What Do Teachers Know About The Science of Learning?

A Survey of Educators on How Students Learn

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September 2019

THE LEARNING AGENCY

Executive Summary

Scientists know a lot about effective learning and teaching. In the past several decades, cognitive psychologists and other learning researchers have performed thousands of studies on effective learning and teaching practices.

In some cases, research findings have gone against conventional wisdom or common practice. For example, varied practice (in terms of the variety of problems or exercises that the learner engages in) often results in more long-term learning than predictable practice. Research has also established that tests are quite powerful learning events — they are not just ways of evaluating student learning.

Often, the effectiveness of these techniques can only be established by evaluating the learner in a particular way. Varied practice often decreases performance in the short-term, but increases performance in the long-term. In other cases, the effectiveness of certain learning experiences can only be seen on tests that evaluate "transfer" — the ability of a student to apply what they learned to a novel situation — or only after other learning events (such as after a lecture).

Several research-supported ways to teach effectively are, therefore, counter to everyday experience, especially if we're used to evaluating students through immediate tests on their ability to perform exactly as practiced. Given the daily challenges that teachers face and the conflicting information teachers often receive, we wondered:

What do teachers believe about the effectiveness of various teaching strategies? Do they employ these techniques?

Several lines of evidence suggest that teachers might have difficulty identifying some effective learning and teaching strategies. A recent review of teacher training textbooks found that they contained little to no discussion of the large body of learning research, and even passed off ideas with little research support as hard science. Myths about learning — such as the idea of "learning styles" and there being "right-brained" and "left-brained" learners — also persist in the general population, in spite of experts' repeated efforts to clarify the lack of support for such ideas in the

literature. Many businesses also sell products to teachers and schools premised on these myths, promoting discredited — or simply nonsensical — ideas about learning.

Researchers have long been interested in teacher beliefs. Beliefs, however, can be conceptualized and tested in a variety of ways. Much research on teacher beliefs has focused on overarching beliefs about teaching and learning: Is learning fundamentally about transmitting knowledge? Or is it fundamentally about constructing one's own knowledge? To what extent do teachers believe in — and support the development of — self-regulated learners: learners who can learn effectively on their own?

Some studies have also explored the relationship between teacher strategy instruction and student strategy use. These lines of research reveal that teachers possess a wide-ranging set of beliefs about learning that is, at times, inconsistent, and context-dependent.

Research on more specific beliefs about research-supported learning strategies — whether testing is more effective than rereading for remembering information, for example — is more rare. Most research on these specific beliefs have focused on students. Surprisingly little research has focused on teachers.

To our knowledge, only a single survey has asked teachers about these research-supported learning strategies. Another recent survey has explored the strategies that academic support centers at universities recommend. To address this gap, we conducted a survey of more than 200 educators about several research-supported learning principles.

While our findings are disconcerting, educators themselves are not to blame. Most teachers work hard each day in often very difficult situations. But clearly our systems of support for teachers must change to provide educators with more robust knowledge about effective teaching practices.

While our findings are disconcerting, educators are not to blame. Our systems of support for teachers must change.

Top Findings

Myths about learning are prevalent among many educators.

We found that 77% of educators endorsed the idea that people are either right-brained or left-brained, and that this difference impacts how they learn. But there is no scientific support for this idea.

Our study found that 97% of respondents endorsed the idea of "learning styles" — the idea that people can be categorized into one of several learning styles — e.g., auditory, visual, and kinesthetic — and that these styles impact learning outcomes. But this idea too has no scientific support. Learning researchers have repeatedly debunked the idea — both in scholarly and popular outlets. The popularity of this myth across all populations has several likely causes: the intuitive appeal of the idea, the success (and continued presence) of learning styles advocates in education, and confusion between learning styles and other kinds of student differences.

Many educators don't have a robust understanding of learning science principles.

The past twenty years of research have established that retrieval practice — actively trying to recall information that we want to remember — is more effective for long-term learning than rereading. Only 31% of survey respondents, however, endorsed retrieval practice over rereading when asked directly about which would be more effective for learning.

Research also establishes that interleaving — mixing up problem types or kinds of examples — is a more effective way of practicing than "blocked" practice — solving blocks of questions of the same basic problem type. Yet in a question that provided a specific scenario, only 20% of respondents believed that interleaving would be more effective than blocking for long-term learning. Responses climb modestly to 35% when asked about interleaving more generally.

More broadly, out of eleven questions related to the science of learning, respondents answered fewer than five correctly on average, or around 45 percent. A majority of educators could correctly identify the effectiveness of three learning strategies — elaboration, spacing, and metacognition — over less effective alternatives.[1]

For each of these learning strategies, roughly 60% of educators thought that the research-supported strategy would be more effective when compared to a strategy that has been shown to be ineffective, regardless of how the question was asked. It's a positive sign that a majority of K-12 educators could identify the effective learning strategy in each of these areas.

