

Neuroscience & the Classroom: *Making Connections*

Course Overview

Welcome to *Neuroscience & the Classroom: Making Connections*. This course provides insight into some of the current research from cognitive science and neuroscience about how the brain learns. The major themes include the deep connection among emotion, thinking, learning, and memory; the huge range of individual cognitive strengths and weaknesses that determine how we perceive and understand the world and solve the problems it presents us; and the dynamic process of building new skills and knowledge. The course invites you to examine the implications of these insights for schools and all aspects of the learning environments we create for our children—teaching, assessment, homework, student course loads, and graduation requirements. It is not a course that offers easy answers or proposes teaching methods that can be universally applied. Rather, it provides new lenses through which to view the teaching and learning challenges you face and invites you to discover your own answers to your own questions.

Course goals

- To foster an understanding of the unity of emotion and thinking and learning.
- To help educators connect brain research to classroom practice and school designs.
- To illustrate the benefits of collaboration between researchers and teachers so that research informs what happens in the classroom, and what happens in the classroom informs research.
- To recognize and strengthen two roles of the teacher:
 1. Teacher as designer who creates the context for learning (environment, lessons) and who is able to take the perspective of learners.
 2. Teacher as researcher who treats student responses as data that reveal the effectiveness of lessons and that provide information for the next step in the learning process.

The greatest benefit of this course is that, instead of providing simple answers, “tricks,” or teacher-proof lesson plans, it treats you as a professional capable of finding your own answers to the specific teaching challenges you face in your particular circumstances. The course focuses on how learners learn and invites you to consider how teachers teach. As a result, you will become more skilled at inventing teaching

strategies to improve the learning of your students.

Along the way, the course offers you an important opportunity to revisit the experience of being a learner. It will remind you of the ways in which your students struggle with new material. In the language we use in this course, you will be “building new neural networks” for understanding and for applying ideas and principles that emerge from the research you study. To get the most from this experience (and from the course), we urge you to become conscious of your own learning—the struggles, the misunderstandings, the moments when ideas gel, the need to repeatedly revisit a new idea, your emotional responses, the conditions under which you do your best learning, the effort required—the whole messy, non-linear process. To this end, you may find it useful to keep a journal of your learning: thoughts, feelings, observations, and insights.

Thinking big, starting small

The course has two main goals:

- To provide new insights into learning based on research.
- To stimulate your thinking on how to connect your teaching and lessons learned to these insights.

Some of the ideas in the course may challenge your current beliefs about learning and teaching. Many of the ideas may reinforce your beliefs, especially by making you conscious of feelings you have had about learning as a result of your years of experience as both a learner and a teacher. Either way, you will be filled with ideas, and you may feel a desire to start changing and fixing things right away. You may even feel obligated to become an agent of change. We can offer only one bit of advice: relax.

Change takes time, and most teachers don't have a lot of that. The scope of what you can change also depends on how much authority or responsibility you have. An experienced division head may be able to implement new ideas more quickly and with wider impact than can a new teacher. You can only do what you can do. What's important is that you start somewhere.

Nick and Martha, the two teachers in Unit 6 (Sections 3, 5), didn't start as revolutionaries. Nick began with an idea that he wanted to give more choice to the students in his English class; he was looking for a way for his students to feel connected to literature. Martha started with an idea about how to reduce the fear of and focus on grades in her history classroom. Other teachers begin with even smaller changes, though they often feel very big to the them. One decides that he is going to stop lecturing and let his students talk more, and find out what they think before telling them what he thinks. Another decides to spend more time getting to know her students as people, creating emotional connections on a personal level. One thing leads to another, and slowly these teachers influence other teachers or, eventually, become leaders—

department chairs, division heads, principals—and these small changes spread. All that matters is that you continue to think, imagine, invent, and experiment.

The course guide

The guide provides exercises to stimulate your thinking and to help you build new neural networks for the ideas presented in the course. The exercises focus on the specific ideas contained in each unit, and run the gamut from a focus on personal exploration to classroom interventions to systemic change. You should find yourself going back and forth from the unit to the exercises, with excursions into some of the additional material available in the course. These include video illustration or explanation, sidebars of related information, and links to relevant articles that also contain bibliographies suggesting further possible readings.

