# Enlightened Learning in a Knowledge Society
## 2008 Congress of Neurological Surgeons Presidential Address

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Ladies and gentlemen, I can't tell you how much it means to me to be introduced by not only a great friend, but someone with whom I've had the opportunity to share many remarkable professional experiences. Although his humility would not let him admit it, Dr. Selden has been critical to the success of every educational initiative he just mentioned.

Friends, our community of neurosurgery is inclusive of physicians, scientists, and also individuals who inspire our efforts and give our lives meaning—our friends and families. I'd like to thank my own family, my wife, Jill, and my children, Tony, Kyle, and Dayna. They are the team that has made my involvement in the Congress of Neurological Surgeons possible.

In addition, as President of the CNS, I'd like to extend my heartfelt thanks to all of our families for their tireless support to each of us individually and for their own contributions to the advancement of what the father of modern medicine, William Osler, termed, our "glorious heritage, from which the greatest gifts to man have been derived."

Dr. Chandler, members of the Congress of Neurological Surgeons, friends, and guests, I've chosen to speak today on learning. In preparing this address, I spent time reflecting on my own educational experiences. In the course of that exercise, I came across my first grade report card. What I found inside wasn't exactly what I was expecting. Frankly, I think the C in handwriting was generous. This card and that experience serve to remind me that I stand before you a humble lifelong student, with more questions than I have answers. My comments today represent a personal vision, an aspiration, if you will, that I hope can guide us as a community of lifelong students.

Ladies and gentlemen, we live in a knowledge society. This knowledge-based society is one in which the most productive members manage and produce information as their primary activity. Modern experts are skilled knowledge managers and producers who collaborate with other professionals to generate new ideas, theories, and products. There has been an unprecedented explosion of information and access to information. In short, technical knowledge has permeated all spheres of life to an unprecedented degree.

In this new environment, we neurosurgeons face both daunting challenges and inspirational opportunities. We live at a moment when neurosurgical science has made extraordinary advances. At the same time, societal forces increasingly insist that we account for the safety, effectiveness, and value of medical care. Both of these challenges require each of us to manage and work effectively with vast amounts of complex data in our daily practices.

Outside of our particular realm, advances in technology vastly increase our potential to collaborate in the creation of additional knowledge and understanding. Those same technological leaps now facilitate our ability to harness our collective knowledge and experience.

In this environment, I believe our systems of learning must provide and develop adaptable knowledge and essential competencies relevant to knowledge management and production. We must learn and teach others how to manage the challenges of knowledge that lie ahead and maximize the opportunities that await us.

The existing learning systems we know have served us well. Most often, teachers design, create, and deliver educational content to learners who generally act as passive recipients of that content. The presentation format is usually that of a traditional lecture, often isolated in time and space from actual practice. Ironically, exactly the type of session in which you and I find ourselves this morning, here in this auditorium. This approach is familiar to us. It's been relatively simple to produce. It's provided a vehicle for introducing broad theories and communicating basic factual information.

It's *not*, however, versatile enough to satisfy the broader range of knowledge and educational needs that are emerging.

A multidisciplinary movement called the Learning Sciences points us to the future. It has redefined education as an active, continuous process in which the learner, not the teacher, assumes the central role. It seeks to make education more efficient and more effective by relating learning directly to daily experience. Most important, it empowers learners to become producers of knowledge, not just consumers.


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These tenets of modern learning theory—that effective learning is closely tied to daily experiences and that knowledge production should be the principal goal of learning—are revolutionizing education at every level in our society. Nevertheless, the reality for each of us in this room is that these basic principles and other elements of learning science have largely failed to influence the design of continuing medical education. This is to our detriment and our patients'. We must reconceptualize the form and function of medical education. Nothing less than our continued ability to effect meaningful change in the systems in which we work is at stake.

This is neither the time nor place to examine thoroughly this vast and important area of inquiry. What I do propose, however, is to initiate a conversation across the neurosurgical community about the role of the learning sciences in guiding our educational efforts.

