of the fundamental instructional strategies.

As discussed on page 15 of the report, **posing probing questions** is the only one of the fundamental instructional strategies in which there is a 50 percent or greater chance that teacher candidates will be prepared by their program. A small percentage of programs prepare candidates on one or more of the strategies of **pairing graphics with words**, or **linking abstract concepts with concrete representations**, or **distributing practice**, while none of the programs in the sample prepare candidates on the strategy of **repeatedly alternating solved and unsolved problems** or **assessing to boost retention**.

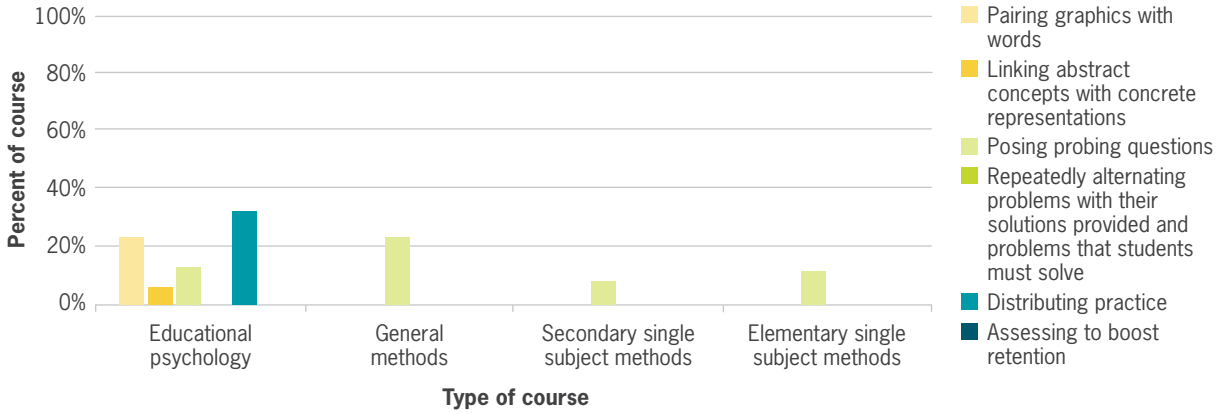
Only minor differences were observed in the preparation on the strategies among the four types of programs in the sample: undergraduate and graduate elementary, and undergraduate and graduate secondary.

How the strategies are taught within a typical program

A typical program includes three types of courses focused on instruction: educational psychology, general methods and subject-specific methods courses. Considering only the degree to which teacher candidates are prepared in coursework and not in student teaching, Figure F2 shows there are significant differences in the types of strategies presented in each type of course.

6 "Preparation" in a strategy is defined in this study as the combination of discussion or lecture in class AND at least one practice assignment.

Figure F2. What type of course covers each strategy? (n = 219)



Only one of the six fundamental strategies is reinforced throughout coursework.

The distribution of strategies implies that that teacher candidates may learn about **distributing practice** or **pairing graphics with words**, but not be asked to practice either of these strategies outside the single course in which they were learned. **Posing probing questions** is the only strategy that is likely to be reinforced throughout coursework. The odds that a teacher candidate will learn about and practice the three remaining strategies — **linking abstract concepts with concrete representations**, **repeatedly alternating solved and unsolved problems** and **assessing to boost retention** — are zero or close to zero.

How the fundamental instructional strategies are addressed in student teaching

We found that only one of the fundamental instructional strategies (**posing probing questions**) was incorporated into student teaching in any of the programs in our sample. Seventy-one percent of programs gave student teachers feedback in observation forms on their **posing** of **probing questions**, but in only one case were candidates explicitly asked to use this strategy in lesson planning assignments.

Figure F3. How did programs make **posing probing questions** part of student teaching?

Instructions in Lesson Plan Assignments	Indicators in Observation Instruments
■ "list key questions that you will ask during the lesson"	■ "Uses questioning strategies to engage students and stimulate higher order thinking and asks follow up questions to expand, clarify, and assess student learning" ■ "Designs multiple opportunities within a lesson for students to be engaged in instructional conversations that allow them to interact and make meaning of the content and language skills being learned" ■ "candidate encourages students to explain their reasoning/strategies" ■ "Incorporates questioning techniques that elicit multiple-level thinking" ■ Uses questioning and discussion techniques to enhance student learning

It would not be difficult for programs to weave all six of the fundamental strategies into student teaching. Given the strategies' importance, it is essential that programs do so. At a minimum, the fundamental strategies should be part of major student teaching assignments including lesson planning and observations. Appendix H is a sample lesson plan format that incorporates the six fundamental strategies, and Appendix I shows how they can be included in observation feedback. Excerpts from an observation form used by one of the programs in our sample show how easily existing assignments can be modified to include the key instructional strategies.

Figure F4. How can the fundamental strategies be included in an existing observation form?

