# Lost in translation: educational psychologists as intermediaries between neurosci...

Health & Medicine

# Introduction

Despite a shift toward evidence-based practice in education in the 21st Century (e. g., Davies, 1999 ), the gap between education and neuroscience research persists (e. g., Bruer, 1997 , 2016 ; Bowers, 2016 ). One approach to bridging this gap is to develop closer collaborations between researchers and teachers; however, such alliances can be hampered by differences in vocabulary, scope, goals, values, and training (e. g., Ansari and Coch, 2006 ; Vanderlinde and van Braak, 2010 ; Coch, 2018 ). Another approach is to use intermediaries, professionals who have been trained interdisciplinarily (e. g., in education, pedagogy, cognitive science, development, the science of teaching and learning, psychology, and neuroscience), to make the connections. The use of intermediaries is commonplace in fields as diverse as nutrition and agriculture (e. g., Tabek et al., 2012 ; Elueze, 2016 ; Soguel et al., 2019 ). Agricultural extension agents may be an ideal model, serving as intermediaries between industry and academia, on the one hand, and farmers and producers on the other, bringing both innovative research findings from the former to the latter and real-world problems to be solved from the latter to the former ( https://nifa. usda. gov/cooperative-extension-system ). Extension agents are proficient in both research and practice—and, crucially, in the reciprocal integration of research and practice. Could educational or school psychologists play a similar role for neuroscience research and educational practice?

## Research and Teaching: Beyond Translation

Despite the plethora of " brain-based" products offered to educators (e. g., Jensen, 2005 ; Sousa, 2006 ), neuroscience findings cannot magically be

turned inside-out or upside-down to become effective teaching practice (e. g., McIntyre, 2005 ; Christodoulou and Gaab, 2009 ). Further work is required to integrate, in principled ways, basic findings concerning learning and development into pedagogical practices that teachers can use ( Daniel and Chew, 2013 , p. 365). Just as psychological theories and research need to be refined to better reflect and apply to complex classroom environments (e. g., Daniel, 2011 ; Lohse-Bossenz et al., 2015 ), findings from neuroscience need to be translated to hypotheses for practice and then " tested—rigorously and scientifically—in the classroom before any ' educational application' or ' translation' can become clear" ( Coch and Ansari, 2009 , p. 546). From the perspective of pedagogical ecology, what is needed for research-informed teaching—beyond simple translational mappings—is understanding of " how the fundamental mental architecture that supports learning interacts with other aspects of individuality and environments to produce meaningful differences in human performance" ( Daniel and Poole, 2009 , p. 95).

Efforts to build such understanding, perhaps facilitated by an intermediary, should be both guided by problems of practice and thoroughly reviewed ( Editorial, 2006 ). Yet this offers no guarantee: In the United States, federal law requires " special education, related services, and supplemental aids and services [to] be based on peer-reviewed research to the extent practicable" ( Individuals with Disabilities Education Act, 2004 ); despite this mandate, special education is not " immune to a research-to-practice gap," as some practices with little empirical support are often used whereas others with strong support are seldom used (e. g., Burns and Ysseldyke, 2009 , p. 3). Even school psychologists, trained in evidence-based practice and intimately

involved in special education, overestimate empirical support for ineffective techniques discredited by behavioral research ( Zaboski et al., 2017 ). This issue intensifies in the context of neuroscience research: Neuroscience (e. g., cognitive, developmental, affective) is not typically covered in American school psychology graduate curricula (e. g., Joyce-Beaulieu and Rossen, 2014 ), nor is it required for program accreditation ( National Association of School Psychologists, 2010 , 2020 ) or assessed in candidate testing ( Educational Testing Service, 2018 ). At least in America, this complicates a role for educational psychologists as translators of neuroscience research into educational practice, more narrowly, or intermediaries between neuroscience and education, more broadly.

