DOWNLOAD PDF THE NEW SCIENCE OF TEACHING AND LEARNING

Chapter 1 : The Science of Learning | Deans for Impact

*The New Science of Teaching and Learning: Using the Best of Mind, Brain, and Education Science in the Classroom [Tracey Tokuhama-Espinosa] on theinnatdunvilla.com *FREE* shipping on qualifying offers. This book offers a definitive, scientifically grounded guide for better teaching and learning practices.*

The following small but powerful set of principles can make teaching both more effective and more efficient, by helping us create the conditions that support student learning and minimize the need for revising materials, content, and policies. While implementing these principles requires a commitment in time and effort, it often saves time and energy later on. Effective teaching involves acquiring relevant knowledge about students and using that knowledge to inform our course design and classroom teaching. When we teach, we do not just teach the content, we teach students the content. A variety of student characteristics can affect learning. Although we cannot adequately measure all of these characteristics, gathering the most relevant information as early as possible in course planning and continuing to do so during the semester can a inform course design e. Effective teaching involves aligning the three major components of instruction: Taking the time to do this upfront saves time in the end and leads to a better course. Teaching is more effective and student learning is enhanced when a we, as instructors, articulate a clear set of learning objectives i. Effective teaching involves articulating explicit expectations regarding learning objectives and policies. There is amazing variation in what is expected of students across American classrooms and even within a given discipline. For example, what constitutes evidence may differ greatly across courses; what is permissible collaboration in one course could be considered cheating in another. Thus, being clear about our expectations and communicating them explicitly helps students learn more and perform better. Articulating our learning objectives i. Similarly, being explicit about course policies e. Altogether, being explicit leads to a more productive learning environment for all students. Coverage is the enemy: Too many topics work against student learning, so it is necessary for us to make decisions â€" sometimes difficult ones â€" about what we will and will not include in a course. This involves a recognizing the parameters of the course e. Effective teaching involves recognizing and overcoming our expert blind spots. We are not our students! As experts, we tend to access and apply knowledge automatically and unconsciously e. They need instructors to break tasks into component steps, explain connections explicitly, and model processes in detail. Though it is difficult for experts to do this, we need to identify and explicitly communicate to students the knowledge and skills we take for granted, so that students can see expert thinking in action and practice applying it themselves. Effective teaching involves adopting appropriate teaching roles to support our learning goals. We can take on a variety of roles in our teaching e. These roles should be chosen in service of the learning objectives and in support of the instructional activities. For example, if the objective is for students to be able to analyze arguments from a case or written text, the most productive instructor role might be to frame, guide and moderate a discussion. If the objective is to help students learn to defend their positions or creative choices as they present their work, our role might be to challenge them to explain their decisions and consider alternative perspectives. Such roles may be constant or variable across the semester depending on the learning objectives. Effective teaching involves progressively refining our courses based on reflection and feedback. We need to continually reflect on our teaching and be ready to make changes when appropriate e. Knowing what and how to change requires us to examine relevant information on our own teaching effectiveness. Much of this information already exists e. Based on such data, we might modify the learning objectives, content, structure, or format of a course, or otherwise adjust our teaching. Small, purposeful changes driven by feedback and our priorities are most likely to be manageable and effective.

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Chapter 2 : The New Art and Science of Teaching by Robert J. Marzano | Solution Tree

This book offers a definitive, scientifically grounded guide for better teaching and learning practices. Drawing from thousands of documents and the opinions of recognized experts worldwide, it explains in straight talk the new Mind, Brain, and Education Scienceâ€"a field that has grown out of the intersection of neuroscience, education, and psychology.