This is, in fact, a major goal of this year's Annual Meeting. Over the next few days, various speakers will explore different facets of education and learning science. I would like to focus in particular on a topic that has attracted my interest over the last several years, using our individual and collective professional experiences to form the cornerstone of meaningful learning. Specifically, I'll propose that we must treat neurosurgical learning and neurosurgical practice as a continuum—one that leverages what we do and what learn in our daily practice—for our benefit and for the benefit of the patients we serve.

In the early 20th century, scholars concluded that knowledge consists of a set of facts and procedures. The goal of education, then, was the mastery of facts. Perhaps appropriately, this approach became known as logical empiricism.

Much of our traditional work as physicians is consistent with this view of the world. We routinely apply relevant facts to clinical decision making, and we use corresponding procedures to treat patients. The formal education that supports these activities is episodic and emphasizes factual, clinical knowledge. That style of work and that style of education were perfectly suited to an industrial age. The world, however, has changed and with it, our job descriptions.

Today's explosion of medical knowledge and our need to keep pace with change requires that we establish constant access to relevant information. That is part of the continuum I mentioned. But we also know that we must wrestle with other factors. Our patients and government officials are demanding that we continuously improve our performance and that we show evidence of that improvement. As a consequence, we must find ways to make continuous learning and improvement an integral part of our workday, just as much as our neurosurgical procedures themselves. Our educational systems must therefore support those new requirements.

Psychologist Carl Rogers once stated the goal of modern education very well (*Fig. 1.1*):

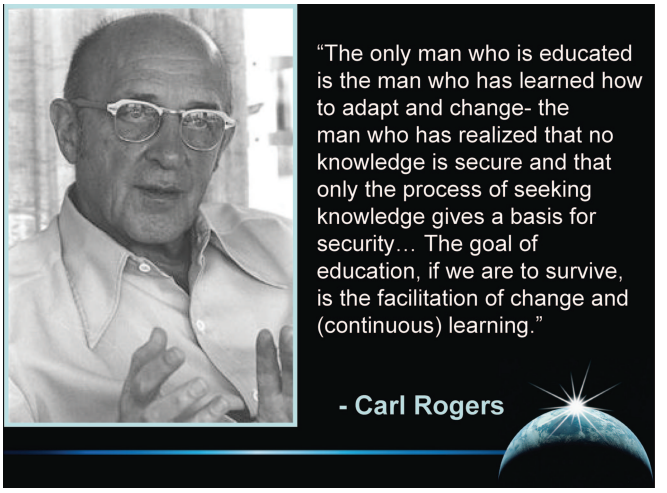


**FIGURE 1.1.** Psychologist Carl Rogers believed the chief goal of education is to facilitate change and continuous learning.

The only man who is educated is the man who has learned how to adapt and change—the man who has realized that no knowledge is secure and that only the process of seeking knowledge gives a basis for security. . . The goal of education, if we are to survive, is the facilitation of change and (continuous) learning.

To thrive in the knowledge society, individuals still need a deep foundation of factual knowledge. However, factual knowledge is no longer sufficient. In addition to factual knowledge, our educational programs must teach individuals how to adapt and continuously learn. Specifically, they must facilitate the development of a skill called *metacognition*.

In its most basic form, metacognition is essentially a keen awareness of the gaps in one's own knowledge (in other words, knowing what you don't know) and the ability to actively fill in those gaps. Scholars of expert thought and work in modern society have consistently identified this skill in high-performance knowledge workers. These high performers are able to recognize the limits of their own knowledge—not only what they know, but how they think about problems. They decide when their knowledge is inadequate and take steps to remedy their deficiencies. Metacognitive individuals view work as continuous, self-directed learning embedded in the fabric of daily life. Their chief goal is performance improvement. They don't just do the same things more efficiently; they attempt to do things better, and in that way they flexibly adapt to new situations throughout their careers and learn throughout their lifetimes. Metacognition is a key skill in the knowledge society. Many of us are occasionally metacognitive and to varying degrees, but like other modern professionals, we must make this skill part of our daily conscious routine.