Indicator	Strategy
Presents material in clear, precise language **accompanied by graphic representations of the material**.	**Pairing graphics with words**
Provides concrete examples and explanations **and connects them to underlying abstract concepts**.	**Linking abstract concepts with concrete representations**
Probes for understanding **using questions such as "why," "how," "what if," "why not," etc.**	**Posing probing questions**
Provides for student practice **distributed over weeks and months, including problem sets that alternate worked problems and problems to be solved**.	**Repeatedly alternating solved and unsolved problems; Distributing practice**
Provides for assessment of student progress, **including assessment that promotes recall**.	**Assessing to boost retention**

The bolded additions show how the fundamental instructional strategies can be incorporated into the original indicators.

Appendix G:
Research Inventory

Part 1: Studies cited in *Organizing Instruction and Study to Improve Student Learning: A Practice Guide* and additional studies that postdate publication of the practice guide and are of comparable caliber.

(Additional studies are listed in bold)

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Part 2: Studies investigating the impact of instruction of teacher candidates on the six fundamental instructional strategies

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Appendix H:
Sample Lesson Plan Format

Fundamental Instructional Strategies are in bold, italicized text

Topic: _____

Subject(s): _____

Grade/Level: _____

Standards, ***Distributed Practice***, and ***Assessment***

Standards:

Distributed Practice: On the calendar of the unit plan of which this lesson is a part, indicate the date(s) on which students will have at least one episode of delayed practice (which may be done as homework).

Assessment: Describe how student performance will be assessed for formative and summative purposes. Describe specifically how one or more ***assessments will be designed to boost retention***.

Formative assessment(s):

Summative assessment(s):

Implementation

Goal(s): What is the overall intent of this lesson in terms of understanding?

Objective: With reference to the standard, what will students know and be able to do as a result of this lesson?

Instructional prep:

Literacy: Identify the text or reading materials to be used, key vocabulary and vocabulary strategy, text-based questions, and any comprehension strategy.

Probing questions: Identify 3-5 questions you will ask students after they have acquired factualunderstanding. Also identify their likely answers and possible misunderstandings.

Concrete concepts and abstract representations: Identify a concrete, real-life application of what you are teaching and an abstract representation if one is relevant. If you plan to present an abstract representation, describe how you will explicitly help students make the transition from the concrete to the abstract representation.

Graphic and verbal representations: Sketch out any graphic representation that you will use to teach, including appropriate labels for the parts of the graphic representation. Write out what you will say to describe each part of the graphic representation.

Problem sets: Prepare a problem-set containing at least six problems, ***alternating solved problems with unsolved problems***. Make sure that you "unpack" the key features of the solved problem. Differentiate the challenge in two or more problem sets if necessary. Note: Some or all of the set may be done as homework.

Modifications and extensions: Describe modifications needed to accommodate children with special needs and English language learners, and extensions needed to accommodate students who have already achieved proficiency on the objective.

Model(s) of instruction: Identify when and why you will be using direct instruction, inquiry learning, cooperative teaming, and so on.

Materials and Resources

Materials and resources: List any printed materials, texts, worksheets, handouts, etc. If you plan to use any technology or technology software/applications, identify them and indicate how they will boost instruction.

Appendix I:
Sample Indicators for Observation Instrument

In addition to other important elements, student teaching observation instruments should measure:

I. **Instructional Strategies: How well does the teacher use the six fundamental instructional strategies to help students learn?**

   a. **Pairing graphics with words.**

      i. Does the teacher provide graphic representations of essential concepts whenever possible?

      ii. Are graphic representations presented at the same time as verbal or text explanations of key concepts, and does the teacher explain how components of a graphic correspond to elements of the key concepts?

      iii. Do graphic representations convey the key ideas of the concept, instead of simply being appealing images?

      iv. Are the graphic representations clearly labeled?

   b. **Linking abstract concepts with concrete representations.**

      i. Does the teacher present a variety of concrete, well-chosen examples to illustrate abstract concepts?

      ii. Particularly when working with young children or students with academic difficulties, when students encounter particular examples of an abstract concept, does the teacher connect those examples to the larger idea?

   c. **Posing probing questions.**

      i. Does the teacher move beyond simple factual questions and ask probing questions that require students to explain the evidence for their answers?

      ii. Does the teacher ask a variety of types of probing questions, such as why, why not, how, what if, how does X compare to Y, and what is the evidence for X?

   d. **Repeatedly alternating solved and unsolved problems.**

      i. Does student practice include worked problems interspersed with problems to be solved?

   e. **Assessing to boost retention.**

      i. Does the teacher give quizzes, tests, and other assessments in which a substantial number of questions require active recall of correct answers?

      ii. Do students receive feedback on assessments that includes the correct answers?

Appendix J:
Analysis of Textbook References

The textbooks examined in this report contain a tremendous amount of advice on how to teach: a typical text includes 100-300 pages on the subject of instruction alone. Similarly, almost every text's recommendations are supported by copious citations, usually filling dozens of pages in the reference list at the back of the book. Examining *which* references textbook authors choose to cite provides a window into why some information is included in each text, while other information, including fundamental instructional strategies, is so often absent.