Traditional sources of teacher knowledge remain popular.

Given these results, we were also interested in where teachers get information about learning research. Professional development, teacher and administrative conferences, and peers seem to be the main sources for teachers to learn about new research and evidence in education. Sixty-seven percent of respondents cited conferences as among their top three places to learn, 59% cited professional development, and 53% cited peers.

Background

Drawing on both the growing literature on effective learning strategies and the surveys researchers have used to study beliefs about teaching and learning, we wanted to explore what K-12 educators knew about effective learning strategies. We focused on six strategies with well-established support in the literature that we thought could add the most value to teacher practice:

- ***Elaboration***, which involves linking new information in the mind to other information in a meaningful way.
- ***Retrieval Practice***, which involves actively trying to recall information that we want to remember.

[1] Elaboration was paired with repetition, spacing with massed practice, and a metacognitive strategy (self-explanation) was paired with memorizing steps.

- ***Metacognition***, which involves reflecting on one's own understandings and problem-solving strategies.
- ***Spaced Practice***, which involves spacing out practice in time to promote long-term retention to make learning more efficient.
- ***Interleaving***, which involves mixing up problem types to facilitate the ability to apply the right procedure to the appropriate problem.
- ***Dual Coding***, which involves integrating visuals and text or audio in a way that facilitates conceptual understanding.

The survey also explored beliefs in several myths about learning:

- ***Learning Styles*** — the idea that students have individual learning styles (e.g., auditory, visual, kinesthetic), and that teachers should try to tailor instruction to students' individual styles.
- ***Right-brained and left-brained learners*** — the idea that some students are right-brained, others are left-brained, and teachers should tailor instruction to individual students' brain style.
- ***Genetically determined intelligence*** — the idea that intelligence cannot be altered through education.

To our knowledge only one study has directly asked educators about their beliefs related to the learning strategies mentioned above. Researcher Kayla Morehead and her colleagues asked 150 college-level instructors at Colorado State University essentially the same questions that prior researchers had asked students. They found that instructors endorsed a mixture of effective and ineffective strategies. Instructors also overwhelmingly endorsed the myth of learning styles.

Other researchers have focused more squarely on myths related to the brain, which includes several prominent myths about learning. A recent survey of educators found that, on average, educators endorsed over half of the myths presented; fewer myths than members of the general population, but more than those with some background in neuroscience.

Methodology

We based our survey instrument on two prominent learning belief surveys: a survey about study strategies and learning styles initially created by Nate Kornell and Robert Bjork, later re-used by Marissa Hartwig and John Dunlosky and adapted by Morehead et al. to apply to instructors. A scenario-based survey on classroom learning strategies, originally created by Jennifer McCabe, and later adapted by Morehead et al followed. We adopted Morehead et al's adaptations and lightly edited the surveys for clarity. Each scenario presents two possible approaches for teaching or studying, pairing an empirically supported approach with an alternative (e.g., spaced practice is paired with massed practice; interleaved practice with blocked practice; retrieval practice with re-reading).

We also drew some questions from the neuro-myths line of research that relate to learning, relying on a survey first developed by Sanne Dekker et al. and later modified by Kelly Macdonald et al. to apply to a U.S. population (we used MacDonald's question wording). These are true/false questions. Finally, we added some questions in order to cover the strategies we were interested in. Some of these were direct questions, missing the context that the scenario-based questions provided; others were questions in the scenario style. As we developed the survey, we also received advice from Megan Sumeracki and Yana Weinstein-Jones — two experts in learning science.

After pilot testing through Amazon's Mechanical Turk[2], we altered the question format slightly for the scenario-based questions. Our format asks teachers to decide whether one instructional approach was more effective, less effective, or about as effective as another approach, instead of asking about the effectiveness of each approach separately. For example, we reformatted one McCabe question as follows:

> In two different classes, a 275-word prose passage about a specific topic is presented. In Class A, students first study the passage for seven minutes, and then are asked to write down from memory as much of the material from the passage as they can for seven more minutes. In Class B, students first study the passage for seven minutes, and then are asked to study the passage again for another seven minutes. After one week, all students are asked to recall as much of the passage as they can remember.

[2] Mechanical Turk is a crowdworking platform often used for social science research. Workers (or "Turkers") get paid to perform short tasks or answer surveys.