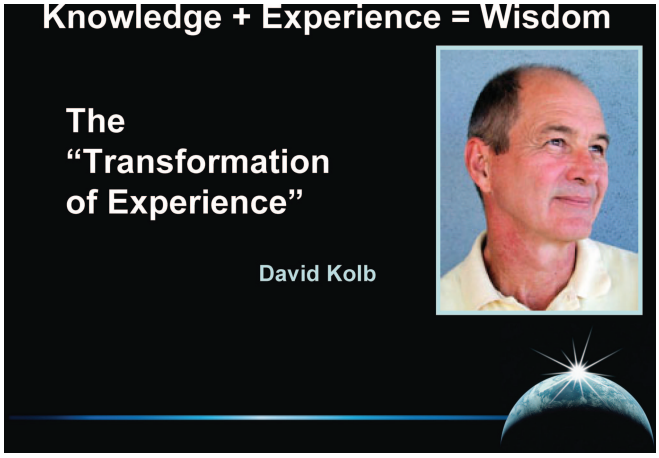


**FIGURE 1.2.** David Kolb is a pioneering American educational theorist whose interests and publications focus on experiential learning.

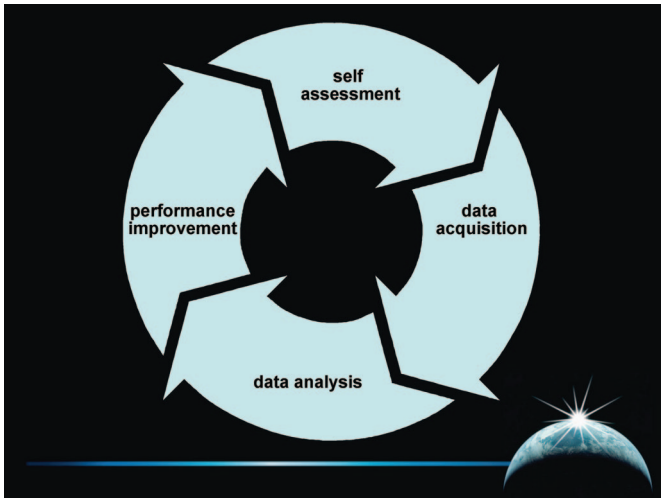


**FIGURE 1.3.** The cycle of practice-based learning.

Because learning is part of the everyday experience of metacognitive individuals, most of them intuitively understand several key truths about knowledge, all of which are supported by learning research. First, adult learners in particular need to perceive a lack of knowledge—or knowledge gap—before they can meaningfully learn. That gap is often exposed by specific needs or problems that arise in daily life. Second, knowledge that is perceived to be highly relevant to daily experience is more likely to be learned. In other words, we devote what time we have to learn what is most immediately important. Lastly, in order to become useful, knowledge has to be put into practice.

When individuals apply highly relevant knowledge, then evaluate the impact of that application, they achieve deep understanding and are better able to transfer that knowledge to different situations in life. Knowledge combined with experience activates it and converts it to its usable form, which is wisdom. This conversion of knowledge to wisdom has been described by the experiential learning scientist David Kolb, as the transformation of experience (*Fig. 1.2*).

All of this surely makes sense for physicians. Our daily practices are where issues arise that stimulate inquiry and lead us to acquire new, relevant information. Unquestionably, we are more likely to learn and apply new information when that information relates to a specific need or question in our practice. So, learning through experience is a powerful factor in education, and we would do well to keep that in mind when designing programs of learning.