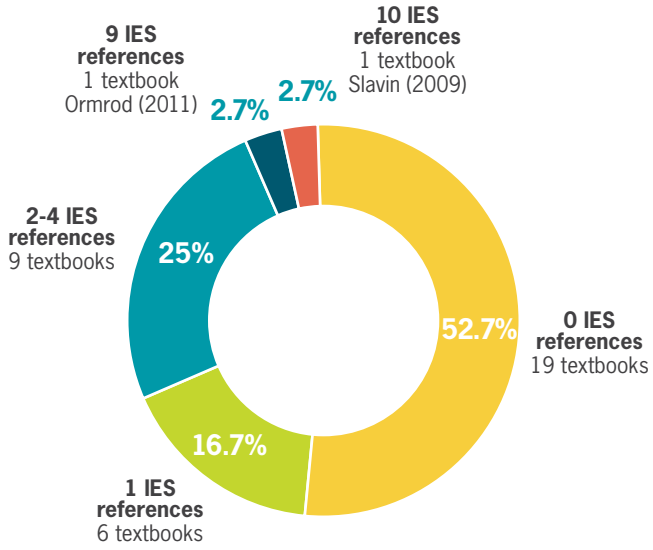
In general, the analysis described in this appendix clearly indicates that the panel of experts that wrote the IES practice guide and textbook authors are drawing on different sources to undergird their discussions of instructional practices. Examination of a sample of the studies which are cited by multiple textbooks indicates that only a small minority have the potential to meet IES research design standards.[7]

To what extent do the IES practice guide *Organizing Instruction and Study to Improve Student Learning* (Pashler et al., 2007) and the assigned textbooks in the sample for this report share a research base?

The IES guide cites 114 journal articles, books, and book chapters (referred to here as "IES references") that provide the research foundation supporting the six fundamental instructional strategies featured in this report. We examined the reference lists of 36 of the 48[8] instructional methods and educational psychology textbooks in our sample to see how many of these 114 publications they likewise cited.[9] We find minimal overlap between the IES references and those cited in the textbooks.

On average each required textbook cites 1.5 of the 114 IES references, or 1.3 percent. Across the 36 textbooks, there are a total of 54 citations to IES references; any individual textbook has between zero and 10 citations of the IES references. Specifically:

Figure J1.



Most of the texts did not cite any of the references in the IES guide.

7 More information on the IES's standards is provided in Seftor, N., et al. (2014). What works clearinghouse: Procedures and standards handbook 3.0. Washington, DC: Institute of Education Sciences, US Department of Education.

8 Most of the single-subject methods texts were not included in this group because they were not added to the sample pool until after this analysis was conducted.

9 The analyses described in this appendix took into account that an investigator or group of investigators may author several different articles describing the results of substantially similar research.

The 54 cites by the textbooks to IES references refer to 26 different publications; in other words, 22.8 percent of the IES references were cited at least once, while 88 (77.2 percent) were never cited. The most commonly cited sources — all related to the strategy of **posing probing questions** — are:

- Palincsar, A. S., & Brown, A. (1984). Reciprocal teaching of comprehension-fostering and comprehension-monitoring activities. *Cognition and Instruction, 1*, 117-175. **[Cited in 10 textbooks]**
- Rosenshine, B., Meister, C., & Chapman, S. (1996). Teaching students to generate questions: A review of the intervention studies. *Review of Educational Research, 66*, 181-221. **[Cited in 5 textbooks]**
- King, A. (1994). Guiding knowledge construction in the classroom: Effects of teaching children how to question and how to explain. *American Educational Research Journal, 31*, 338-368. **[Cited in 4 textbooks]**
- Dillon, T. J. (1988). *Questioning and teaching: A manual of practice*. New York, NY: Teachers College Press. **[Cited in 4 textbooks]**

One possible explanation for these differences could be that textbook authors may have an incentive to use the newest citations possible. For example, their publishers may pressure them to update citations in each subsequent edition of a book. This practice would compel authors to substitute secondary sources for primary sources (such as the primary sources cited in the IES guide) in the process. While we did not comprehensively evaluate this possibility, we found evidence suggesting that it is not the case: We examined the publication dates of the references in five textbooks in the sample and compared them to publication dates of references in the IES guide. We found that the references cited in the IES guide were slightly newer than those cited in the textbooks, not older, making the IES guide references *more* likely to meet with a publisher's approval should the publisher care about keeping a textbook looking current: Almost half (49 percent) of references in the IES guide were published in the last 15 years, compared to 40 percent of textbook references. We also checked to see if texts in our sample that were published after the IES guide were more likely to reference sources mentioned in the guide, but they were not.

Do the textbooks within our sample show greater overlap in their research base than they do with the IES practice guide?