Teaching and Learning Theory There is substantial research on teaching and learning theories. In this Website, we are particularly interested in those aspects of teaching and learning theory that are directly applicable to math education. To illustrate, Behaviorism, Constructivism, and Situated Learning are three important learning theories. Behaviorism is a theory that underlies stimulus-response learning. Drill and practice can train the brain to provide quick response to number fact questions. Constructivism posits that students construct new knowledge and understanding upon their current knowledge and understanding. This theory is applicable in all disciplines, but may be particularly important in vertically structures disciplines such as mathematics and science. For example, one might find that a student is having a great deal of trouble dealing with fractions in Algebra. The difficulty may lie in an inadequate understanding of fractions in arithmetic. The student may have memorized without understanding rules that lead to correct answers in working with fractions in arithmetic. This lack of understanding may lead to major problems in dealing with fractions in Algebra. All three of these theories are important in math education. For many years, leaders in math education have been emphasizing that teachers tend to place far to much emphasis on rote memory leaning of math, and not enough emphasis on Constructivism and on Situated Learning. Look in the Cognitive Science part of the References in: The human brain is not well adapted to learning and doing some aspects of math, such as arithmetic. Stanislas Debaene Mathematical and other types of "talents" vary among people. Howard Gardner Rote memory versus learning concepts. One-on-one tutoring seems to produce a "2-sigma" gain in learning. This helps explain the need for a rich and highly interactive learning environment for young children. See research on Head Start programs. This means that compared to a control group with a class average at the 50th percentile, the experimental group has an average at the 98th percentile. Students have the capacity to learn to much higher standards. There is some evidence that a combination of an emphasis on modeling and on use of Microcomputer-based Laboratory, along with a lot of intensive staff development, can produce a 2-sigma gain in high school physics courses. Teachers and students should be particularly interested in learning that transfers so it can be used in new problem-solving and task-accomplishing situations. Far Transfer Low-Road Transfer vs. This is an excellent analysis of reform movements and why most fail. One of the key ideas discussed is the need for a reform movement to be supported by a "technology" defined as follows: Large-scale reform requires highly specific, systematic, and structural methodologies with supporting materials of tremendously high quality. Such methodologies are hereafter referred to as a "technology. Feedback can come from many different sources, such as teachers, peers, answer keys in books, computers for example, in computer-assisted instruction , and ones self. The research on self assessment and on providing feedback to ones self is reasonably strong, The implementation of this research in our educational system is not widespread. In math education, students are highly dependent on others not themselves in learning whether they have does their math in a correct manner and produced correct results. A Google search under Student Self Assessment produces some useful references. Self-assessment can take many forms, including:

Chapter 3 : Teaching Principles - Eberly Center - Carnegie Mellon University

Overview. Almost daily, neuroscience, biology and cognitive science researchers reveal new insights about how the human brain works and learns. The value of this research is its potential to elevate the learning success of all students regardless of their learning situations.