## Mental Models for Teaching and Learning

Expert teachers develop content knowledge about the subjects they teach, pedagogical knowledge, curricular knowledge, pedagogical content knowledge, knowledge of learning, learners, and their development, knowledge of educational contexts, and knowledge of educational goals and values (among others, e. g., Shulman, 1987 ; Cochran et al., 1993 ; Beijaard and Verloop, 1996 ; Borko and Putnam, 1996 ; Darling-Hammond and Bransford, 2005 ), all of which may be used in any given teaching and learning interaction, moment-to-moment, many times per day in a dynamic and complex classroom environment ( Shulman, 2004 ). Expert teachers are effective in part because they have developed mental models that comprise a deep, contemporary understanding of how students learn and how teaching affects learning, an understanding which may be “ more advanced than the current state of learning science” ( Daniel and Chew, 2013 , p. 364).

Remarkably, with the exception of Australia, most countries do not require previous teaching experience for educational psychologists ( Jimerson et al., 2004 , 2006 , 2008 ; Boyle and Lauchlan, 2014 ), meaning that they have had little opportunity to develop such mental models. Thus, they may lack the classroom-based expertise, vocabulary, and working knowledge of problems of practice and resources available to address them that are crucial to an intermediaries' toolkit.

Teachers' beliefs may be related to their practices in multiple ways: through filtering information and experiences, framing situations and problems, and guiding intention and action ( Fives and Buehl, 2012 ). It should be expected that teachers will struggle with recognizing when and how to replace or amend elements of their beliefs about teaching based upon experience with those that are based upon research evidence ( Schwartz et al., 2019 ). Thus, the role of " translator" is more complex than simply supplying information: It involves understanding context, the teacher's objectives and approach, and the process for conceptual change (e. g., Nussbaum and Novick, 1982 ; Pintrich et al., 1993 ) from deeply valued, experience-based models of teaching to models updated and augmented with evidence-based strategies. Intermediaries can be powerful allies if they teach educators how to adapt research to practice and build evidence-informed mental models in principled ways, rather than usurping their agency with mandates or prescriptions; this can help counteract a " technocratic orientation to teaching that gives the understanding and thinking about teaching practice to others, rather than retaining it in the realm of the practitioner" ( Fives and Buehl, 2014 , p. 444), thereby diminishing both agency and professionalism

in teaching. In turn, the knowledge that intermediaries glean while working with teachers in classrooms would need to be valued enough to inform the research goals of neuroscientists, who seldom derive hypotheses directly from classroom practice or design interventions for ubiquitous classroom use.

## Educational Psychologists and Research

Concepts from neuroscience are almost exclusively descriptive, rather than prescriptive, with regard to classroom practice (e. g., Christodoulou and Gaab, 2009 ). However, they can potentially contribute to explanations for why and how particular approaches work or do not work in terms of underlying neural processes (e. g., Thomas, 2013 ; Howard-Jones et al., 2016 , 2020 ). While such explanations are valuable and may be an important point of confluence for intermediaries to facilitate development of evidence-based mental models, they are far from recommendations for practice. Because very little from neuroscience applies directly to the classroom, an intermediary would need to be skilled in mapping problems of practice to potential hypotheses derived from a relatively nuanced understanding of relevant neuroscience findings. Then, they would need to guide and facilitate the design of specific interventions and explore impacts, unintended consequences, and practicality of use in context. Thus, additional research methods and curricular design skills would be necessary to cultivate in the optimal intermediary.

At present, school psychologists worldwide spend the majority of their time on psychoeducational evaluations and individual student counseling, with comparatively little time spent on staff training or in-service programs (

Jimerson et al., 2004 , 2006 , 2008 ; Boyle and Lauchlan, 2014 ; Passenger, 2014 ). In survey studies, most school psychologists also reported that research was at least somewhat relevant to their professional practice, but no respondents indicated spending any portion of their time on research-related activities ( Jimerson et al., 2004 , 2006 , 2008 ; Boyle and Lauchlan, 2014 ). In the United Kingdom, some educational psychologists reported having been trained in research skills but not using those skills in practice ( Evans et al., 2012 ), and in the United States, school psychologists reported minimal engagement in conducting, participating in, or reviewing research ( McNamara et al., 2019 ). Even for graduate students in school psychology, interest in research ranked last among factors influencing the decision to pursue the profession and engaging in research ranked last among factors contributing to excitement about school psychology ( Bocanegra et al., 2017 ). Although the model of a school psychologist as a scientist-practitioner providing assessment, intervention, and consultation services informed by research to support student success is strong ( Joyce-Beaulieu and Rossen, 2014 ), its expansion to supporting educators in using or conducting research is less so.