To address this question, we selected six research-focused, frequently assigned books from our original sample of books. The resulting subsample includes five educational psychology textbooks (Bohlin, et al, 2009; Eggen & Kauchak, 2010; Ormrod, 2011; Santrock, 2009; Woolfolk, 2010) and one general methods text (Marzano et al., 2001). The number of references in these texts ranges from 290 (Marzano et al.) to 3189 (Ormrod), with an average of 1793. We compared the reference list of each text with that of four other texts in the subsample, resulting in a total of 12 comparisons as shown in Figure J2.

Figure J2.

Text A	Text B	Number of references in Text A	Number of references in Text B	Number of shared references	Percent agreement
Bohlin et al.	Eggen & Kauchak	1959	1438	184	12.80%
Bohlin et al.	Marzano et al.	1959	290	28	9.66%
Eggen & Kauchak	Ormrod, J. E.	1438	3189	315	21.91%
Eggen & Kauchak	Santrock, J W	1438	2083	183	12.73%
Marzano et al.	Woolfolk, A. E.	290	1798	19	6.55%
Marzano et al.	Eggen & Kauchak	290	1438	15	5.17%
Ormrod, J. E.	Marzano et al.	3189	290	34	11.72%
Ormrod, J. E.	Santrock, J W	3189	2083	205	9.84%
Santrock, J W	Bohlin et al.	2083	1959	186	9.49%
Santrock, J W	Woolfolk, A. E.	2083	1798	189	10.51%
Woolfolk, A. E.	Bohlin et al.	1798	1959	277	15.41%
Woolfolk, A. E.	Ormrod, J. E.	1798	3189	324	18.02%

These texts share an average of 12 percent of their references with each other, but only cite 1.3 percent of the references found in the IES guide.

As previously reported, each textbook in the full sample cites on average only 1.3 percent of the IES references; for the subsample shown above, the proportion of IES reference cited rises to 4.0 percent. In contrast, each pair of textbooks in the subsample shows a 12 percent overlap on average.[10] These statistics indicate that there is more agreement among textbooks than between the textbooks and the IES guide, but that this by no means constitutes consensus among textbooks about educational research most important for training future teachers.

What are the characteristics of the most commonly cited publications in textbooks within the sample for this report? Why were they not cited in the IES guide?

To understand what types of references are most commonly cited by the textbooks in the sample for this report, we examined references that are cited by multiple textbooks but not by the IES guide. Specifically, we examined the references cited by four texts that are among the most commonly used, research-focused texts in the full sample, including two methods texts (Marzano et al., 2001 and Orlich et al., 2010) and two educational psychology texts (Bohlin et al., 2009 and Woolfolk, 2010).[11] These texts were compared in pairs, with each pair including at least one methods text (as shown in Figure J3) because we wished to identify references relevant to instruction. If educational psychology texts were paired, it was likely that a large proportion of their common references would relate to topics besides instruction, such as the structure of the brain.

10 The overlapping percentage of references for each textbook pair was calculated by dividing the number of mutual references by the lower total number of references.

11 The subsample for this analysis contains more methods texts and fewer educational psychology textbooks than the previous subsample because it was necessary for each pair of texts to include a methods text.

Figure J3.

Text A	Text B	Number of shared references
Marzano et al.	Orlich et al.	10
Marzano et al.	Bohlin et al.	29
Marzano et al.	Woolfolk	21
Orlich et al.	Bohlin et al.	37
Orlich et al.	Woolfolk	38

A total of 101 references were shared between two or more of the four texts.

We identified 101 "overlapping" references within these pairs of texts, including 76 references cited by 2 texts, 24 cited by 3 texts, and 1 (Mager, 1962) cited by all 4 texts in this subsample. Just 1 of these 101 references is also cited in the IES guide: Palincsar & Brown (1984), a reference which supports the strategy of **posing probing questions**. Given that the other 100 publications were deemed critical sources on instruction by more than one textbook author, one might ask why they were *not* included in the IES guide.[12] While some may have been outside the scope of the IES practice guide, their most salient feature is that they lack the quality sufficient to meet IES standards.[13]

Of the 100 references shared by at least two textbooks but not by IES, 58 were related to instruction; that is, they concern instructional strategies or design, classroom assessment, or cognitive psychology. Of these 58 references, 38 (65.5 percent) are secondary sources including books, book chapters, and journal articles providing description and/or commentary on research on varied aspects of instruction. The remainder (34.5 percent) consists of primary sources, including reports of individual empirical studies, meta-analyses, and systematic literature reviews. In comparison, the IES reference guide cites mostly primary sources (85.1 percent); only a few secondary sources are referenced (14.9 percent).

This comparison suggests that textbook authors are relying on non-systematic research summaries and other writers' opinions much more often than the IES panel did.