> Do you think students in Class A will remember more about the topic, less about the topic, or about the same amount about the topic as students in Class B?
>
> ☐ Remember more
> ☐ Remember less
> ☐ Remember about the same

This approach mimics, in part, the main analysis ultimately performed by Morehead et al, which compared endorsements of the empirically supported approach to endorsements of the alternative approach to determine which approach was endorsed more highly. It also reflects that teachers make instructional choices without necessarily having to make generic judgments of effectiveness in the absence of other alternatives.

We also added questions that evaluate the respondent's confidence in their answer to the main belief questions. This helps to distinguish between entrenched beliefs and tentative beliefs. Finally, we added some questions about where teachers learn about new teaching approaches — and when they change how they teach. Each of these instruments — the Kornell and Bjork survey, the McCabe survey, the Dekker survey, our direct questions about learning, and the added questions about where teachers learn about new approaches — was its own question block. When reporting results, we've opted to mimic the language from the question and not use quotations.

To remove ordering effects, we randomized question blocks and the questions within each block. We also counterbalanced the presentation of learning strategies within each question (i.e. for questions comparing strategies against each other, about 50% of people would see the effective strategy first and about 50% would see the ineffective strategy first). All questions and response options can be viewed in the Appendix.

We distributed the survey to a panel of 515 educators created through Amazon's Mechanical Turk. We received 214 responses, but excluded 11 responses from further analysis because we couldn't link survey responses to corresponding panel data. One hundred and fifty-nine of the respondents were teachers, 37 were support staff, and 7 were administrators.

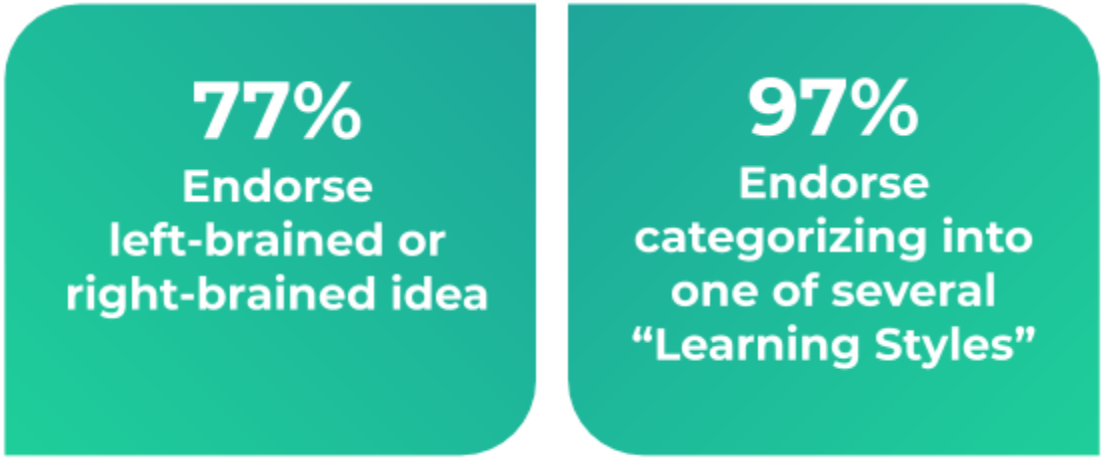
Seventy-three percent of respondents identified as White, 15% as Black, 6% as Hispanic, 4% as Asian, and 1% as Native American. This distribution is broadly representative of the racial and ethnic diversity of the teaching workforce in the U.S. as a whole. The most common income categories reported by respondents were $35,000 to $49,999 and $50,000 to $74,999; recent measures estimate the average

teaching salary in the U.S. is $58,950. Forty-nine percent of respondents identified as female; the rest as male, indicating that our sample over-represents male teachers compared to national demographic estimates (about 77% of U.S. teachers are women).

Results

Beliefs in myths about learning

Two myths about learning continue to be pervasive among educators. Seventy-seven percent of respondents endorsed the idea that people are either right-brained or left-brained, and that this difference impacts how they learn. But there is no scientific support for this idea, and it has been thoroughly debunked in the literature.



Ninety-seven percent of respondents endorsed the idea of "learning styles" — the idea that people can be categorized into one of several learning styles — e.g., auditory, visual, and kinesthetic — and that these styles impact how people learn. But this idea too has no scientific support. Learning researchers have repeatedly debunked the idea — both in scholarly and popular outlets.

Students will report *preferences* for learning from visual material or audio material on surveys, but these preferences do not impact actual learning outcomes.[3]

[3] These preferences — as reported on diagnostic tests — can also be inconsistent with students' own feelings of their personal "style".

Students also have varied cognitive abilities; but, these, too, do not imply the effectiveness of learning styles instruction. As Doug Rohrer and Harold Pashler put it: giving a student with low visual-spatial skills a textbook with fewer diagrams in it is not going to improve their learning outcomes.

