

Learning as Problem Design Versus Problem Solving: Making the Connection Between Cognitive Neuroscience Research and Educational Practice

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ABSTRACT—How can current findings in neuroscience help educators identify particular cognitive strengths in students? In this commentary on Immordino-Yang's research regarding Nico and Brooke, I make 3 primary assertions: (a) the cognitive science community needs to develop an accessible language and mode of communicating applicable research to educators, (b) educators need proper professional development in order to understand and relate current research findings to practice in the classroom, and (c) the specific research on Nico and Brooke clearly suggests that educators need to rethink the classroom as a place not of problem solving but rather problem design in order to further understand and use the cognitive strengths of each individual student.

For educators, there is still an open question as to how to effectively apply the research being conducted in the rapidly unfolding fields of cognitive neuroscience and developmental psychology to educational practice. How can educators best use such research in order to improve standard notions of classroom design? The assessment of the research on Nico and Brooke (Immordino-Yang, 2007) provides a good first example of generalizable neuropsychological principles from case studies that can be translated into practical application by educators. Specifically, through the way in which Nico and Brooke develop essential skills, educators can begin to

see a shift from a classroom as a place of problem solving to one of active problem design. In using the research on Nico and Brooke in this manner, neuroscientific research receives practical grounded application in the classroom. Emerging from Immordino-Yang's research, this commentary addresses three critical areas: the neuroscientific community's approach to communicating results to educators, the necessity for professional development for educators, and how this particular research strongly suggests that classrooms should be thought of as places of problem design rather than the more traditional notion of problem solving.

COMMUNICATING AND USING RESEARCH RESULTS

The first essential question raised by the research results regarding Nico and Brooke is, how can researchers best present their work to facilitate connections to education? Immordino-Yang's article makes several steps toward this goal. First, she directly and clearly relates the results of the research to principles of learning and describes Nico and Brooke as learners. Second, she applies the "developmental lens of an educator" (Immordino-Yang, 2007), drawing applicable conclusions for education as the research unfolds and providing a much needed model for articulating principles that then can be extracted for application in the classroom. Third and related, the essay creates a dialogue, developing trust between researcher and educator. The assumption throughout the writing is that the information provided by the study is accessible and applicable to all educators who

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might put their eyes to it, not just those with advanced knowledge of neuroscience and cognitive science.

As Immordino-Yang crafts this highly effective approach to communicating her research results to professionals in the educational community, the next question becomes inescapable: What kind of background and professional training do educators need in order to draw valuable conclusions from research? Given the rapid and extraordinary findings in neuro- and cognitive sciences, focused professional development is essential (Fischer et al., 2007). We need an approach that both assumes that educators are intelligent enough and have the desire to seek solutions toward improved student learning and puts the proper responsibility in the lap of educators to become better students of the brain and current neuroscientific research (Pickering & Howard-Jones, 2007). Although graduate education programs and school in-service programs often expose and train teachers in theories of education, such as constructivism, the reading of original research and the drawing out of working principles from areas directly relevant to educational practice need to be modeled for teachers and educational leaders. It is here where the neuroscientific community can play a direct role with professional development. With such training from neuroscientists, educators could improve their practice by drawing from general principles, and in turn could provide vital information and raise essential questions for neuroscience to pursue, based on insights from observations of their students. This would create an essential network or loop of exchange between the educational and the scientific spheres, benefiting both practitioners and researchers.

With the research of Immordino-Yang and my own background in cognitive neuroscience and developmental psychology, I was able, as an educator, to identify the generalizable principles that would allow me to apply what I had learned from Nico and Brooke to a broader, more typical student population. As an educator always looking for ways that the classroom can become a more effective learning environment, one implication of the study of Nico and Brooke is that the classroom should actively engage students with problem design, rather than with simply solving problems as the teacher has conceived them.

PROBLEM DESIGN VERSUS PROBLEM SOLVING

What makes the portrayal of Nico and Brooke's cognitive development so valuable is that they are both portrayed as shapers (constructors) of problems. In these boys, problem-solving skills emerge from a reinterpretation of existing problems into new problems that suit their individual strengths. This implies that students are using various cognitive and emotional approaches, shaping problems in very individualistic ways to solve what appears on the surface to be the same

problem for everyone. Moreover, it suggests that if a student is constantly asked to problem solve solely based on sets constructed from the particular perspective or idiosyncratic strengths of the instructor, the student might experience nothing but frustrations and difficulties by only attempting to perceive problems as the teacher intended. The result is bound to be confusion on the part of the student as to what actually constitutes a problem and why, as well as on the part of the instructor who is unable to piece together the student's lack of clarity.

As many of the constructionist theorists have outlined (Piaget, 1937/1954; Vygotsky, 1978), although the ability of students to problem solve is essential, solutions are irrelevant if the problem is somehow unintelligible or unobtainable on the part of the learner. That is, defining the classroom solely on the neuropsychological strengths of the instructor makes for a narrow place. Instead, this research suggests that there may be value in reframing lessons so that students are actually engaged in problem construction and design. Under the modeling and guidance of teachers, students will frame questions, considerations, and principles inside of contexts and narratives, which give the learning culturally and individually relevant, associative, symbolic, or numerate meanings (Fischer & Immordino-Yang, 2002; Immordino-Yang & Damasio, 2007). Furthermore, teachers who engage their students in problem design will have the opportunity to observe individual student's cognitive-emotional profiles to facilitate greater student awareness of their own learning.

A simple example of this shift in emphasis can be found in game construction, a common assessment practice used particularly in middle school classrooms and used extensively in Design-Based Learning programs (Nelson, 1984; Nelson & Sundt, 1993). The construction of a game becomes a form of assessment, where students show a clear understanding of principles applied to a board or logic game. Excellent models of this assessment practice include clearly written game rules, which help students with functional literacy skills as well. The essential question that students need to answer would be, how does the game design express not only the principle being taught but also an approach to the problem that needs a solution? The student-designed game would only become "winnable" if the students playing know how to use the principle taught to the set of problems within the game designed. The game then becomes not only a process of discovery for the students playing but also a window into the cognitive processes of the game "designer." Through such a process, teachers would invariably find a variety of underrecognized and underused strengths in how students approach concepts and principles.

This shift in lesson planning and assessment practice should prove fairly straightforward. Teachers already have a strong grounding in the practices of problem design

because, ultimately, this is exactly what they do in putting together everything from lesson plans to long-term projects to assessments. It is telling that educators will often express that their own learning is never more enhanced than when they must construct the ideas and concepts for their students, and it is this process that creates the passion that makes education such an exciting and stimulating field. The irony, however, is that teachers are not necessarily applying the same principles to student learning. Incorporating problem design suggests that teachers need to be explicit with students that a major goal of the lesson is to learn how to become aware of their own problem-solving strategies in order to be self-directed learners. Teachers would need to model the very techniques that they use to create dynamic learning environments, allowing students to practice these techniques and then eventually creating many of their own practices as the learning year progresses. In a problem design classroom, teachers and students become, as Adler suggests, “cooperative artists” (Adler, 1988), as students become more aware of their individual strengths in constructing problems.

The research regarding Nico and Brooke allows educators to imagine that through thoughtful processes of educational practice, they can identify unique strengths within each individual learner. With proper teacher training coupled with approaches to communicating research results, as practiced by Immordino-Yang, the classroom then becomes a place where each student’s mind and spirit can find his or her unique perspective on constructing knowledge. With students directing the construction of problems, the classroom becomes an exciting opportunity for students not only to

acquire general knowledge but to acquire invaluable insights into how they learn best as well.

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