Discoveries about how the brain learns are fueling interest in applying neuroscience in the classroom. In the new field of neuroeducation, scientists and educators should join forces to develop goals for learning-related research, the authors argue. The new field of neuroeducation connects neuroscientists who study learning and educators who hope to make use of the research. But building a bridge between these groups will require overcoming some high hurdles: As Mariale Hardiman and Martha Bridge Denckla emphasize here, the next generation of educators will need to broaden their approachâ€”focusing not just on teaching math, for example, but also on how math reasoning develops in the brain. Meanwhile, scientists should take the needs and concerns of educators into account as they continue to investigate how we learn. Such crosstalk is already occurring in collaborative efforts focusing on learning, arts and the brain. Research shows that learning changes the brain. In the past decade, the enormous growth in understanding brain plasticity has created an entirely new way to consider how learning and achievement take place in the education of children. As this knowledge has grown, teachers have increasingly sought to apply it in the classroom. But the link between research lab and school need not be a one-way streetâ€”the experiences of educators and students also can suggest questions about learning that neuroscientists should be exploring. Collaboration among educators and cognitive scientists will enrich both fields: Educators can design instructional methods based on research results, and researchers can assess whether these new methods enhance student learning. Such translational research collaborations have the potential to improve teaching and learning and to influence both the practices of school administrators and the policies of boards of education. Neuroeducationâ€"a field establishing how neuroscience research can inform educational practice and vice versaâ€"is taking root. Yet as educators seek new insights from cognitive research about how people think and learn, they must reconcile extreme opinions in their own field on howâ€"and whetherâ€"to apply these findings to the science of teaching. Our charge to cognitive neuroscientists and educators is to work together to apply compelling, evidence-based findings to teaching and learning, but also to identify misplaced exuberance. The Science of Learning Whether or not a teacher understands fundamental concepts derived from basic brain science, such as plasticity, can have a profound effect on how he or she views the learner. Many classroom teachers today, for example, were trained at a time when scientists thought the brain was fixed at birth and changeable only in one direction: For example, a teacher may think that a fifth-grader who has failed to master basic mathematics skills will always struggle with math because of limited cognitive capacities. Contrast this view with contemporary knowledge that the brain constantly changes with experience, makes new brain cell connections synapses , strengthens connections through repeated use and practice, and even produces new cells in certain regions. Knowing that experiences change the brain might encourage this teacher to design targeted remedial lessons. Engaging the student in multiple, creative math-oriented tasks might do more than increase achievement scores: It might actually change brain circuitry. We are also discovering the importance of the cognitive and emotional control people use to arrive at judgments and to make decisions. Findings suggest that ADHD symptoms may represent developmental delay rather than damage in the brain, and that any neural circuitry with such protracted development may be exquisitely sensitive to environmental and experiential influences, which may even alter brain structures. Research demonstrating the effects of emotions on learning2 provides another example of how teaching involves not only transmitting information but also crafting classroom climates that promote learning. Other research highlights the role of motivation in learning and cognition. Studies by Michael Posner, Ph. Obstacles to Uniting Science and Education Even as the field of neuroeducation grows, educators will continue to face hurdles. We must begin to establish that tradition. Coherent translation of cognitive neuroscience to education is sparse. Educational policy-makers and administrators focus on the external structures of education, such as standards, data analysis, scheduling, curriculum, school governance and accountability, yet they pay little attention to the learners themselves. And few teacher preparation programs include courses on cognition and learning. One source of this apparent disconnect is the human tendency to view research findings through the lens of a specific discipline. Neuroeducation, on the other hand, involves examining and synthesizing findings across disciplines. Mazzocco, who trained as both an elementary school educator