Although you can certainly take this course alone, you might find value in going through it either with colleagues (at your school or online) or in a more formal class with a leader or facilitator. You or your facilitator can select exercises from those suggested in this Guide, and can invent some of your own based on questions, issues, or problems that affect your school or classroom. Combining written responses, discussions with colleagues, and personal reflection about what you are learning will be most helpful.

A note to facilitators and those taking the course for credit

You can take the course for credit in one of three ways: on your own, with a colleague (at your school or online), or as part of a larger group with a facilitator. The course can be taken for two graduate education credits through Colorado State University. For more information on receiving graduate credit for this course, go to learner.org/workshops/graduate_credit.html.

It is the facilitator's job to create the shape of the course by selecting the specific additional readings and the exercises—balancing the apparent needs of the group with the time requirements for earning the credits. If you are taking the course alone or with a partner for credit, your job will be to take on the facilitator's role—creating the shape of the course by selecting from the course materials to meet your educational goals and to meet the requirements for earning the credits.

Reading the text and sidebars in each unit, including the Introduction and Conclusion, should take about two hours per unit. This includes watching the videos and thinking about what you've read. Most of the supplemental articles will also take about an hour to read, and each one of the assignments for each section of the text can be done in some fashion in an hour, except where otherwise noted. However, as teachers you know that learning new material tends to demand more time and thought than an initial reading takes, and you know that everyone works differently and requires different amounts of time to work through problems or assimilate new ideas. So rather than

A note on the approach to preparation between units

moving through the course and the exercises to the rhythm of a clock, we suggest that you move to the more irregular pace of your personal learning process, guided by its inevitable cycles of progress and regression. Ultimately, the most important outcome is that you learn the concepts sufficiently so that you can take them back to your schools and put them into practice. To achieve this goal, you will spend more than the minimum hours specified to receive credit.

A note on the approach to preparation between units

In courses like this, you get a lot of information, but assimilating that information—beginning to really understand and internalize it so that you can use it—tends to be very difficult. Information comes to you; some of it seems exciting and provocative and stimulates all sorts of ideas. But pursuing those ideas is like chasing rabbits through a field: a glimpse here, a feeling that you’ve almost caught one, and then they disappear.

As you go through each unit, it is essential to think about the ideas—to see if you can put them into your own words or apply them and discover where you still have questions. Each of us assimilates information differently, so between units we encourage you to design your own homework. (Those taking the course for credit will need to discuss this suggestion with the facilitator.) Decide what you need in order to begin the process of internalizing and applying the ideas around which the workshop is constructed. Ask yourself, “What would help me? What do I need now?”

Here are some possible homework avenues and some resources that are available to you:

- **Review:** Read an essay that develops some of the ideas from the unit that you just studied. In each unit, you will find supplemental articles for further reading. (For the complete bibliography, please go to the Resources section of the website.) View one or more of the videos in a unit and think about how it illustrates the principles in that unit, or simply reread the unit.
- **Preview:** Read an article that touches on ideas that will be presented in the next unit. Some people like to preview ideas, so you might select one of the supplemental articles contained in the upcoming unit. Or you can read the upcoming unit before it is assigned, watch the accompanying videos, and jot down some ideas. Then, reread the unit and think more deeply about the ideas you wrote down. In this method, the rereading is important.
- **Discuss:** Get together with one or two people to discuss the ideas from the unit just completed: “Here’s what I think I understand; here are the questions I still have.” If you are taking the course for credit, you can have these informal discussions before or after your full-group discussions.
- **Record your thoughts:** Sit alone and write about the ideas from a unit—put

them in your own words, look at their implications, see what questions still arise. Especially useful might be to explore how a new concept challenges, changes, or supports an idea or belief you already have. For example, you might productively examine your initial thinking about the connection between emotion and learning in light of new ideas presented in the course.

- **Apply the ideas:** Give yourself a practical exercise such as looking at the implications of a specific idea for some aspect of school (homework, a lesson plan, a teaching method, grading, memorization, etc.). Try to link a specific idea or quotation from the unit to the particular implication. (In the supplemental articles, you also will find some essays that are written by teachers that focus on practical implications.)
- **Combine exercises:** Any of these suggestions can be combined. For example, while writing in your journal, you might find yourself wanting to reread a section of a unit or replay a video, or you might want to read a related supplemental article or start a discussion with a colleague. Then, you might want to return to your writing.