The ubiquity of these beliefs among teachers is distressing. Nearly every teacher strives to make class material relevant, engaging, and valuable to all students, which often involves differentiating instruction.

There are lots of ways to differentiate instruction. But learning styles are not effective ways to do so.

This suggests that conversations about "individualized" or "personalized" learning must emphasize the difference between an idea like "learning styles" (which doesn't impact student outcomes) and an idea like "prior knowledge" (which can dramatically impact student outcomes).

It's also possible that the high percentage of respondents endorsing "learning styles" reflects, in part, differences in the way that educators and researchers use the term. For researchers, the term refers to a particular claim about how students learn: that each student learns best through one of a handful of different modalities. Educators, in some cases, use the term simply to refer to any kind of student differences, which can include all kinds of things that *would* impact how a student learns, such as prior experience, interest, motivation, and cognitive ability. There is no doubt, however, that learning styles-based instruction continues to be endorsed in classroom and research practice.

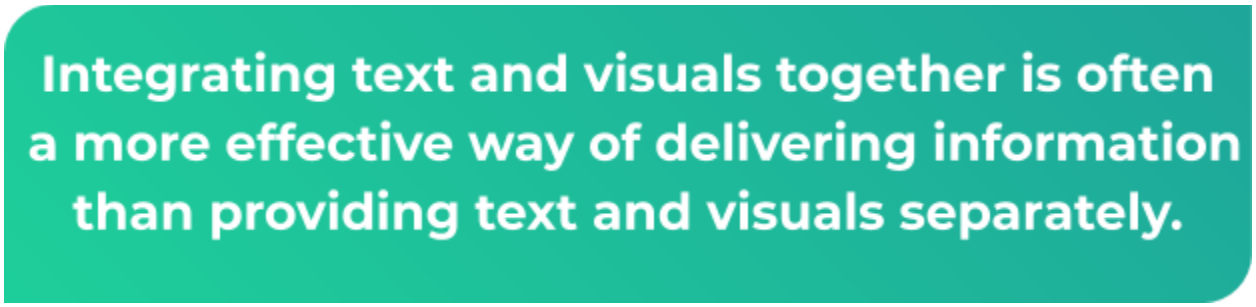
Other common neuro-myths about learning were not endorsed nearly as highly. Only 26% endorsed the idea that there are critical periods during childhood after which certain things can no longer be learned. Only 23% endorsed the idea that learning problems associated with developmental differences in brain function cannot be remediated by education. Only 20% endorsed the idea that mental capacity is genetic and cannot be changed by the environment or experience. And 80% of respondents correctly endorsed the idea that children's circadian rhythm changes as they become adolescents.

Knowledge of effective practices

A majority of educators could correctly identify the effectiveness of three learning strategies — elaboration, spacing, and metacognition — over less effective alternatives.[4] For each of these learning strategies, roughly 60% of educators thought that the research-supported strategy would be more effective when compared to a strategy that has been shown to be less effective, regardless of how the question was asked. It's a positive sign that a majority of K-12 educators could identify the effective learning strategy in each of these areas.

Only 31%, however, endorsed retrieval practice over re-reading when asked directly about which would be more effective for learning, even though research is clear that retrieval practice is much more effective than re-reading for promoting long-term learning. When provided with a specific classroom scenario, however, almost double the number of respondents — 59% — correctly endorsed the retrieval practice option over a re-read option.

Most respondents, however, did not identify two research-supported principles as being particularly effective. Psychological research has established that integrating text and visuals together is often a more effective way of delivering information than providing text and visuals separately.



But only 26% of respondents believed that a student would learn more from spending a total of five minutes studying a diagram and listening to a passage about how the heart works than from spending a total of five minutes looking at the diagram and reading the passage on a separate page. Accurate responses climb to 38% when asked about whether a diagram that incorporates text would be more effective for learning than having students look at a diagram and the text separately.

[4] Elaboration was paired with repetition, spacing with massed practice, and a metacognitive strategy (self-explanation) was paired with memorizing steps.

Research also establishes that interleaving — mixing up problem types or kinds of examples — is a more effective way of practicing than "blocked" practice — solving blocks of questions of the same basic problem type. Yet, in a question that provided a specific scenario, only 20% of respondents believed that interleaving would be more effective than blocking for long-term learning. Responses climb modestly to 35% when asking about interleaving more generally.

A majority of teachers aren't able to identify these strategies as particularly effective ones. These results are broadly consistent with Morehead et al.'s results on college instructors from 2016. Interleaving was the instructional strategy that teachers most often misunderstood there as well.

In all, we asked a total of 17 questions related to beliefs of effective teaching strategies and learning myths. The lowest number of correct responses was two; the highest 13. On average, respondents performed only somewhat better than chance. Respondents identified 8.34 of these beliefs correctly on average. Given the available response options for each question, random chance would yield an average response rate of 6.63.