and an experimental psychologist, stresses that the importance of basic cognitive processes sometimes gets lost amid a strong focus only on the result of those processesâ€"student achievement. According to Mazzocco, our knowledge of basic cognitive processes, while informative, is not yet sufficiently advanced to provide a solid basis for a specific method of teaching or curriculum. Setting a New Research Agenda As neuroeducators seek to address the practical needs of teachers and administrators, they need to conduct more interdisciplinary research to bridge the differences among the methods that scientific and education communities use. Bringing scientists and educators together allows for such intellectual exchange and offers the opportunity to formulate questions that neither group could answer alone. Input from students about how they learn best, as well as what hinders their learning, can also help direct our investigation. While evaluating children who were having difficulty speaking and reading, I viewed the possible brain basis of their difficulties in terms of a popular notion at that time: As he explained, his difficulty was in assigning a name or sound to each letter seen alone; b and d sound too much alike. In contrast, p and q, another visually similar pair, do not have confusable sounds or names. Results from this test, in turn, led neuroimaging researchers to determine where to look in the brain to identify the circuit, or neural connections, normally involved in making automatic the naming of colors, letters and numbers. All of this resulted from a child describing why it was hard for him to learn to read. To encourage cooperation today, Mary Brabeck, dean of the Steinhardt School of Culture, Education, and Human Development at New York University, suggests establishing a web of collaboration among scientistsâ€"including neuroscientists conducting work in medical schools, applied researchers and cognitive scientists working in schools of arts and sciencesâ€"and teacher-educators from schools of education. The Learning, Arts, and the Brain educational summit in May , sponsored by the Johns Hopkins University School of Education in collaboration with the Dana Foundation, was an example of such an effort. The research reported was preliminary but intriguing, especially the suggestion that skills learned via arts training could carry over to learning in other domains. A report from the summit, published in October , reveals rich conversations among scientists and educators that will help shape a research agenda to examine the influence of arts training on creativity and learning. Such schools would serve as laboratories for university-based researchers to design and develop studies based on the needs of teachers, test new methods, evaluate interventions and provide teacher-development opportunities. In this model, a neuroscientist might examine how a specific neurotransmitter, such as dopamine, affects attention; a developmental neurologist might study the delayed structural development of the brain in children with ADHD and compare it with structural abnormalities related to dyslexia; a cognitive scientist might review the neurophysiological correlates involved in self-control; educational researchers might assess whether specific types of enriched environments and experiences improved attention for students with ADHD; and teachers might observe instructional interventions that appeared to improve math or reading skills and propose studies to determine how those interventions might affect brain processes. Effect on Educational Policy and Practice These types of collaborations would help us start to better align educational practices with evidence from cognitive development studies. For instance, preschool-age children may not be ready for reading instruction, and young adolescents may not be cognitively prepared for the type of conceptual thinking that algebra requires. Educators and parents are asking how this information should influence educational practice and wondering who will translate such knowledge from the brain sciences to the educational community. To provide such information, university research and academic programs, too, must break free from a narrow focus on specific disciplines such as teaching mathematics and instead view education through a wider lens that includes the science of learning such as the development of mathematic reasoning skills. Focusing on the science of learning should be as important as accountability for student achievement. Education in the 21st century requires a new model for preparing children to become more creative and innovative thinkers and learners. The Dana Consortium Report Minkowsky, 3â€"70 Oxford, England:

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Chapter 4 : 5 New Approaches to Teaching and Learning: The Next Frontier | HuffPost

The New Science of Teaching and Learning: Using the Best of Mind, Brain, and Education Science in the Classroom Kindle Edition by Tracey Tokuhama-Espinosa.