Advisory and regulatory agencies like the Institute of Medicine and CMS certainly understand the importance of metacognition in practice. One of the critical skills these agencies now require of us is called practice-based learning and improvement. This is, essentially, metacognition applied to the medical practice environment. Practice-based learning and improvement is a continuous cycle of four basic activities. These activities include self-assessment, which leads to the acquisition of data relevant to medical practice, analysis of those data, performance improvement based on that analysis, and repeat self-assessment (*Fig. 1.3*). The process is intended to make physicians agents of improvement and change. Unfortunately, in the rush to respond to public and governmental pressure for accountability, various components of practice-based learning, particularly practice data collection, have been implemented superficially. Regulatory bodies and third-party payors have developed generic data collection systems that are a mile wide and an inch deep. They emphasize administrative procedure where doctors who "check the box" are deemed quality physicians. They do not, however, measure true competency development as much as adherence to protocol. Consequently, many physicians view these practices as unwelcome intrusions and meaningless bureaucratic abstractions.

The application of practice-based learning has been imperfect, but that does not mean we should dismiss it. It is based on sound principles of educational theory, quality control, continuous improvement, innovation, and safety. These same principles are found in fields such as technology, manufacturing, and in many industries, such as airlines. The current shortcoming with practice-based learning presently is not in its theory, but in its implementation. Friends, we can do better. Knowledge workers in a variety of domains outside of medicine are harnessing information from daily experience to facilitate collective improvement. In doing so, they are driving their disciplines and industries forward. We, as a community of learners, can and must develop meaningful methods of learning and improvement in practice.

What specific types of learning programs support learning from medical practice? First and foremost, we have to

teach effective self-assessment and performance enhancement skills. Products like the Self-Assessment in Neurological Surgery, otherwise known as SANS, allow clinicians to participate in self-assessment at various intervals in their practice experience by posing important clinical questions and forcing learners to reflect on their practice.

Individual reflection on data from practice and the literature can also greatly assist self-assessment, which is why fluency in outcomes data collection and evidence-based medicine will soon be required of all clinicians. The ability to learn from our own experience and the experience of others is a critical aspect of metacognition and is characteristic of high-level performers in modern society. Our systems of neurosurgical learning must therefore emphasize information literacy and knowledge management skills. The American Board of Neurological Surgery has started neurosurgery down this important path through the Maintenance of Certification process. The joint AANS/CNS guidelines project and the planned joint practice outcomes data project will be critical elements in the development and expansion of these essential competencies.

Continuous performance assessment can be ideally accomplished in what are known as communities of learning—groups of highly motivated clinician-learners with common clinical interests. They typically gather online or in person to share information from practice and the literature to cooperatively learn new competencies, generate new knowledge, and address difficult questions that arise in practice. Participation in these groups exposes individual learners to new ideas that reveal strengths and flaws in their existing understandings and allows participants to develop more profound and novel solutions than they would find on their own.

I propose that our national societies, which were designed specifically to promote learning through professional interaction, should facilitate the development of these communities.

One way we can help grow these programs is to help individual learners in practice master the digital tools of a knowledge society. These tools, such as those envisioned by the Web 2.0 movement, are essential for modern communities of learners to share experience and construct new knowledge. Web 2.0 includes internet-based communities and hosted services, such as social networking, wikis, video-sharing sites, blogs, and interactive databases. These sites have in common the ability to host sophisticated interactions among groups of individuals with focused interests. Look inside your children's classrooms; these tools, such as the wiki shown here (*Fig. 1.4*) are now routinely employed to facilitate individual and group understanding. Many of our children might look upon us as digital immigrants, navigating the turnstiles of a new Ellis Island as we adapt to the knowledge society. Our children, the digital natives, intuitively understand the incredible potential of these tools—that they can powerfully leverage the collective intelligence of groups to facilitate understanding, problem solving, and knowledge generation. Moreover, they allow these interactions anytime and anyplace.