Where teachers learn about the research on learning

Professional development and conferences/workshops seem to be the dominant sources for teachers to learn about new research and evidence in education. Sixty-seven percent of respondents cited conferences as among their top three places to learn, 59% professional development, and 53% peers.

Educators also cite these top three sources most often when seeking help when they struggle teaching a specific skill or area of knowledge: 40% of teachers named conferences, 50% professional development, 62% peers. The most popular outlets for reading about issues related to education were Scholastic.com (37%), Education Week (30%) and American Educator (25%).

Thus, in spite of the rise of blogs and online communities, traditional sources of teacher education — professional development and teacher conferences — remain common ways for teachers to learn about new research and evidence in education.

Professional development and teacher conferences — remain common ways for teachers to learn about new research and evidence in education

Discussion

Beliefs are complex and multifaceted things that play different roles in thinking and behavior. Some beliefs affect how we interpret information; other beliefs affect how we frame problems; still other beliefs guide our actions. Although beliefs and actions are not necessarily consistent, incomplete and inaccurate beliefs about how students learn can impact teacher effectiveness in several ways. Belief in an ineffective teaching strategy may mean that initial decisions about how to teach a topic will be suboptimal.

But, teachers without knowledge of how their students learn also do not necessarily have an effective explanatory framework for dealing with student learning problems. If students are having trouble remembering something, for example, their teachers might misunderstand why that is an issue.

Teachers also shape the views of their students on teaching and learning. Ninety-five percent of teachers in our survey said that they recommended study strategies in class. But, just as teachers often learn ineffective strategies in teacher preparation programs or professional development programs, students can learn ineffective strategies about learning and studying, which can impact student habits (and long-term learning outcomes) over the course of a student's school career.

In other cases, these beliefs can simply misdirect teacher time. Ninety-four percent of all respondents said that they tried to accommodate student learning styles. We don't know how these teachers accommodate student learning styles — presenting varied instruction to all students could be beneficial. But providing diagnostic tests to students and differentiating instruction based on individual learning styles is resource-intensive. It's likely a misapplication of a teacher's time and resources, which could be redirected to support students in more effective ways.

More broadly, these findings support the idea that "the transfer of knowledge — from researchers to publishers to teacher educators to aspiring teachers — is not happening."[5] This gap is not about teachers themselves but about how our society supports teaching as a profession. Science of learning principles just don't seem to be making their way into teacher training or professional development programs.

This body of knowledge is certainly not the only thing that teachers need to know to teach well. Teaching is an immensely complex profession. Teachers have to know their discipline well, understand students' current knowledge base, address behavioral and motivational problems, collaborate with other teachers and administrators on curriculum design, interact with parents, notice signs of potential issues students may be having at home, integrate quantitative and qualitative measures of student learning, and constantly adapt to changing student populations and a changing regulatory environment.

These activities are challenging enough as it is. But 43% of our respondents reported making decisions about how to teach something almost every day. Knowledge about how students learn, especially when integrated with discipline-specific knowledge, could support the decision-making process for millions of teachers across the country. Moreover, teachers *want to know* this information. Many teachers believe that knowledge about how students learn is necessary for effective teaching.

Science of learning principles don't seem to be making their way into teacher training or professional development programs.

Conclusion

The existing evidence on teaching practice and beliefs paints a consistent picture: teachers are not being provided with the knowledge to make their teaching truly effective. Teacher textbooks do not discuss what scientists know about learning; students and members of the public do not know what effective teaching and

[5] Pomerance, L., Greenberg, J., & Walsh, K. (2016). Learning about Learning: What Every New Teacher Needs to Know. *National Council on Teacher Quality*.

learning looks like; and teachers cannot consistently identify effective teaching and studying techniques.

These findings, however, also suggest a way forward: teachers seem to get most of their information on teaching and learning from professional development courses, conferences, and their peers. Providing accurate information through these channels could be an effective way of combating the widely believed myths and misunderstandings about teaching and learning.

Proposed solutions to the U.S.'s educational problems often focus on dramatic policy reforms: divert resources toward charter schools to let educational innovation flourish; hold schools accountable for student success through widespread standardized testing and federal funding; motivate more people to enter the teaching profession.

Our recommendations, based on this research and the large body of research on teaching, learning, and the current state of the teaching profession, are more prosaic. Provide teachers with the knowledge and skills to improve instruction based on the science of learning. Foster the development of professional teaching communities that work to integrate — and test — this knowledge in the classroom. Create time and space for teachers to collaborate and iterate on what they're doing.

Understanding teacher beliefs about learning and teaching is one thing; integrating the science of learning into teaching practice is another.