Evaluation of Teaching and Learning Obtaining frequent feedback on your teaching Getting regular insight on student learning Soliciting student opinion during the term Assessing a course at the end of the term Educational researchers have found that effective teachers share several characteristics e. Two of these characteristics stand out: Through frequent assessment and feedback, effective teachers regularly assess what they do in the classroom and whether their students are really learning. They try to anticipate the topics and concepts that will be difficult for their students and to develop teaching strategies that present these topics in ways their students will best understand. Yet, teachers, especially new teachers, may sometimes be too overwhelmed by all that is involved with teaching to assess student knowledge and learning. Creating a syllabus, preparing assignments, developing lectures, designing laboratories, structuring discussions, and writing test questions all take time, thought, and planning. The following sections describe various assessment schemes for both you and your students. If students have a solid foundation, the new pieces fit together more easily. If the new material conflicts with earlier misconceptions or firmly held assumptions, the students Page 34 Share Cite Suggested Citation: Evaluation of Teaching and Learning. The National Academies Press. This suggests the following: What are the prerequisites for your course, and have all student taken the prerequisites? How do we know that? The diagnostic pretest might include a list of key concepts, facts and figures, or major ideas. Ask students to indicate their familiarity with each topic. During the term, frequent diagnostic mini-quizzes can help identify which students are keeping up and which need help. These quizzes also help students to identify the areas on which they need to work. Reading the quizzes will give the instructor a good indication of where to start the next class. Most undergraduate courses include students with a range of academic abilities, interests, skills, and goals. Differences in preparation, abilities, and learning styles are likely to be more noticeable when new information is abstract and complex. Individual students do not make uniform progress; sometimes a student reaches a plateau after a burst of learning. Try to sample how well your students are learning. Informal ways can be used to determine whether students are learning the material throughout the term. Some suggestions see, for example, Davis ; Silberman, to try are to: Ask questions during class. Give the students time to respond. Try to get a sense of whether students are keeping up by asking questions for which answers require students to apply a given concept or skill to a new context. Ask students for their questions. Rather than ask, "Do you have any questions? Give frequent, short, in-class assignments or quizzes. Pose a question or problem on an overhead or the board, give students time to respond, perhaps in writing, and have students compare answers with their neighbors. Open-ended questions such as "How does food give us energy? Page 35 Share Cite Suggested Citation: Reading these will help you to evaluate how well your students are grasping the material, and you can respond, if needed, during the next class period. Ask students to jot down three or four key concepts or real-world connections about a recent topic, then start a class discussion by having students compare their lists. Ask students to keep a learning journal in which they write, once or twice a week, about things they disagree with or how what they are learning is reflected in other things they read, see, or do. Collect and comment on the learning journals periodically. An alternative approach is to request informal constructive criticism throughout the term, when classroom presentations organization, pacing, and workload can be adjusted. Instructors can gather information about the effectiveness of their teaching strategies, the usefulness of instructional materials, and other features of the course e. Faculty who are teaching a course they have taught many times before may want to wait until midterm before asking for student assessments, although if feedback is solicited immediately after an exam, most of the comments will relate to the exam. If your students are having obvious difficulties with the material or with other requirements, try to find out why, using some of the quick techniques mentioned earlier. Many teachers now use electronic mail. Give students your e-mail address and ask them to mail questions, concerns, or comments about the course see Chapter 7 for more ideas. Other faculty find it helpful to ask, after the first month, that students bring a sheet, which can be anonymous, with their answer to the question: In this situation, you might ask a colleague to collect the comments and summarize them for you. Some faculty members feel awkward soliciting feedback and reporting back to the class. Many find it helpful first to look over the positive things students have said about the course this step is reassuring and puts the negative comments in perspective. Then they consider the suggestions for improvement and group them into three categories: Other ways to respond to advice: If changes are to be made, give a brief account of which changes will be made this term and which will be used in future courses. Let students know what they can do as well. For example, if students report that they are often confused, invite them to ask questions more often. Consider making changes to your course or teaching methods based upon the feedback. Using a Portfolio to Assess Your Course Faculty members at some colleges and universities are beginning to experiment with teaching portfolios composed of work samples and self-evaluative commentary. Portfolios can also include a statement of your teaching philosophy. Advice on how to put together a portfolio can be found in Edgerton et al. Less comprehensive than portfolios are self-evaluations that ask faculty to comment on their courses: How satisfied were you with this course? What do you think were the strong points of the course and your teaching? What did you find most interesting about this course? What would you do differently if you taught this course again? In addition to evaluating your course using the fast-feedback methods or teaching portfolio described above, other powerful methods for evaluating your teaching include formal end-of-term student evaluations, peer review, and videotaping. Watching Yourself on Videotape What are the specific things I did well? What are the specific things I could have done better? What kept the students engaged? When did students get lost or lose interest? If I could do this session over again, what three things would I change? How would I go about making those changes? You can also check the accuracy of your perceptions of how well you teach and identify those techniques that work and those that need improvement. Many schools have professional development offices which can help with taping or assessing the tapes, but informal recording by the instructor can be useful and effective. However, you may want someone from the professional development office to view the tape with you to avoid focusing on your appearance or mannerisms. These programs work best when faculty members: Conduct visits as part of a consultation process that involves a pre-visit conference to discuss goals for the class, and a post-visit debriefing to discuss what happened. Combine classroom observation with other strategies that enrich the picture such as interviewing students, reviewing materials, and examining student work. Are self-conscious about the learning that can occur for the observer as well as the observed. Let the students know what is happening, and why. Are purposeful about who might best visit whom. Depending on their questions and purposes, they may want to pair up with someone from the same field who can comment on content; alternatively, if they are experimenting with a new teaching strategy, they might want to find a colleague who has extensive experience with that strategy. Keep track of how classroom observation is working, so they can learn from the process and improve it. How can you analyze your classroom interactions with students? As you watch the tape, try the technique of stopping every five seconds and putting a check in the following columns: Or look at your lecture in terms of organization and preparation: Did I give the purpose of the session? Emphasize or restate the most important ideas? Make smooth transitions from one topic to another? Summarize the main points? Include neither too much nor too little material in a class period? Seem at ease with the material? Begin and end class promptly? Although conceived as an effort to improve the quality of evidence about teaching in faculty tenure and promotion decisions, the project puts greater emphasis on faculty collaboration to improve teaching throughout their careers. Reciprocal classroom visits, mentoring programs for new faculty, team teaching, and departmental seminars about teaching and learning are but a few of the ways that faculty members work with colleagues to improve undergraduate education. These forms often are used by faculty committees and administrators to make personnel Page 38 Share Cite Suggested Citation: A substantial body of research has concluded that administering questionnaires to students can be both valid and reliable, providing faculty and administrators with a wealth of knowledge about the attitudes, behavior, and values of students Hinton, Advice on how to design, administer, and interpret evaluation forms can be found in Cashin , Theall and Franklin , Davis , and Braskamp and Ory However, Arons observes that many vacuous courses in science have been developed which students have rated highly, describing them as fun and exciting. Subsequent testing indicated that these students learned very little. This does not suggest that student perspectives are unimportant. However, before distributing the evaluation forms, many instructors tell students the purpose of the forms.