## An Evidence-Based Ethos

Cultural values—such as appreciating and responsibly using research evidence in practice (or not)—are central to the enterprise of education ( Sheridan et al., 2005 ). Despite advances (e. g., Davies, 1999 ; Thomas and Pring, 2004 ; Coldwell et al., 2017 ), an evidence-informed ethos is neither common in the field of education nor supported in many educational systems (e. g., Biesta, 2007 ). An “ honest broker” may be needed to advocate for a

research-based culture in which practices and products are scientifically evaluated before classroom use ( Editorial, 2006 , p. 1345), but the system itself must first endorse—or at least allow for the possibility of—that role if educational psychologists are to be trained and resourced to fulfill it. With regard to such training, the most recent National Association of School Psychologists Practice Model in the United States reflects a transition from the traditional role of school psychologists related to assessment for special education to a more systems-level role that *could* be consistent with developing and sustaining such a school-wide, research-informed and evidence-generating culture; however, this transition has been difficult to navigate and school psychologists continue to engage in a traditional role while reporting a need for further systems-level training ( Rossen and Charvat, 2011 ; Walcott and Hyson, 2018 ; McNamara et al., 2019 ). Given that almost two-thirds of respondents also reported having four or fewer days of annual release time and about three-quarters reported no financial reimbursement for costs related to professional development, opportunities for growth in this direction at present appear severely limited ( Walcott and Hyson, 2018 ).

## Discussion

Education, in both principle and practice, is a cultural effort to guide development. Intermediaries would serve as educators, for both teachers and researchers. An intermediary professional with training in the neuroscience, development, learning, and education literatures; experience with teaching and research methods relevant to classroom application; and a deep working knowledge of pedagogical mental models and the intricacies of

educational contexts could cultivate evidence-informed mindsets and aid in the process of adapting scientific findings for educational use as well as bring educationally-relevant questions to the research agenda. Could educational or school psychologists effectively serve in this complex role? Given current levels of training and roles within many educational systems, this seems unlikely. However, with changes in training to include deeper exposure to relevant neuroscience literature, time to develop expertise in classroom teaching, improved understanding of school-based translational efforts that embrace the complexity of both teaching and learning, greater familiarity with mental models of pedagogy, deepened interest in and experience with research, and facility with systems-level change, it is possible that empowered educational psychologists could serve in such a role. Although possible, we believe that incorporating this additional intricate and interdisciplinary role could significantly compromise the otherwise important job of educational psychologists within the education system and dilute the potential impact of responsibly informed translational efforts.

Federal education law in the United States has redefined professional development as involving activities that are “ sustained, intensive, collaborative, job-embedded, data-driven, and classroom-focused... [and]... improve and increase teachers'... understanding of how students learn... [and] effective instructional strategies that are evidence-based” ( The Every Student Succeeds Act, 2015 ). These qualities align with our description of the role of a new kind of intermediary, who would be trained from the beginning in relevant aspects of research, education, pedagogy, cognitive science, development, science of teaching and learning, psychology, and

neuroscience, and who could design such activities for the responsible linking of research and practice. Others have proposed “ neuroeducators” (e. g., Cruickshank, 1981 ; Fuller and Glendening, 1985 ; Sheridan et al., 2005 ) or “ learning engineers” (e. g., Uncapher, 2019 ); however, these conceptions appear to be more top-down than the embedded, bidirectional, collaborative, sustained model that we are proposing here. There are many interacting fields, perspectives, and levels of analysis involved in connecting educational practice to scientific findings. Neuroscience, as highlighted in the “ neuroeducator” proposal, or the science of learning, central to the concept of a “ learning engineer,” would only be two components of a mosaic of knowledge necessary for this newly proposed professional to be effective. Well beyond translation, then, an ideal intermediary between neuroscience and education in dynamic context—a new kind of professional rather than an addition to the profession of educational psychologist—might be thought of as providing extended learning opportunities to continually re-shape and adapt mental models and practice, encouraging and supporting a synthetic, evidence-to-practice-based ethos across schools and research labs.

## Author Contributions

DC and DD contributed to the conception and critical revision of the work. DC contributed to the original drafting of the work. All authors contributed to the article and approved the submitted version.

## Conflict of Interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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