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Translating Neuroscience Research to Practice Through Grassroots Professional Learning Communities

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Abstract

The fields of Educational Neuroscience and Mind, Brain, and Education explore how neuroscience and psychology research can be applied to education practice. Prior work in these fields helped to distill and convey various learning strategies to educators, but bidirectional communication between researchers and educators is still very limited. Given the current challenges facing students and educators, such as the student mental health crisis [1–4] and educator burnout [5–7], there is a great need for more inclusive research translation efforts. In this commentary, we are proposing that neuroeducators, be they researchers, educators, and/or other interested parties, partake in grassroots efforts to help translate and advocate for educational neuroscience-informed practices in local school districts. One well known translation structure is the professional learning community (PLC). By offering to join or form a PLC with local schools, neuroeducators can help address urgent educational needs using research-informed guidance and strategies.

Background

Educational Neuroscience is a research field geared towards the translation of research findings of neuroscience and psychology to classroom practice [8–10]. The field has a great, not yet fully fulfilled, potential, to help address urgent challenges in the education system. For example, students are growing up in a stressful time when there is anxiety about the climate crisis, concerns about social media use, and political unrest and polarization. Educational neuroscience research has shown that stress can impair learning, and that it is not equitably experienced by all students [11–13]. Further, this research emphasize the

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importance of “raising teachers’ awareness of the inter-individual differences in their pupil’s stress responses” [Whiting et al. [13], pg 184]. The more complete this understanding is, the better equipped our teachers will be to deliver effective, personalized and timely interventions for their students and mitigate stress.

Another perspective is offered by the “Whole Child approach” to education [14]. This framework considers the complex interactions of multiple aspects of the learner, including academic, cognitive, ethical, physical, psychosocial, and social-emotional dynamics. Guidance and research insights like this could be used to help local schools address classroom needs around safety, improving engagement and creating supportive learning environments, lessening anxiety, and cultivating optimal learning habits [14, 15, 16].

To address the needs discussed above, we believe that a grassroots approach, informed by educational leadership theory, can improve teacher buy-in and the effectiveness of translation efforts. Educational leadership focuses on assessing and understanding school culture, attitudes, beliefs, and values, and based on these assessments, co-creating a mission and vision for the intended work that can help guide the school organization to its goals using evidence-based practices [17]. As a way to promote a collaborative structure that can support translation efforts, we are proposing that neuroeducators (a term originally used by Fuller & Glendening [18]; used here to include educational neuroscience researchers and practitioners) participate in structured professional learning communities (PLCs) with local educators and school leaders.

While this commentary focuses primarily on partnerships between researchers and educators, students can be involved in a PLC and directly benefit from its work. Indeed, neuroscience is typically an engaging topic for students due to its relatedness to their everyday life (how do we learn? How can we improve our memory? How does exercise affect brain function?) [19]. Exposing students to neuroscience research on learning can potentially increase their metacognitive awareness and help them make better personal decisions (e.g., exercise more often; get more sleep on school nights) [20–22].

In the following sections, we review the benefits and challenges of current translation models and the ways PLCs differ from these models. We also provide a test case to illustrate how an educational neuroscience PLC might look like and discuss the potential impacts of PLCs.

Benefits and challenges of current translation models

Existing communication efforts in educational neuroscience can be categorized based on their primary function: those that mostly **transmit** information to the public, those that primarily **collaborate** with the public, and those that primarily **receive** information from the public [23]. In recent years, significant progress has been made in transmitting information in more user-friendly formats, including websites, interactive online communities, books, and organizations and societies. Some advances have also been made in tools that foster *collaboration* between researchers and educators, such as professional development educational neuroscience courses, collaborative platforms and social media [23], but few to

no tools exist with the expressed purpose of *receiving* the knowledge, skills and viewpoints of the general public, including teachers, with the purpose of informing the research. Furthermore, educational neuroscience resources, such as conferences, organizations and publications, are often only available to those who can afford the time and money necessary to attend or access publications behind paywalls [23]. Therefore, accessible options such as grassroots PLCs provide an opportunity to bridge the research to practice gap. Grassroots teacher professional development efforts are currently under-researched [24], but some suggest that common elements, including easy access, a lack of hierarchy, and opportunities to collaborate, can increase motivation to participate [25]. To our knowledge, no research has yet been done on grassroots PLC's that involve researchers.