The 20 overlapping references identified as primary sources potentially present the strongest evidence for how teachers should use their instructional time. The references were all published prior to the IES guide, and thus they all potentially could have been included. However, all but four have clear problems in their design that limit or negate the validity of their conclusions. These problems fall into 6 main categories and Figure 4J shows how often they occurred.

- **Small sample size**: Fewer than 50 participants, based on considerations that (a) 52 participants (26/group) is minimum number needed to detect a large effect when conducting a 1-way ANOVA with 2 groups[14] and (b) if a study is conducted in classrooms, with classes averaging about 25 students, then a sample of 50 means probably only 2 classes (1 treatment and 1 control group) included, which is not sufficient for ruling out whether treatment and teacher effects are confounded
- **Lack of internal validity**: Study design makes it difficult to infer causal relationships, e.g., all teachers at each participating school assigned to same condition, making it unclear whether treatment or school variables responsible for outcomes, or no evidence of pre-test equivalence for groups in a quasi-experiment
- **Lack of external validity**: Findings very limited in generalizability, e.g., focuses on a highly specific student group such as middle school students struggling with basic arithmetic. Does not show effects across grade levels or subject areas.

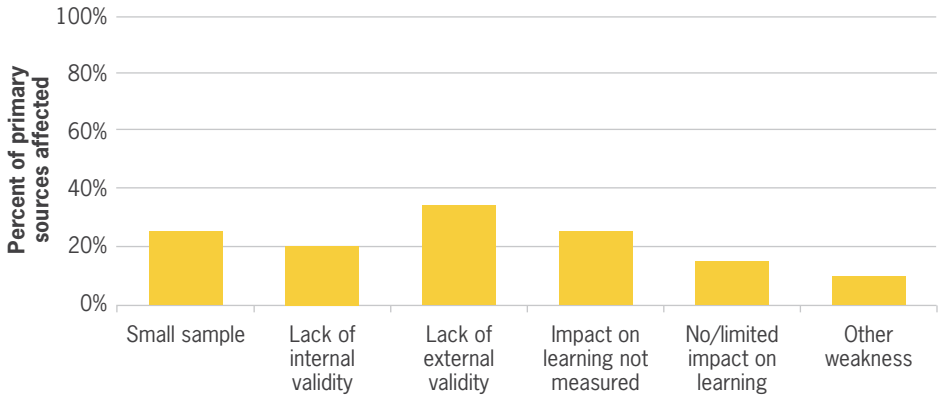
12 While some IES materials only include IES-funded studies, this is not the case for the practice guides.

13 See p. vi of Pashler et al. (2007) for information on the levels of evidence applied in the IES guide, including information on the characteristics of research suitable for use as evidence.

14 Stangor, C. (2004). *Research methods for the behavioral sciences*. Boston, MA: Houghton Mifflin.

- **Does not measure impact on learning**: Focuses on instruction but does not examine impact of strategies(s) on students' learning or achievement — critical outcomes for evaluating efficacy of instructional variables
- **No/limited impact on learning**: Focuses on instruction and includes students' learning or achievement outcome variable(s), but findings indicate little if any positive impact on them
- **Other weakness**: E.g., methodology minimally described (making it impossible to determine potential validity issues); authors make large interpretive leaps from brain research to instructional applications

Figure J4. Why do textbook sources not meet the IES's standards? (n = 20)



The bars sum to greater than 100 percent because we identified as many as three reasons that a single reference did not meet the IES panel's standards.

One especially worrisome finding is how frequently textbooks reference studies clearly lacking internal validity, that is, 20 percent of the studies referenced showed design problems that make it impossible to determine if the focal independent variable in a study was truly a *causal* agent.

None of the above analyses explains *why* the sources cited by the IES practice guide are rarely (or never) referenced in the textbooks in our sample. Are the authors of the textbooks unaware of this research? Is the information these studies convey so far from the accepted wisdom that they are simply ignored? In any case, it is worth asking why this seminal research is not cited more often.

Appendix K:
The Rigor of Typical Assignments in Teacher Prep Coursework on Instruction

In November 2014, NCTQ published *Easy A's and What's Behind Them*, which uses evidence from more than 500 institutions of higher education to show that at a majority (58 percent) of these institutions, teacher candidates earn higher grades than undergraduates as a whole. NCTQ's analysis of approximately 7,500 assignments at nearly three dozen institutions suggests that high grades result from a prevalence of assignments in teacher preparation that were termed "criterion-deficient" or "unanchored" — because they are not designed to increase mastery of specific knowledge and skills and can generally only be evaluated for completeness. More discussion of the nature of unanchored and anchored assignments can be found at http://www.nctq.org/dmsStage/EasyAs.

Assignments in teacher prep coursework syllabi evaluated for this study were examined to determine whether they are anchored or unanchored; if the latter, the means to anchor them is explained.

Assignments in syllabi

All assignments in syllabi in the sample that were identified as including one or more of the fundamental instructional strategies were examined. Assignments were coded as anchored or unanchored. Assignments that were not described in sufficient detail to be coded were not included.