Chapter 5 : Science of Learning

This book offers a definitive, scientifically grounded guide for better teaching and learning practices. Drawing from thousands of documents and the opinions of recognized experts worldwide, it explains in straight talk the new Mind, Brain, and Education Science--a field that has grown out of the.

The Next Frontier This cycle of dysfunction is a reality for educators across the country, and is part of the reason why achievement gaps exist, dropout rates remain high, and teacher retention is a perpetual issue. I describe five approaches that have a proven record of being successful in the many schools. To meet these goals, I was provided with a curriculum, a school rulebook, test prep materials, and was wished good luck. The curriculum I was given consisted of a set of lessons that were organized like a script. The formula was simple: Teacher asks this, students say that. Write this on the blackboard, students will write that. On any given day, there was a document I could reference that detailed exactly what I was going to be teaching, and when I was going to teach it. The document was complimented by a margin on the left side of my teachers manual that told me what assignments to give, when to give them, and what responses I should expect from students. In addition to the curriculum, I was given the school rulebook. This small manual documented what was appropriate for student behavior, and what punishment would be given when the school "code of conduct" was violated. There were two warnings for small infractions, calls home for others, and an elaborate protocol for "major infractions. Technically, all I had to do was follow the instructions, and my class would run perfectly. The final set of tools I was armed with were a set of test prep materials. They consisted of slim booklets that looked just like the ones students would receive at the end of the year when they took their standardized exams. I also received thick books that consisted of past standardized tests questions, and a schedule for when to assign test prep. Students were to be given mock exams once a week. These exams would prepare them for another set of sporadic exams that would be given throughout the year. At the end of the year, they would all sit for a final standardized exam. For anyone on the outside looking in, all the materials I was given meant that I was well-prepared. Technically, I was given all that I needed to succeed. Unfortunately, none of the tools I was given considered the complexities of teaching that I faced once I entered the classroom. The curriculum was so scripted that it allowed little to no time or space for me to be creative in teaching. For students who asked a lot of questions, thought deeply, and wanted to create a true connection to what was being taught, my classroom did not work. The script I was given was so structured that it forced me to ignore students who were asking brilliant questions. These students quickly grew frustrated, and before long, became increasingly disengaged. As they grew more disengaged, they began to feel disconnected from the classroom. Before long, their frustration turned into either behavior problems or complete disinterest or behavior problems. As behavior problems rose, I was forced to pull out the school rulebook. They would talk to each other in class just to get their voices heard, and I would follow the rulebook and call their parents to report inappropriate behavior. I ended up spending so much time during and after class punishing students for breaking small infractions that it was virtually impossible to stay on the schedule of the curriculum. My school administrators would then come into my class to see how close I was to script, and reprimand me for being behind. In just a few weeks, teaching became a battle to stick to the curriculum, a constant fight with students who no longer liked school, practice for weekly mock exams, and anticipation for weekends and days off. This cycle of dysfunction is a reality for educators across the country, and is part of the reason why achievement gaps exist because classes who follow this model are overwhelmingly present inn urban schools populated by youth of color , dropout rates remain high, and teacher retention is a perpetual issue. In response, I describe five approaches to teaching that engage and motivate students and teachers, and have a proven record of being successful in the many schools that I have worked with across the country. Hip-Hop Education HipHopEd HipHopEd is an approach to teaching and learning that focuses on the use of hip-hop culture and its elements in teaching and learning both within and outside of traditional schools. HipHopEd is also a Twitter chat where educators convene every Tuesday night at 9 p. EST to discuss this approach to teaching. HipHopEd involves the use of hip-hop music, art and culture to create philosophies for teaching. It also uses hip-hop to develop and implement teaching tools and helps to create contexts for teaching and learning that youth are comfortable in. In its simplest form, HipHopEd involves the use of rap lyrics as text to be used in the classroom. In a more complex form, it involves raps created by students as classroom assignments that are used to measure knowledge. Most recently, the use of hip-hop in education has included elements of hip-hop culture like the rap battle to enhance learning and create competitions that spur on learning. This approach has been used to increase student attendance, motivation and content knowledge. In other words, it focuses on using the real life experiences of the learner to create knowledge and considers how students relates to the environment where they are taught. In this process, the teacher has to fight the urge to give students any answers or facts to memorize. Their main role is to pose questions that provoke the students to look more deeply at the text they are given. In a POGIL classroom, students develop conclusions about the text they are interrogating that will increase their knowledge. As students answer questions, teachers "guide the inquiry" by asking supplemental questions that will eventually move the students towards thinking deeply and drawing more complex conclusions. This approach has resulted in increased student interest in the subject being taught and increased mastery of content in the science classes where it is mostly used. Project Based Learning PBL Project-based learning is an approach to teaching that focuses primarily on having students engage in explorations of real-world problems and challenges. Through these explorations, they develop their content knowledge, but also develop solutions to problems. This approach to teaching functions to engage students that may be disinterested in traditional content because it allows them to identify problems in their community or the world at large that they want to solve. It also provides teachers and students with opportunities to be creative. In schools that commit to project based learning, students can engage in a project, and learn all subjects as they complete their project. In this process, the teacher looks for ways to connect the subject to the project. In turn, students look to the teacher for content knowledge so they can complete their project. Reality Pedagogy Reality Pedagogy is an approach to teaching and learning that focuses on teachers gaining an understanding of student realities, and then using this information as the starting point for instruction. It begins with the fundamental premise that students are the experts on how to teach, and students are the experts on content. Where teachers and students discuss the classroom and both suggest ways to improve it. Where students get opportunities to learn content and then teach the class. Where students have a role in how the class operates and in what is taught. Where the neighborhood and community of the school is seen as part of the classroom. Flipped Classroom One of the most popular new approaches to teaching is the flipped classroom. This approach involves a process where the typical lecture that happens in the classroom occurs at home. Students watch lectures on video, and then return to school to engage in the exercises they would traditionally have for homework, and to ask questions based on the lecture they watched on their own at home. When students watch videos at home, they can stop and go and at their own pace, and take notes a their leisure. In this process, students create, collaborate and learn at their own pace, and apply what they have learned at home in the classroom. In all of these approaches, the most powerful thing to recognize is that they focus explicitly on engaging both the student and the teacher. When teachers are treated like the intelligent professionals that they are, and given the flexibility to engage in approaches to teaching and learning that go beyond archaic models that they are often bound to, students respond differently, and education is improved.