Over a decade ago, Stein & Fischer [26] cautioned against the temptation to offer “unidimensional solutions to multidimensional problems,” and instead advocated for a truly interdisciplinary, collaborative approach to addressing current challenges in education. An optimal connection between education and neuroscience recognizes this need for a multi-disciplinary approach with no single superior method, that cooperation between science and education must be reciprocal, and that ongoing professional development is imperative for teachers [27]. A collaborative, bidirectional approach requires the development of communication channels that enable researchers to *receive* information generated by educators [23], allowing educators' knowledge and experience to inform future research. This type of communication also provides researchers with a more complete understanding of the multivariate nature of actual classrooms, helping them to design more contextually relevant studies and refine their recommendations for various contexts. Both parties could benefit. To this end, we are proposing that neuroeducators engage in learning communities with local schools and districts. Both educators and researchers could benefit from this type of partnership. For example, educators could gain access to research that addresses their needs. Researchers could design more ecologically-valid experiments and pilot them in diverse classroom settings [28].

Professional Learning Communities

In this section we review the structure, function, and practices of PLCs to raise awareness of the opportunities they present for grassroots work and the impact they can have. DuFour and Fullan [29] define PLCs as groups of teachers reviewing student learning in an iterative process to adjust classroom practice. Since their inception, PLCs have been used in schools throughout the world, and they can be effectively implemented and used to increase teacher buy-in and facilitate school change [30]. PLCs provide teachers choice and a voice in decision-making, allowing them to talk through their goals and select strategies that are meaningful to them, ultimately resulting in more willingness to engage in change efforts [31].

Pirtle and Tobia [32] list the following guidelines for implementing PLCs:

1. Provide a clear structure and purpose for PLC meetings
2. Address the most pressing instructional challenges

3. Provide support from all levels of the school system (e.g., financial support, planning time and meeting spaces).
4. Foster an atmosphere of trust.
5. Monitor the work of PLCs and provide constructive feedback
6. Support teachers' sense of efficacy and level of professionalism

By incorporating neuroeducators into these PLCs, pressing instructional concerns of local educators and leaders can be brought to the attention of the educational neuroscience community, and researchers can get to know and build trust with local practitioners. This can lead to boundary crossing [33]. Together, educators and researchers can work to drive continuous change using research to guide instructional decisions and develop teacher mindsets about understanding and implementing educational neuroscience research.

PLCs leverage the practices of educational leadership and school change theory and can drive change in two main ways [32, 34]. First, in creating a shared purpose or vision for the work, members of the PLC have time to review their hopes and goals. It is essential that these are brought up early on so as to make sure each stakeholder is working towards the same end result. Having a collective vision statement also helps to cultivate ownership in the work at hand and allows members to set goals that can be progress monitored and used to calibrate the improvement process. Second, PLCs can help foster collective efficacy and can be leveraged to improve educator practice and student outcomes [35, 36]. As an example, K.S. (one of the authors of this paper) started an educational neuroscience-focused group in her school, inspired by the work of Dr. Tokuhamma-Espinosa, an educational neuroscience researcher. Starting with just a collective vision and committed practitioners, the group investigated ways in which educational neuroscience research could inform their practice, with members ranging from Academic Assistants to Principals and the Head of School. This organic gathering sparked educational neuroscience connections throughout the school, fostering novel collaborations (such as Early Childhood teachers with High School teachers), enabled all practitioners to apply their learning in their own unique settings, and eventually led to whole-school professional development sessions based on the work of this group. Their story is a great example of grassroots advocacy for this work and how PLC structures can transform a school community that is aligned under a collective vision [37].

Extending these collaborations to groups of teachers collectively working together towards the refinement of neuroscience-informed practices along with a researcher in a PLC provides an opportunity to develop collective teacher efficacy, a sharing of master practices with group reviews of the implementation of these practices. In his sequel to *Visible Learning*, Hattie (2023) determined that one of the biggest impacts on student outcomes is teacher collective efficacy [38]. Promoting collaborative models that foster efficacy amongst teaching groups and provide researchers opportunities to see their work in action is the true strength of the PLC model and helps to bridge the gap between research and practice. The PLC model encourages those with experience and knowledge, in this case the educational neuroscience experts, to share ideas, pilot-test practices, and work together to refine these practices within each participant's classroom.

Each school organization, classroom, and student is unique, and local practitioners are experts best situated to bring about change in their educational contexts and with their students. By partnering with local researchers who bring knowledge about conditions under which students learn best, practitioners can make better decisions about how to make instructional shifts at schools to support students [14, 15, 23]. To this end, bringing researchers together with local educators and school leaders in PLC structures has much potential for bringing about continuous and effective school change. Further, by promoting a sense of trust and understanding of educational neuroscience principles and why they work, educators and school leaders can in turn become advocates for further translation of educational neuroscience.