Figure K1 provides examples of anchored and unanchored assignments.

Figure K1.

Anchored Assignment	Unanchored Assignment
One mini-lesson must include: a. Introduction/effective motivation b. Organization/logical and sequential development of lesson c. Subject matter knowledge d. Effective use of questioning e. Effective use of materials and equipment f. Enthusiasm/self confidence **Topics for mini-Lessons – Choose one** a. Subtraction algorithm of whole numbers b. Division algorithm of whole numbers. *The topic for this assignment is appropriately limited, allowing the instructor to give detailed feedback on how content is addressed. Requirements for the assignment are clear and are focused on demonstrating specific knowledge and skills.*	Each candidate will teach a short lesson on the topic of the candidate's choice to the class. The lesson presentation must include all critical lesson components, follow a specific model of instruction, and actively engage students in the learning. The lesson presentation should be 20 minutes in length. All lessons will be videotaped. *The assignment has clear requirements on which it will be graded, but candidates can select any topic/grade level they wish, limiting the likelihood that instructor can provide detailed feedback on how content is addressed.*

Only 47 of the assignments given in the 219 courses in the sample incorporated one or more of the fundamental instructional strategies (an average of fewer than one assignment per program). Of those 47 assignments, only 20 assignments (43 percent) were anchored. All but two of the anchored assignments were tests or quizzes, rather than lesson planning assignments in which understanding of the fundamental instructional strategies could most productively be discerned.

Given that lesson planning is an integral part of teacher preparation and lesson planning assignments are common, why are anchored lesson planning assignments not common? The answer lies in the expansiveness of lesson planning assignments: Instructors allow candidates to select the topics on which they will write lesson plans, rather than offering a limited number of topics. This makes it less likely that instructors can provide productive feedback on the work product.

For example, the strategy most often seen in lesson plans is the requirement to **posing probing questions**. Productive instructor feedback on the possible questions included in a lesson plan is much more likely if the questions pertain to the same (or only a few) possible lesson topics than if the questions are unique to each teacher candidate in a class.

Anchoring assignments

Often assignments can be easily anchored. Two typical assignments found in syllabi in our sample show that only simple changes are needed to increase their effectiveness for training purposes.

Figure K2. Typical Assignments

Unanchored assignment	Steps to improve	Why is the anchored version more effective?
Lesson Plan After instruction, each candidate will prepare a lesson plan that incorporates all of the required elements included in the lesson plan template in this syllabus. Your lesson plan should also incorporate one of the instructional strategies we learned about this semester. This is an opportunity for social studies majors to show their primary source materials.	Rather than allowing the teacher candidate to choose any subject area and the instructional strategy, the instructor should: ■ specify the standards and content area that the lesson plan should address, and ■ specify the instructional strategy to be used.	Limiting the scope of the content lets the professor efficiently compare work across teacher candidates to determine who has a strong grasp of the material and who may need additional training in teaching the standards and using key instructional strategies.
Instruction paper Participants will complete and submit a 5- to 10-page paper that explains how you plan to use what you have learned this semester in your future classroom. We will discuss this paper in class and you will be provided with opportunities to discuss this piece with others.	This open-ended assignment may cause some teacher candidates to propose and reinforce incorrect approaches to instruction. Instead, ask teacher candidates to: ■ summarize the six fundamental instructional strategies, and ■ offer examples of how they might implement a strategy related to each of the "big five" in a first-grade classroom when teaching a specific topic.	Asking teacher candidates to summarize research-backed techniques can help them internalize what they've learned. Asking that they apply these techniques in a specific context ensures that the candidates are capable of using their knowledge in practice. Limiting the scope of the content by specifying the instructional strategies and the topic to be taught lets the professor efficiently compare the work across teacher candidates to determine who has a strong grasp of the material and who may need additional training.

Appendix L:
More about *Teacher Prep Review 2016*'s Standard 11: Fundamentals of Instruction

How NCTQ develops standards for the Teacher Prep Review

NCTQ has honed its process for developing its central standards over the course of 15 reports issued over nearly a decade.[15] Our development process for standards begins by studying the topic at hand as thoroughly as possible. We do a literature review and examine teacher preparation materials (most often syllabi and course textbooks, but often student teacher handbooks or other available documents) to develop an understanding of the context, research, and common practices in an area of preparation. Although this exploration sometimes informs us that the data we are seeking are not found in materials available to us, in this case — examination of instruction on and practice with research-supported instructional strategies — we have found a plethora of usable information. We always develop standards by consulting with leading experts in the field. We supplement the advice provided to us by these experts with that of advisors on the *Teacher Prep Review*'s Technical Panel, always aiming to have adequate representation of all those points of view *for which there is strong scientific support*.