Chapter 6 : New Jersey Center for Teaching and Learning

Brain-based Learning was an assigned text for an educational class I took. It provides a foundation of how the brain functions, followed by ways to help the brain learn in the school environment. Lots of research went into the thought process, so it doesn't simply stem from one author's ideas.

Teaching Should Be Consistent With the Nature of Scientific Inquiry Science, mathematics, and technology are defined as much by what they do and how they do it as they are by the results they achieve. To understand them as ways of thinking and doing, as well as bodies of knowledge, requires that students have some experience with the kinds of thought and action that are typical of those fields. Teachers, therefore, should do the following: Start With Questions About Nature Sound teaching usually begins with questions and phenomena that are interesting and familiar to students, not with abstractions or phenomena outside their range of perception, understanding, or knowledge. Engage Students Actively Students need to have many and varied opportunities for collecting, sorting and cataloging; observing, note taking and sketching; interviewing, polling, and surveying; and using hand lenses, microscopes, thermometers, cameras, and other common instruments. They should dissect; measure, count, graph, and compute; explore the chemical properties of common substances; plant and cultivate; and systematically observe the social behavior of humans and other animals. Among these activities, none is more important than measurement, in that figuring out what to measure, what instruments to use, how to check the correctness of measurements, and how to configure and make sense out of the results are at the heart of much of science and engineering. This puts a premium, just as science does, on careful observation and thoughtful analysis. Students need guidance, encouragement, and practice in collecting, sorting, and analyzing evidence, and in building arguments based on it. However, if such activities are not to be destructively boring, they must lead to some intellectually satisfying payoff that students care about. Provide Historical Perspectives During their school years, students should encounter many scientific ideas presented in historical context. It matters less which particular episodes teachers select in addition to the few key episodes presented in Chapter 10 than that the selection represent the scope and diversity of the scientific enterprise. Students can develop a sense of how science really happens by learning something of the growth of scientific ideas, of the twists and turns on the way to our current understanding of such ideas, of the roles played by different investigators and commentators, and of the interplay between evidence and theory over time. It is important, for example, for students to become aware that women and minorities have made significant contributions in spite of the barriers put in their way by society; that the roots of science, mathematics, and technology go back to the early Egyptian, Greek, Arabic, and Chinese cultures; and that scientists bring to their work the values and prejudices of the cultures in which they live. Insist on Clear Expression Effective oral and written communication is so important in every facet of life that teachers of every subject and at every level should place a high priority on it for all students. Use a Team Approach The collaborative nature of scientific and technological work should be strongly reinforced by frequent group activity in the classroom. Scientists and engineers work mostly in groups and less often as isolated investigators. Similarly, students should gain experience sharing responsibility for learning with each other. In the process of coming to common understandings, students in a group must frequently inform each other about procedures and meanings, argue over findings, and assess how the task is progressing. In the context of team responsibility, feedback and communication become more realistic and of a character very different from the usual individualistic textbook-homework-recitation approach. The nature of inquiry depends on what is being investigated, and what is learned depends on the methods used. Science teaching that attempts solely to impart to students the accumulated knowledge of a field leads to very little understanding and certainly not to the development of intellectual independence and facility. Science teachers should help students to acquire both scientific knowledge of the world and scientific habits of mind at the same time. Deemphasize the Memorization of Technical Vocabulary Understanding rather than vocabulary should be the main purpose of science teaching. Some technical terms are therefore helpful for everyone, but the number of essential ones is relatively small. If teachers introduce technical terms only as needed to clarify thinking and promote effective communication, then students will gradually build a functional vocabulary that will survive beyond the next test. For teachers to concentrate on vocabulary, however, is to detract from science as a process, to put learning for understanding in jeopardy, and to risk being misled about what students have learned. Science Teaching Should Reflect Scientific Values Science is more than a body of knowledge and a way of accumulating and validating that knowledge. It is also a social activity that incorporates certain human values. However, they are all highly characteristic of the scientific endeavor. In learning science, students should encounter such values as part of their experience, not as empty claims. This suggests that teachers should strive to do the following: Welcome Curiosity Science, mathematics, and technology do not create curiosity. Thus, science teachers should encourage students to raise questions about the material being studied, help them learn to frame their questions clearly enough to begin to search for answers, suggest to them productive ways for finding answers, and reward those who raise and then pursue unusual but relevant questions. In the science classroom, wondering should be as highly valued as knowing. Reward Creativity Scientists, mathematicians, and engineers