How can PLCs create opportunities for grassroots change and transform existing partnerships?

The importance of PLCs as outlined above is that they are a structure that can allow local educators, school leaders, educational neuroscience researchers and practitioners a space to collaborate and bring about effective change in schools. Furthermore, they allow for a unique collaborative approach that encourages educators to try out and refine practices alongside researchers, promoting a sense of collective effort and sharing of practices that cannot be provided through traditional professional development. A first step can be for researchers to reach out to district leaders or school leaders to establish contact and offer support. Once communication has been established with an interested school or district, the stakeholders involved can discuss how to best structure their meetings to achieve the guidelines outlined by Pirtle and Tobia [32] (see above). The overall meeting structure can be tailored to the group's needs. That said, to optimize the group's effectiveness, the group should strive to incorporate as many perspectives as possible such as students or family voices.

As part of the first step in determining the PLC structure, stakeholders would need to clarify the shared vision and purpose of the group. By highlighting the goals of educational neuroscience to teachers, this vision can be shaped to benefit all, but it will require the team to bridge the gap between different roles and foster a mutual understanding of how these two professions function and what unique set of knowledge and skills each brings to the table. An example of a shared goal or a vision could be "During these challenging times following the pandemic, it is our goal to find strategies and research that can help us to improve our instructional environment, help improve teacher and student well-being, in ways that are sustainable for our faculty and community."

In the second step, a mutual understanding of available data and its use in the group would need to be developed. For example, most classroom teachers are not trained in scientific research while most educational neuroscience experts might not be familiar with the types of discussions that occur in the classroom or within PLCs, such as instructional planning and reviewing student work. Finding a middle-ground understanding of how these two groups can provide mutually beneficial analysis of classroom practice is key.

Lastly, an additional element to consider is the challenge of navigating local district policies to support these partnerships and institutional review requirements for districts and research institutions. Therefore, researchers should be open to discussions with district leadership to highlight the benefits of this type of relationship, the potential barriers, and how to overcome them. In some cases, these partnerships may begin with developing a better informal understanding of current classroom practice and the realities within schools, with more rigorous data collection practices coming only after established researcher-district partnerships have grown.

When seeking partnership districts, the key should be to find communities willing to allow voluntary participation in PLCs, rather than mandating teacher participation. The structure for PLCs could be pre-existing or might need to be created. To begin, the teachers should present their current classroom goals and challenges and set a goal for improvement and progress monitoring. Researchers should then present options for viable educational neuroscience principles that can help target these specific classroom improvement areas. Together, the teams should review implementation of strategies and revise practice as needed. The results would allow educational neuroscience researchers to refine how they present strategies while building teacher capacity and trust in the research.

When exploring the logistics of these partnerships, one key consideration is the use of virtual tools to expand partnership opportunities. Arnold [39] surveyed district leaders in New York State and found that the use of online collaborative tools, such as virtual meeting platforms, shared documents and lesson materials, and online coaching had a positive association to collective teacher efficacy in the district. This is further supported by a mixed-methods study exploring the use of tailored online resources for job-embedded support. Here, Schluntz [40] found that these platforms allow for more access to resources and also support collective teacher efficacy. This suggests that online platforms could serve as a means of connecting educational neuroscience researchers with practicing educators beyond local geographical boundaries and within the confines of teachers' work days. By highlighting the use of virtual engagement, researchers can expand the scope of their partnerships to include learning communities around the world.

A Test Case: Addressing Student Stress with PLCs

As a hypothetical example of how PLCs could be used to help translate educational neuroscience principles, we will assume the role of Dr. Doe, an educational neuroscience researcher who studies the impact of stress on learning. Dr. Doe mostly conducts functional MRI research, and they are interested in exploring how their research can be translated to school practices. Dr. Doe recently spoke at a teacher conference and had a conversation with a teacher at a local high school who was intrigued by their research and its potential to address concerns at the school related to student stress. The teacher proposed the idea of forming a PLC, and the idea was well received by the school principal.

In the initial meetings of the PLC, Dr. Doe learned about the lived experiences of students and school staff as well as current challenges faced by educators related to student stress. In subsequent meetings, Dr. Doe talked about the neurobiology of stress and how it might

impact learning, as well as how strategies like movement, breathing exercises, and creating a safe environment and a sense of belonging can benefit student learning [13]. These initial conversations led to a set of co-created vision and goals for the PLC, which were then used to monitor the work over time and to recommend adjustments if the change effort is not initially successful.