After taking several different approaches to field tests, ranging from national to state studies, we've honed the most successful method, which is an internal field test that generates a published report. These internal field tests examine about 50 teacher preparation programs, so that we can more readily adjust the standard and its evaluation protocol based on new evidence that emerges from what is usually a great deal of variation across programs. In this case, our internal field test involved 48 undergraduate and graduate, elementary and secondary teacher preparation programs. We are currently conducting two other internal field tests to develop or support standards planned for use in the next three editions of the *Teacher Prep Review*.

The challenge of developing a standard in instructional strategies

The development of an instructional strategies standard started in 2010, when a number of new standards (including one on integrating the state's learning standards into instruction) were field-tested in a study of teacher preparation in Illinois.[16] In a consolidation of considerations of various elements of instructional design, this standard was folded into a broader standard on "Lesson Planning" in *Teacher Prep Review 2013*.[17] The Lesson Planning Standard relied on evaluation of lesson and unit planning templates used in student teaching to ascertain the requirements that programs placed on teacher candidates to design instruction so as to "enhance the academic performance of all students."

In an effort to align the standard more closely to the best evidence for instructional strategies, we have revised the standard once again, although we continue to rely on the same sources of data as well as the observation forms used in student teaching. In using these sources of data, we are asserting a common-sense principle: As the defining capstone experience of traditional teacher preparation programs, student teaching *must* include feedback to the candidate on how well he or she enacts research-based instructional strategies. Candidates receiving such feedback will be more likely to be able to continue to use such strategies in their own classrooms, while those who do not will probably think whatever they may have learned in coursework (which this report indicates is quite scant) is merely "theoretical" and therefore of little benefit to them or their students.

15 See http://www.nctq.org/reports.do?d=Teacher%20Prep

16 *Ed School Essentials: A Review of Illinois Teacher Preparation* can be found at http://www.nctq.org/dmsStage/Ed_School_Essentials_IL_Teacher_Prep_NCTQ_Report

17 More information on this standard and its evaluation is at http://nctq.org/dmsView/Standard_Book_11

Teacher Prep Review 2016's Standard 11: Fundamentals of Instruction

In the first edition of its application, the Fundamentals of Instruction Standard will apply only to secondary programs. The standard and its indicators are as follows:

The program ensures that teacher candidates have opportunities to practice fundamental instructional strategies.

Standard applies to: **Secondary programs**.

Indicators that the program meets the standard:

The program ensures that student teachers practice the fundamental instructional strategies found to have the strongest research basis by the Institute of Education Sciences. Requirements for lesson and unit planning and/or observation and evaluation forms should address these strategies:

11.1 Using graphic depictions of content, such as flow charts or diagrams, in combination with verbal representations of the same information.

AND

11.2 Explicitly linking abstract concepts with concrete representations of concepts.

AND

11.3 Posing probing questions that require students to explain their knowledge, such as "why," "how," "what if" and "how do you know."

AND

11.4 Repeatedly alternating problems for which solutions are delineated with problems that students solve independently or in groups.

AND

11.5 Providing multiple opportunities, distributed over weeks and months, for students to practice what they learned previously.

Indicator that the program has strong design:

11.6 A program will earn a "strong design" designation if the indicators above are satisfied and if it also demonstrates that candidates learn how to design assessments that enhance student retention and practice designing assessments that do so.

Appendix M:
Author and Publisher Responses

All 11 publishers of the 48 textbooks in the sample were invited to respond to information on the nature of NCTQ's evaluation of textbooks and percentage scores that their textbooks received on each of the six fundamental instructional strategies. (See Appendix A for a table of scores similar to that provided to publishers.) The publishers were invited to respond themselves or to forward the scores to authors for response. One response was received from Dr. Harry Wong (author and publisher of *The First Days of School*) and one from Pearson Higher Education (publisher of 19 textbooks in the sample). These two responses and NCTQ's comments are provided below.

Dr. Harry Wong Statement for the NCTQ *Learning About Learning* Report (8-30-2015)

I am asking you to remove ***The First Days of School*** from your list of books reviewed. ***The First Days of School*** is not a book on instruction. It is a book written to help teachers, especially newer teachers, to be Effective Teachers. The subtitle of the book is "*How To Be An Effective Teacher*."

The purpose of ***The First Days of School*** is on organization and consistency, not on instruction.

You may remember I previously wrote to you to seriously and adamantly remove or rewrite the sentence, "common behavior models such as "Assertive Discipline" or "First Days of School." It is an insult to equate ***The First Days of School*** with Assertive Discipline. ***The First Days of School*** is not a behavior model. It is a book designed to help teachers organize and start the first days of school effectively.

Other than an opening and closing unit, the book centers on the three characteristics of effective teachers:

1. They have good classroom management skills.
2. They know how to deliver instruction for student mastery.
3. They have positive expectations for student success.

These are the same research-based characteristics found in *Looking in Classrooms* by Good and Brophy, now in its 10th edition.