prize the creative use of imagination. Encourage a Spirit of Healthy Questioning Science, mathematics, and engineering prosper because of the institutionalized skepticism of their practitioners. In science classrooms, it should be the normal practice for teachers to raise such questions as: How do we know? What is the evidence? What is the argument that interprets the evidence? Are there alternative explanations or other ways of solving the problem that could be better? The aim should be to get students into the habit of posing such questions and framing answers. Avoid Dogmatism Students should experience science as a process for extending understanding, not as unalterable truth. This means that teachers must take care not to convey the impression that they themselves or the textbooks are absolute authorities whose conclusions are always correct. By dealing with the credibility of scientific claims, the overturn of accepted scientific beliefs, and what to make out of disagreements among scientists, science teachers can help students to balance the necessity for accepting a great deal of science on faith against the importance of keeping an open mind. Promote Aesthetic Responses Many people regard science as cold and uninteresting. However, a scientific understanding of, say, the formation of stars, the blue of the sky, or the construction of the human heart need not displace the romantic and spiritual meanings of such phenomena. Teachers of science, mathematics, and technology should establish a learning environment in which students are able to broaden and deepen their response to the beauty of ideas, methods, tools, structures, objects, and living organisms. Science Teaching Should Aim to Counteract Learning Anxieties Teachers should recognize that for many students, the learning of mathematics and science involves feelings of severe anxiety and fear of failure. No doubt this results partly from what is taught and the way it is taught, and partly from attitudes picked up incidentally very early in schooling from parents and teachers who are themselves ill at ease with science and mathematics. Far from dismissing math and science anxiety as groundless, though, teachers should assure students that they understand the problem and will work with them to overcome it. Teachers can take such measures as the following: Build on Success Teachers should make sure that students have some sense of success in learning science and mathematics, and they should deemphasize getting all the right answers as being the main criterion of success. After all, science itself, as Alfred North Whitehead said, is never quite right. Understanding anything is never absolute, and it takes many forms. Provide Abundant Experience in Using Tools Many students are fearful of using laboratory instruments and other tools. This fear may result primarily from the lack of opportunity many of them have to become familiar with tools in safe circumstances. Girls in particular suffer from the mistaken notion that boys are naturally more adept at using tools. Starting in the earliest grades, all students should gradually gain familiarity with tools and the proper use of tools. By the time they finish school, all students should have had supervised experience with common hand tools, soldering irons, electrical meters, drafting tools, optical and sound equipment, calculators, and computers. Support the Roles of Girls and Minorities in Science Because the scientific and engineering professions have been predominantly male and white, female and minority students could easily get the impression that these fields are beyond them or are otherwise unsuited to them. Teachers should select learning materials that illustrate the contributions of women and minorities, bring in role models, and make it clear to female and minority students that they are expected to study the same subjects at the same level as everyone else and to perform as well. Emphasize Group Learning A group approach has motivational value apart from the need to use team learning as noted earlier to promote an understanding of how science and engineering work. Overemphasis on competition among students for high grades distorts what ought to be the prime motive for studying science: Competition among students in the science classroom may also result in many of them developing a dislike of science and losing their confidence in their ability to learn science. Science Teaching Should Extend Beyond the School Children learn from their parents, siblings, other relatives, peers, and adult authority figures, as well as from teachers. They learn from movies, television, radio, records, trade books and magazines, and home computers, and from going to museums and zoos, parties, club meetings, rock concerts, and sports events, as well as from schoolbooks and the school environment in general. Science teachers should exploit the rich resources of the larger community and involve parents and other concerned adults in useful ways. It is also important for teachers to recognize that some of what their students learn informally is wrong, incomplete, poorly understood, or misunderstood, but that formal education can help students to restructure that knowledge and acquire new knowledge. Teaching Should Take Its Time In learning science, students need time for exploring, for making observations, for taking wrong turns, for testing ideas, for doing things over again; time for building things, calibrating instruments, collecting things, constructing physical and mathematical models for testing ideas; time for learning whatever mathematics, technology, and science they may need to deal with the questions at hand; time for asking around, reading, and arguing; time for wrestling with unfamiliar and counterintuitive ideas and for coming to see the advantage in thinking in a different way. Moreover, any topic in science, mathematics, or technology that is taught only in a single lesson or unit is unlikely to leave a trace by the end of schooling. To take hold and mature, concepts must not just be presented to students from time to time but must be offered to them periodically in different contexts and at increasing levels of sophistication.

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