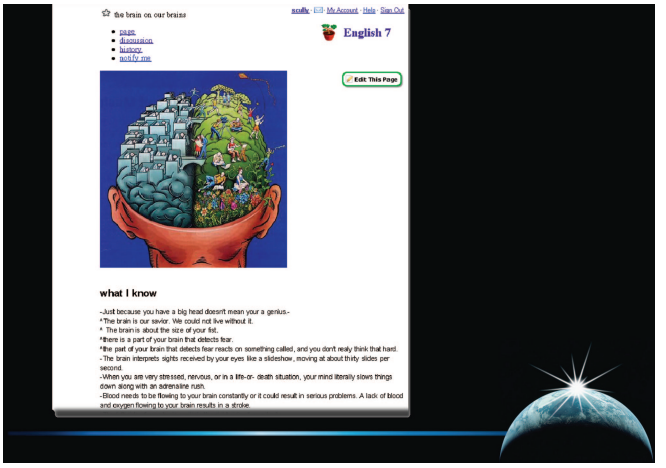


**FIGURE 1.4.** Technology is enhancing collaborative learning in classrooms.

Through our annual scientific meetings, our societies can also facilitate, extend, and enrich practice-based leaning activities by fostering and enabling communities of learners. Case-based interactive programs allow learners to share experiences, reflect on their own practice, and engage in self-assessment. Interactive technologies allow surgeons to actually create and analyze new repositories of practice-based data that point the way toward quality improvement, more formal clinical trials, and new ideas about practice. Most importantly, we can study, analyze, and continuously refine our educational methods themselves. By doing that, we can improve the educational process and thereby improve performance in practice and ultimately patient outcomes.

Admittedly, doing this, and proving that we are doing it, creates a high bar to reach, but the CNS and its membership have begun a significant effort to do so using the Integrated Medical Learning (IML) process. This process allows learners to contribute their data, access and interact with medical evidence and expert opinion, analyze the practices and opinions of their community of learners, and decide on future directions. We are applying the same methodology to help the community of neurosurgery point the way forward on various complex or controversial policy questions, using interactive Consensus sessions. These interactive, practice-oriented programs will help us collectively address the knowledge gap represented by our lack of formal medical evidence about the large majority of practice-based decisions. The tens of thousands of data points that have already been collected in the IML and Consensus projects have been meticulously analyzed and submitted to the peer-review pro-

 

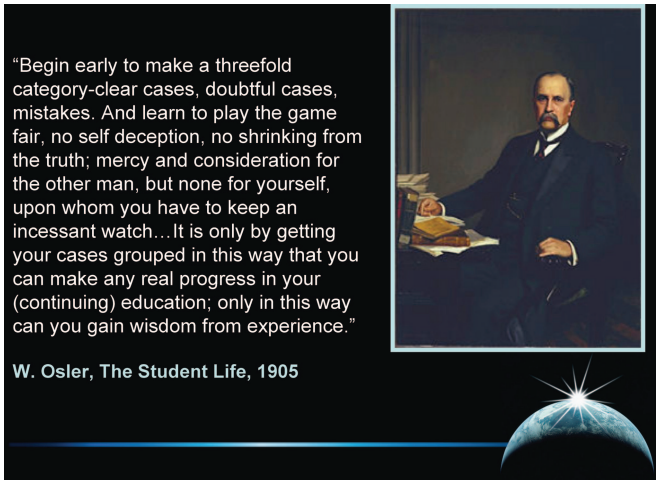


**FIGURE 1.5.** William Osler was the father of modern medical education and a strong believer in the value of reflection on individual experience.

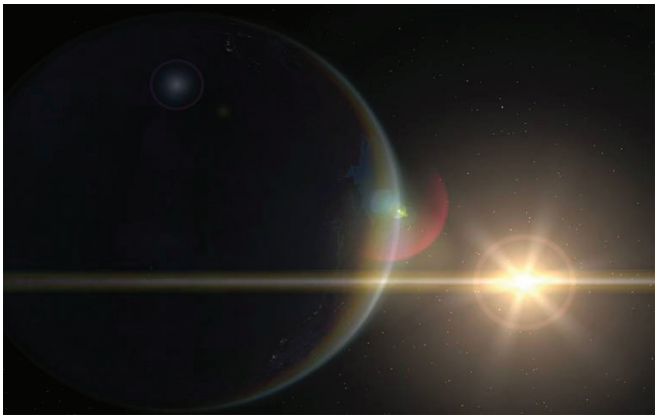

**FIGURE 1.6.** The old paradigm of passive learning is ill-suited to a knowledge society.

cess. The results will be disseminated to the community of neurosurgery in the next few months.