Acknowledgements: We're grateful to the Overdeck Foundation for funding this project. Ben Keep did tremendous work on both the research and the writing of this report. We also thank Megan Sumeracki and Yana Weinstein-Jones who provided advice as we developed the survey, and Jessica Tsang of the Chan Zuckerberg Initiative for providing questions about where teachers get information about learning. Finally, we'd like to thank Neil Heffernan for shepherding the project through IRB review.

Appendix

Learning Strategies Survey

(Asterisked questions represent questions or scenarios created by The Learning Agency.)

Block 1

(Questions adapted from Morehead et al's 2016 version of a survey originally created by Kornell and Bjork, 2007)

The next set of questions asks about your classroom practices. There are about eight questions.

1) Do you recommend learning or studying strategies to students, either in class or during out of class meetings?

- ☐ Yes
- ☐ No

2) Which of the following study techniques do you recommend students use regularly? (Please check off all that apply.)

- ☐ Test yourself with questions or practice problems
- ☐ Use flashcards
- ☐ Recopy your notes
- ☐ Re-read chapters, articles, notes, etc.
- ☐ Make outlines underline or highlight while reading
- ☐ Make diagrams, charts, or pictures
- ☐ Study with friends
- ☐ 'Cram' lots of information the night before the test
- ☐ Ask questions or verbally participate during class
- ☐ Other (Please describe): _____

3) When you discuss techniques in class, do you think students use those techniques?

- ☐ Yes
- ☐ Yes for my class, but not necessarily for others.
- ☐ No
- ☐ Some do, some do not.

4) If you think students should quiz themselves (either using a quiz at the end of a chapter, a practice quiz, flash cards, or something else), why should they do so?

☐ They will learn more that way than through rereading
☐ To figure out how well they have learned the information they're studying
☐ I do not think quizzing will necessarily benefit students.

5) Do you use or encourage spacing techniques in class? (e.g., leaving days/weeks for students to study for the next exam or returning to information after discussing it)

☐ Yes
☐ No

6) When teaching students new material, how often do you ask them to elaborate on the material in a way that relates to what they're learning or to what they already know?*

☐ Always
☐ Most of the time
☐ About half the time
☐ Sometimes
☐ Never

7) When teaching students new material, how often do you ask them to think about their thinking?*

☐ Always
☐ Most of the time
☐ About half the time
☐ Sometimes
☐ Never

8) Do you believe students have different learning styles (e.g., visual vs. auditory learners)?

☐ Yes
☐ No

9) Do you teach to accommodate those differences?

☐ Yes
☐ No

Block 2

(Direct questions created by The Learning Agency)

The next set of questions ask about your beliefs on the effectiveness of various learning strategies. There are four questions. For each response you make, we also ask you to assess your confidence in your answer.

10) Do you think that self-quizzing is more effective, less effective, or about as effective as re-reading chapters or other texts?*

- ☐ More effective
- ☐ Less effective
- ☐ About as effective

11) How confident are in your answer?

- ☐ Extremely confident
- ☐ Very confident
- ☐ Moderately confident
- ☐ Slightly confident
- ☐ Not confident at all

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12) Do you think that writing everything one knows about a topic on a blank sheet of paper is more effective, less effective, or about as effective as highlighting sentences and vocabulary words in reading materials and re-reading them later?*

- ☐ More effective
- ☐ Less effective
- ☐ About as effective

13) How confident are in your answer?

- ☐ Extremely confident
- ☐ Very confident
- ☐ Moderately confident

☐ Slightly confident
☐ Not confident at all

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14) Do you think that providing students with a diagram that incorporated text would be more effective, less effective, or about as effective as providing them a diagram and a passage describing the material separately?*

☐ More effective
☐ Less effective
☐ About as effective

15) How confident are in your answer?

☐ Extremely confident
☐ Very confident
☐ Moderately confident
☐ Slightly confident
☐ Not confident at all

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16) If you want students to learn to apply the correct procedure to the appropriate problem:

Do you think that "interleaving" problem types with each other (*e.g., students solve a division problem, then a multiplication problem, then two exponent problems...*) would be more effective, less effective, or about as effective as giving them "blocked" practice (*e.g., students solve a bunch of division problems, then a bunch of multiplication problems, then a bunch of exponent problems*)?*****

☐ More effective
☐ Less effective
☐ About as effective

17) How confident are in your answer?

☐ Extremely confident
☐ Very confident
☐ Moderately confident

☐ Slightly confident
☐ Not confident at all

Block 3

(Questions from Macdonald et al's 2017 version of a survey originally created by Dekker, et al., 2012)

The next set of questions asks you to assess the truth of each statement. There are five questions. For each response you make, we also ask you to assess your confidence in your answer.