For those who like more direction for homework possibilities between units, we offer some reading suggestions from the collection of supplemental articles. And, there are exercises later in this guide under the heading of each unit.

Getting started: Your first assignments for the course

Prior to studying the course text or viewing the videos, we ask you to read a short essay and do some writing assignments. These first assignments lay the foundation for the course, for you will return to this work both as you progress through some of the units and at the end of the course. While you can go through the course materials however you wish, the course is designed to take you through an introduction, six units, and a conclusion. Between each of these parts, there are suggested readings and exercises to help you build an understanding of the concepts over time.

Assignment 1: Write about the connection between emotion, thinking, and learning.

Send what you have written to the facilitator or share it with others who are taking the course with you. (The facilitator can revisit these periodically during discussions.)

Assignment 2: Read and discuss “Fostering Conceptual Change.”

The purpose of this assignment is to begin to make you aware of your own cognitive and emotional processes. You should read the article to explore the extent to which it applies to you—the degree of difficulty you experience when making conceptual change.

This course may challenge some of your strongest beliefs about teaching and

learning, and the essay may help to sensitize you to signs of resistance to new ideas and may help to provide some strategies for overcoming this resistance.

As you proceed through the course, revisit the ideas in this essay and examine your reactions to challenges to your beliefs about education. In addition to discussing these thoughts with others who are taking the course with you, you might find it beneficial to begin your course journal with these reactions and thoughts.

Assignment 3: Write about a teaching or learning problem.

Think of a specific teaching or learning problem you have encountered. The problem should derive from something that you found difficult to help your students (if you are a teacher) or colleagues (if you are an administrator) to learn or understand. Focus on the essence of it, not a detailed retelling. Follow the models below to get an idea of the length expected.

1. Write a brief analysis of the problem: What do you think is the issue? What solutions might you try?
2. Send this assignment to the course facilitator or share it with your group or partner. (The facilitator can revisit these periodically during discussions, and you will be using this problem for the final assignment.)

Here are a few examples:

- A teacher was focusing on teaching ninth graders how to write a coherent paragraph—a topic sentence followed by an illustration and explanation and then a concluding sentence. In class the teacher provided examples of paragraphs, modeled the creation of a paragraph, and then led the class through the creation of a paragraph composed on the white board. This group paragraph was successful. For homework, he asked each student to write a paragraph, and he was puzzled to find that most of the paragraphs he received reflected no understanding of how to write a paragraph.
- A second grade math teacher worked to help students to articulate their mathematical reasoning. He wanted them to explain, “The problem said ‘two more came,’ so I knew I needed to add,” but he got, “I knew $2+4$ was 6.” In a two-step problem, he was looking for, “I knew I needed to find the total before I could divide them all equally,” but he got, “I knew $13+3$ was 16, and I knew 16 divided in half was 8.” Or in a problem involving permutations, he wanted, “I found 4 combinations starting with the yellow shirt, so I knew there would be 4 combinations with the green shirt and the orange shirt, and 3×4 is 12,” but he often got, “I tried all the different combinations I could think of and got 9.” Even after introducing the notion of organizing data and demonstrating various possibilities, he found that many students didn’t internalize the importance of

organizing the data and approached a similar problem, a few weeks later, as randomly as the first.

- A school administrator’s greatest challenge was figuring out how to motivate her faculty to incorporate more research-based strategies into their instruction in order to develop higher-level thinking skills in the students. Despite all her efforts—explaining the benefits of these ideas, providing articles for her teachers to read, sending specific teachers to workshops and conferences, providing in-service workshops, offering financial incentives—she could not teach them to effect the changes she hoped to see.

Unit exercises for thinking, writing, and discussion

All assignments are meant to be done after you have read the unit text and watched the accompanying videos under which the assignments appear. For example, before doing the assignments listed under “Introduction,” read the Introduction in the course text, including the sidebar, and watch the videos.

In approaching all exercises and discussions, it is important to be free from self-defeating mindsets of “can’t,” such as “we could never do that in my school,” or “we tried that and it didn’t work.” These exercises are intended to be explorations inviting you to look at existing structures and practices through new lenses and imagining “What if?” and “Why not try?” Once you have a vision of what might be, there is always plenty of opportunity to explore the obstacles and imagine how to deal with them.