Medical visionaries have long understood the importance of metacognition in practice. Again, William Osler (*Fig. 1.5*):

Begin early to make a threefold category-clear cases, doubtful cases, mistakes. And learn to play the game fair, no self deception, no shrinking from the truth; mercy and consideration for the other man, but none for yourself, upon whom you have to keep an incessant watch…It is only by getting your cases grouped in this way that you can make any real progress in your (continuing) education; only in this way can you gain wisdom from experience. — William Osler, *The Student Life*, 1905.

William Osler was not only the father of modern medicine, but also of modern medical education. Even in 1905, Osler recognized the central need for studying practice outcomes. The opportunity of our medical generation is to develop the skills to analyze our own practices and determine opportunities for improvement—to practice that metacognition that our world demands. These are the skills that are essential to the new knowledge society. Learning in and through practice is a particularly powerful mechanism. It can enable us to improve individual understanding, promote individual improvement, and, perhaps most importantly, allow and empower each of us to contribute to the advance of our collective knowledge.

That collective-knowledge generation will help advance neurosurgical science, which is critically important. But major shifts in the health care environment are creating other urgent needs for this capability. Agencies responsible for broad oversight of health care funding, quality, and safety are creating standards of care and education based on fragmentary and sometimes ambiguous data. Our continued ability to effect meaningful change in our environments and retain autonomy as clinical decision makers will depend on our ability to master the skills of the knowledge society, particularly the ability to create meaningful new knowledge. If we get it right, we can be leaders in change rather than victims of change.

I realize many of these efforts will be challenging. A new theory of practice has to grow along with new theories of learning. We are all very busy. These techniques must be relevant and embedded in practice to work. We need to scientifically evaluate the effectiveness of new learning programs. Without question, significant barriers exist, including cost and the development of meaningful incentives. Access to relevant technology remains an issue for many, but the rapid proliferation of flexible communication technologies and the universal implementation of the electronic medical record should resolve many of those issues. I'm reminded that when SANS Lifelong Learning was originally conceived, very few of us had high-speed Internet access. Eighteen months later, that access was ubiquitous.

I'm not suggesting that practice-based learning should replace all existing educational programs. Many different approaches will be required to meet our learning needs. Most importantly, we must be aware of a growing effort that is transforming contemporary opinion about the processes of learning and the very nature of disciplinary knowledge. At a minimum, we are called on to recognize how the learning science effort can potentially improve our own processes of learning and education and thereby improve our practice of neurosurgery.

In traditional models of learning, knowledge was seen as a powerful external source of illumination around which learners circled, passively accepting light and enlightenment (*Fig. 1.6*), but that model is no longer valid. Knowledge—useful, usable knowledge—is here (gesture to projected

 

**FIGURE 1.7.** Enlightened learning and new knowledge generation are rooted in our daily experience.

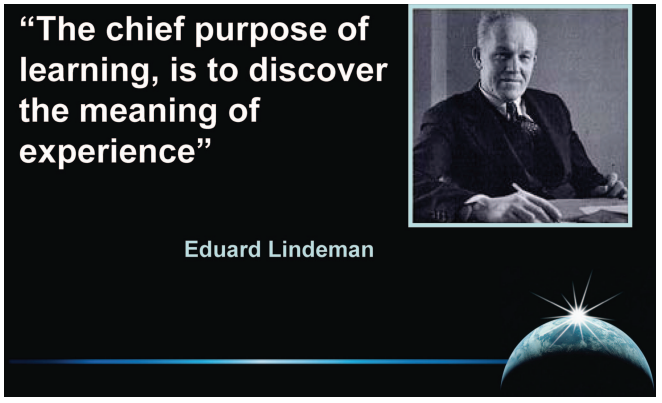


**FIGURE 1.8.** The adult education theorist Eduard Lindeman intuitively understood that our knowledge only gains relevance in its constant application to daily experience.