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18) Some of us are "right-brained" and some of us are "left-brained" and this helps explain differences in how we learn.

☐ True
☐ False

19) How confident are in your answer?

☐ Extremely confident
☐ Very confident
☐ Moderately confident
☐ Slightly confident
☐ Not confident at all

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20) There are critical periods in childhood after which certain things can no longer be learned.

☐ True
☐ False

21) How confident are in your answer?

☐ Extremely confident

☐ Very confident
☐ Moderately confident
☐ Slightly confident
☐ Not confident at all

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22) Mental capacity is genetic and cannot be changed by the environment or experience.

☐ True
☐ False

23) How confident are in your answer?

☐ Extremely confident
☐ Very confident
☐ Moderately confident
☐ Slightly confident
☐ Not confident at all

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24) Circadian rhythms (“body-clock”) shift during adolescence, causing students to be tired during the first lessons of the school day.

☐ True
☐ False

25) How confident are in your answer?

☐ Extremely confident
☐ Very confident
☐ Moderately confident
☐ Slightly confident
☐ Not confident at all

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26) Learning problems associated with developmental differences in brain function cannot be improved by education.

☐ True
☐ False

27) How confident are you in your answer?

☐ Extremely confident
☐ Very confident
☐ Moderately confident
☐ Slightly confident
☐ Not confident at all

Block 4

(Questions derived from Morehead et al.'s 2016 version of McCabe, 2011)

The next set of questions ask you to evaluate certain classroom scenarios. There are seven scenarios. Although a lot of factors can affect what a student learns, please provide the best answer you can based on the information provided. For each response you make, we also ask you to assess your confidence in your answer.

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*Two students are trying to remember the new vocabulary word "gloaming," which means "twilight" or "dusk". Student A spends a minute creating a sentence that illustrates the meaning of gloaming. Student B spends a minute repeating the sentence, "gloaming means twilight," in her head.**

28) Do you think Student A's approach will be more effective at remembering the meaning of the word, less effective at remembering the meaning of the word, or about as effective as Student B's approach?

☐ More effective
☐ Less effective
☐ About as effective

29) How confident are in your answer?

☐ Extremely confident
☐ Very confident

☐ Moderately confident
☐ Slightly confident
☐ Not confident at all

Students are learning about how a heart pumps blood. Teacher A has students study for a total of five minutes, having them look at a diagram of how the heart works and listen to a passage that describes how the heart works, reading aloud to the student. Teacher B also has students study for a total of five minutes, having them look at the same diagram, and then read a passage of the same text on the next page. [What is the subtle difference here?]

30) Do you think students in Teacher A's class will learn more about how the heart pumps blood, less about how the heart pumps blood, or about the same amount as students in Teacher B's class?

☐ Learn more
☐ Learn less
☐ Learn about the same

31) How confident are in your answer?

☐ Extremely confident
☐ Very confident
☐ Moderately confident
☐ Slightly confident
☐ Not confident at all

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*It is mid-way through the semester. The students are learning a new technique to solve a problem. Student A spends ten minutes asking himself questions about the reasoning for each step. Student B spends ten minutes trying to memorize the steps in order. If both students then face a problem that asks students to apply the technique in an unusual way a few days later…**

32) Do you think student A will be more likely to solve the problem, less likely to solve the problem, or about as likely to solve the problem as student B?

☐ More likely
☐ Less likely

☐ About as likely

33) How confident are in your answer?

☐ Extremely confident
☐ Very confident
☐ Moderately confident
☐ Slightly confident
☐ Not confident at all

Two assignments ask students to learn the list of cranial nerves using a mnemonic device. Assignment A asks students to create their own mnemonic device to assist their learning. Assignment B includes a commonly used mnemonic device provided by the instructor to assist students in their learning. After two weeks, all students are asked to list the cranial nerves in order.

34) Do you think students completing Assignment A will remember more nerves from the list, fewer nerves from the list, or about the same number of nerves as students completing Assignment B?

( ) Remember more nerves
( ) Remember fewer nerves
( ) Remember about the same number of nerves

35) How confident are in your answer?

( ) Extremely confident
( ) Very confident
( ) Moderately confident
( ) Slightly confident
( ) Not confident at all

In two different classes, a 275-word prose passage about a specific topic is presented. In Class A, students first study the passage for seven minutes, and then are asked to write down from memory as much of the material from the passage as they can for seven more minutes. In Class B, students first study the passage for seven minutes, and then are asked to study the passage again for another seven

minutes. After one week, all students are asked to recall as much of the passage as they can remember.

36) Do you think students in Class A will remember more about the topic, less about the topic, or about the same amount about the topic as students in Class B?