Members of the PLC decided to focus on mindfulness practices. This decision was informed by educational neuroscience research, which showed that mindfulness can decrease student anxiety and boost student resilience [41]. However, as members of the PLC dived deeper into the topic, they have noticed that the outcomes of mindfulness programs in schools are mixed [41,42]. Conversations in the PLC focused on what specific mindfulness practices seem to be the most effective and how they can be best applied to their unique school context.

With the help of Dr. Doe, members of the PLC reviewed prior research to determine if incorporating mindfulness practices into the school day can help address their needs and goals. The teachers in the PLC began implementing mindfulness practices in their classrooms and reported back their experiences. Finally, the PLC created a list of recommendations for how to best implement mindfulness practices in their school and shared these recommendations with the larger school community. Dr. Doe is now collecting research data at the school to assess the impact of mindfulness practices on student learning. A subset of students is also participating in a longitudinal functional MRI study at Dr. Doe's lab.

Another example could be a PLC focused on supporting students' executive functions [43], utilizing the expertise of a neuroeducator to unpack the complexities and interconnectedness of various executive functions, as well as examine their expected development throughout the school years. This partnership would support educators in better understanding and supporting their learners, and it would help the researcher to gain insight into what executive functioning challenges students and teachers face, and help to find effective solutions and recommendations.

A final example is a PLC that focuses on the adoption of active learning strategies. These strategies have been shown to reduce student stress and improve performance on assessments [44]. In a grassroots PLC, educators and a neuroeducator could review current school data and example student work throughout a unit. In addition, the PLC members could speak to students to learn more about their experiences at the school. Using this information, PLC members could discuss opportunities for strategic formative assessments to improve students' understanding of their learning and reduce test anxiety [44].

In all three of these examples, the educators benefit from having the support of research-informed strategies tailored to their specific context, and researchers benefit from gaining a deeper understanding of how research can improve practice in a range of settings. There are a number of potential outcomes for this iterative process. Researchers can glean essential insights into the realities of the classroom that can guide their future research. In turn, school

leaders and educators could design more effective curricula and make research-informed decisions about policies, school culture, and future initiatives.

Overcoming Potential Challenges

When research identifies “promising principles” [28] in education, such as using mindfulness practices to address stress, we need to work together to ensure these principles are practical to implement within the financial, time and political structure of a school. These practices should also be adaptable to be effective in a range of actual classroom settings. While both parties may be eager to work with the other in theory, significant obstacles still exist, such as the various pressures and demands on teachers’ limited time. An example of this is in Teig, Scherer & Nilsen’s [45] investigation of the role of teachers’ perceived self-efficacy and time constraints in implementing the research-informed practice of Cognitive Activation Strategies (CAS) in their classrooms. Their findings suggest that teachers with a higher sense of self-efficacy and lower perceived time constraints are more likely to enact CAS, whereas teachers who did not feel as confident or perceived more time limitations were less-likely to enact this recommended intervention. Similarly, Simmonds [46] found that one of the most common reasons that teachers may be reluctant to attempt a new research-informed neuroscience intervention is a lack of time, or concerns about the intervention being too complex or time-intensive.

The collaborative approach of grassroots PLCs places educators as active participants in the co-creation of both research studies and the design and application of interventions, rather than as passive participants or removed recipients. Teacher knowledge, experience and expertise can help to ensure that findings are effectively disseminated in ways that teachers find helpful and useful. Further, effective partnerships could eventually contribute to the co-construction of “banks” of research-informed practices, from which skilled practitioners (teachers) could select the most appropriate practice to apply and modify to suit their specific context. Furthermore, steps can be taken by researchers to make their findings more directly relevant to teachers.

Conclusion

In this piece, we proposed a grassroots process that leverages educational leadership theory in hopes of expanding access to the field of Educational Neuroscience and its impact on education systems. We believe that grassroots PLCs are uniquely situated to be an effective bridge between neuroscience and education, enhancing bidirectional communication between researchers and educators.

By empowering educators and school leaders, PLCs can help cultivate buy-in and develop teacher leaders who in turn can further advocate for educational neuroscience research. There is much work to be done in terms of translating educational neuroscience to meet today’s challenges, and we believe that forming PLC’s with local education stakeholders could help improve upon these efforts.

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