earth) and here (gesture to room). It's in our interactions with our colleagues. It's in our relationships with patients. And it's in our operating rooms (*Fig. 1.7*). In the knowledge society, learning and knowledge are inextricably tied to experience, and for that reason alone, learning itself must be enlightened. The visionary educational theorist Eduard Lindeman explained that the "chief purpose of learning is to discover the meaning of experience" (*Fig. 1.8*). Enlightened learners recognize that information only gains relevance in its constant application to daily experience. With that experience, enlightened learners convert knowledge from many sources into its useful form: wisdom. In doing so, they themselves illuminate their surroundings.

Friends and colleagues, we have an obligation and an opportunity to advance our systems of learning. Our most enlightened and intuitive medical learners, teachers, and practitioners have long engaged themselves in many of the activities I described today, but the times do not allow for the spontaneous, intuitive emergence of such individuals. Even a beginning practitioner must develop the basic skills of a knowledge society to help them realize their full potential. Furthermore, these times require that all of our learning efforts possess both value and efficacy.

Learning scientists are now using knowledge of human cognitive structure to inform the design of educational programs. Our specialty possesses a singularly cogent perspective on human functional neuroanatomy and cognitive architecture. If neurosurgeons cannot lead the revolution in medical learning, then the risk that medicine will fail to attain its full measure of influence and relevance in the knowledge society is, unfortunately, real.

Based on all of this, I propose a number of key initiatives: 1. We should make learning science a top academic priority. Specifically, we must train and promote expertise in applied learning theory and develop leaders to advance this cause in neurosurgery and throughout medicine. 2. We need to develop partnerships with learning scientists to promote formal learning program development and enhance learning in practice. These individuals can assist and guide us in the conduct of meaningful education research to evaluate the efficacy of both novel and existing learning approaches. 3. Our national societies should cooperatively engage in the development of learning science programs. Collaborative evidence-based medicine and practice database projects are central to these efforts. 4. We should immediately engage with national regulatory agencies, such as the ACCME and ABMS, to define and develop intelligent, practical, and meaningful methods of continuing medical education and assessment. With our input, the entire CME enterprise can be more flexible, relevant, and serve a larger purpose.

In keeping with our learning theme, I have a homework assignment for all of you. On the CNS web site, I've referenced some resources that members of the community of neurosurgery can use as a starting point for beginning their own journeys to exploring the learning sciences. Listed among those references, are Osler's essays, which contain relevant words of wisdom for us as we seek to enhance the way we and future generations learn.

Osler frequently references the reality and the frustration that complete knowledge is unobtainable. For the most part, individuals have to content themselves with gathering fragments of a larger truth, never able to see the complete picture. Nonetheless, Osler constantly emphasizes the importance of the continuous search, and he acknowledges that there are occasional "moments, when mortality weighs less heavily upon the spirit (in which) we can, as in a vision, see the form, divine."

It was late at night when I first read that passage in Osler's essay "Aeqaunimitas," and I initially thought he had written "the divine form." Upon rereading the line, I realized

 

**FIGURE 1.9.** Imagine the potential of the Community of Neurosurgery to harness our collective experience for the good of our patients and for society.

he was using divine as a verb, in this sense, to see the full form take shape. Either way, it's a wonderful sentiment.

In believing, as Osler did, in our individual responsibility and our collective potential to effect change, we can preserve and *enhance* our glorious heritage. Imagine the potential of harnessing the collective experience of our fellow surgeons for the good of our patients and for society. How much easier would it be for us to see, as a community of learners, the complete picture, the complete form—divine (*Fig. 1.9*).

## Disclosure

The author has no personal, financial, or institutional interest in any of the drugs, materials, or devices described in this article.

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