( ) Remember more
( ) Remember less
( ) Remember about the same

37) How confident are in your answer?

( ) Extremely confident
( ) Very confident
( ) Moderately confident
( ) Slightly confident
( ) Not confident at all

Two art history professors want their students to recognize paintings by famous artists.They both present 6 paintings by each of12 artists (72 paintings total). Professor A presents the various artists' paintings in an intermingled fashion (i.e., mixed), such that a single painting by a particular artist would be followed by a different artist. Professor B presents all six paintings by a single artist consecutively (i.e., grouped), and then moves onto the next artist's six paintings, and so on, until all paintings have been presented.

38) Do you think students in Professor A's class will recognize more paintings, fewer paintings, or about the same number of paintings as students in Professor B's class?

( ) Recognize more paintings
( ) Recognize fewer paintings
( ) Recognize about the same number of paintings

39) How confident are in your answer?

( ) Extremely confident
( ) Very confident
( ) Moderately confident
( ) Slightly confident
( ) Not confident at all

Two students are studying for a test. Student A studies for a total of 10 hours, and begins studying two weeks before the test, studying a little bit everyday, including the day before the test. Student B studies for a total of 10 hours on the two days leading up to the test.

40) Do you think that Student A will do better, worse, or about the same as Student B on the test?

( ) Better on the test
( ) Worse on the test
( ) About the same on the test

41) How confident are in your answer?

( ) Extremely confident
( ) Very confident
( ) Moderately confident
( ) Slightly confident
( ) Not confident at all

Block 5

(Questions relating to readership and decision-making created by The Learning Agency)

This last section contains four questions about how you keep up with developments in education and a demographic question.

42) What education outlets do you read most regularly? Check up to three.*

[]Education Week
[ ] Educational Leadership
[ ] Phi Delta Kappan
[ ] American Educator
[ ] American School Board Journal
[ ] Review of Educational Research
[ ] American Educational Research Journal
[ ] Educational Research Review
[ ] MindShift
[ ] EduTopia
[ ] Larry Ferlazzo's Blog
[ ] Dan Meyer's Blog

[ ] Cult of Pedagogy
[ ] We Are Teachers.com
[ ] Teach Hub
[ ] Teaching Channel
[ ] Education World
[ ] Scholastic.com
[ ] Other: _____

43) How do you learn about new research and evidence in education? Check up to three.*

[ ] Conferences /workshops
[ ] Professional development events
[ ] Peers
[ ] Blogs
[ ] Traditional media (newspapers, magazines, etc.)
[ ] Twitter/Facebook
[ ] School leaders
[ ] Videos
[ ] Instructional coaches
[ ] Newsletters
[ ] Other: _____

44) When do you typically make decisions about how to teach specific skills or ideas in your classroom?*****

( ) Start of the school year
( ) During school vacations/breaks
( ) During professional development days
( ) When school leaders make a change in curriculum
( ) Make these decisions almost every day
( ) Other: _____

45) If you struggle with teaching a specific skill or area of knowledge, what sources do you rely on for help? Check up to three.*****

[ ] Conferences /workshops
[ ] Professional development
[ ] Peers
[ ] Blogs
[ ] Traditional media (newspapers, magazines, etc.)
[ ] Twitter/Facebook
[ ] Videos

[ ] School leaders like principals
[ ] Instructional coaches
[ ] Newsletters
[ ] Other: _____

Relevant Teacher Panel Questions

1) Which one of the roles best describes your role?

( ) K-12 teacher (public, private or substitute)

( ) K-12 administrator (principal, assistant principal)

( ) K-12 other (support staff, social worker, guidance counselor)

( ) University-level educator/professor (public, private or adjunct)

( ) University-level administrator (assistant dean, admissions officer)

( ) University-level other (support staff, social worker, nurse)

( ) Non-school jobs in education, for-profit (ed tech company, textbook firm, etc)

( ) Non-school jobs in education, non-profit (youth services, Boys and Girls club)

2) What is your gender?

( ) Male

( ) Female

3) What is your annual household income?

( ) Less than $25,000

( ) $25,000 to $34,999

( ) $35,000 to $49,999

( ) $50,000 to $74,999

( ) $75,000 to $99,999

( ) $100,000 to $124,999

( ) $125,000 to $149,999

( ) $150,000 or more

4) What is your age?

( ) 17 or younger

( ) 18 to 24

( ) 25 to 34

( ) 35 to 44

( ) 45 to 54

( ) 55 to 64

( ) 65 to 74

( ) 75 or older

5) How would you describe yourself?

[ ] White
[ ] Black or African American
[ ] Native American or Alaska Native
[ ] Native Hawaiian or Other Pacific Islander
[ ] Hispanic or Latinx
[ ] Asian
[ ] Other: _____