In 2008, Robert Pianta of the University of Virginia, published his research on over 100 schools and came to the same conclusion that the three characteristics of effective teachers are:

1. Organizational support
2. Instructional support
3. Emotional support

Classroom Assessment Scoring Guide (CLASS)
Harvard Education Letter, "Neither Art nor Accident."

In 2008, the National Center for Mental Health at UCLA found that the "Three Barriers to Learning and School Improvement" were the same three:

1. Management component
2. Instructional component
3. Enabling component

Framework for Systematic Transformation of Student and Learning Supports.
www.smhp.psych.ucla.edu.

Bruce Torff of Hofstra University interviewed school principals and in 2009 published their responses to the "Common Causes of Teacher Ineffectiveness" and they were the same:

1. Lacked classroom management skills
2. Lacked lesson mastery skills
3. Inability to establish rapport with students

Charlotte Danielson, in her *Framework of Teaching*, states that teacher effectiveness falls into four domains. If you combine domain one and two, as they overlap, her three characteristics of effective teachers are the same:

1. Planning the environment
2. Instruction
3. Professional responsibilities

And some ten years ago I received your permission to quote you when you listed the same three characteristics of a really good teacher:

1. Skilled at handling a classroom.
2. Knows effective strategies for delivering instruction.
3. Makes kids soar.

Kate Walsh
NCTQ

Although the six recommended *organizational instructional* strategies are important, ***The First Days of School*** addresses instruction based on the preeminent research of John Hattie. John Hattie's research is titled ***Visible Learning*** and is the result of 15 years of research and synthesises of over 800 meta-analyses (over 50,000 studies and 250+ million students) relating to the influences on achievement in school-aged students. It presents the largest ever collection of evidence-based research into what actually works in schools to improve learning. His research continues to today with three more books.

Hattie's research states:

- Tell students what they will be learning (objectives) before the lesson begins and student achievement can be raised as much as 27 percent. (This is Chapter 21 in ***The First Days of School***.)

- Additionally, provide students with specific feedback (rubric) about their progress and achievement can be raised as much as 37 percent. (This is Chapter 21 in ***The First Days of School***.)

Good formative assessment can raise student achievement up to two years in an academic year, John Hattie and Larry Ainsworth (0.90 effect size). THE major teacher effect that will raise student achievement is formative assessment and this is not on your *Organizing Instruction* list.

Since NCQT's mission is to improve student achievement, I find Hattie's research more up-to-date and more meaningful as he indicates the teacher effect size of each strategy.

For new teachers and for teachers in general, if they will but start a lesson with an objective and then consistently check for understanding (assessment), that will suffice to start the first days of school effectively.

I commend NCTQ on your fine work and I am very supportive of it, but please remove ***The First Days of School*** from your list of books reviewed for *Organizing Instruction* as it does not fit your criteria.

Again, the purpose of ***The First Days of School*** is on organization and consistency, not on instruction.

NCTQ comment

Dr. Wong's statement was conveyed in a letter addressed to Kate Walsh, NCTQ President. Ms. Walsh sent Dr. Wong a full response to the effect that the sample of textbooks evaluated for our study included textbooks assigned in general methods or subject-specific methods courses that address instructional strategies in whole *or in part*. In her response, she noted a chapter entitled "Lesson Mastery: The successful teacher knows how to design lessons the help students achieve" which has a section entitled "How to Enhance Student Learning" and another on "How to Assess for Student Learning." Because this chapter addresses instructional strategies, the textbook was appropriately included in the sample.

Pearson Statement for the NCTQ *Learning About Learning* Report (1-8-2015)

Submitted by Jeffrey Johnston, Vice President and Editorial Director, Pearson Higher Education

Pearson is committed to quality education and recognizes the key role played by teachers in ensuring students' life-long love of learning and academic success. We are tremendously proud of our contribution to teacher training and preparation, as well as our collaborative work with Schools of Education throughout the country. In the development of high quality print and digital products across the teacher education curriculum, our authors and editors, aided by a rigorous peer review process, strive to ensure our products are academically sound, as evidenced by accurate and current coverage of theory and research. Equally important, we focus on outcomes; helping learners to excel in their courses, pass their licensure exams and become effective teachers.

Guided by this mission and commitment, we look forward to reviewing the National Council on Teacher Quality (NCTQ) report on teacher education products, *Learning About Learning*. We want to better understand the Report, its aims and research methodology, as well as NCTQ's perspective. We welcome that dialog and will continue to work with Schools of Education to incorporate any appropriate suggestions that would further help aspiring teachers be successful in their coursework and achieve their goal of becoming effective and inspiring educators.

NCTQ comment

NCTQ and the learning experts who signed a prefatory statement supporting the examination of issues raised by *Learning About Learning* welcome a dialog with Pearson on concrete steps that can be taken to make critical improvements in teacher education textbooks.

National Council on Teacher Quality

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The National Council on Teacher Quality advocates for reforms in a broad range of teacher policies at the federal, state and local levels in order to increase the number of effective teachers.

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