

Learning Sciences in Curricula: Making Excellence in Physical Therapy Education Stick

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The first comprehensive study of physical therapist education¹⁻³ since Worthingham⁴⁻⁹ was disseminated in 2017. Specific in the action items within that study is the need to “infuse the learning sciences into the preparation of academic, clinical, residency, and fellowship faculty.”³ Specific recommendations from this action item call for faculty development grounded in the learning sciences, and opportunities for educational researchers to generate evidence-based approaches to teaching and learning.³ The connections across these recommendations by Jensen, Hack, Nordstrom, Gwyer, and Mostrom³ brings to light curriculum itself as scholarship and the importance of disseminating the social practice of knowing, doing, and understanding curricula.^{10,11}

LEARNING, LEARNING SCIENCE, AND THE HUMANITIES

Our understanding of learning has developed over thousands of years and across multiple evolving theories.¹² In the profession of physical therapy, our explicit introduction to learning often starts with a study of motor learning (see Note 1). What theories are

emphasized in this early introduction to learning? How does this prior knowledge among faculty influence their view of how students learn? How does it influence how faculty themselves engage in learning about learning? It is questions like these that can highlight different beliefs about learning and the need for a more explicit consideration of the science of learning in curricula.

Differences in belief and understanding across learning theories has often centered on different ontological and epistemological beliefs, making comparisons and consensus difficult. Murphy and Knight¹² highlight differences in theories of learning by describing beliefs of knowing—specifically, where does knowledge come from, and where does it reside? Considering the range of these beliefs—from knowledge that derives from within the individual and resides within the individual to knowledge that is socially constructed and resides in the environment surrounding the individual—highlights these differences. At the same time, Murphy and Knight¹² highlight what is seemingly present across theoretical differences: that learning requires the production of an enduring change. The emergence of

the term “Learning Sciences” brings together the science of learning across the epistemological spectrum. Learning Sciences is an interdisciplinary science that brings together, among others, psychology, education, computer science, and anthropology, resulting in new ways of thinking about learning.¹³ The very term Learning Sciences provides for a pluralist approach to beliefs of knowing and the understanding of learning due to its interdisciplinary nature and its considerations across the epistemic vector space.¹⁴

A DEEPER UNDERSTANDING OF ‘LEARNING’

A unifying terminology, Learning Sciences allows for a more complete understanding of learning and one that holds true across subject domains, level of experience, and cultural differences.¹⁵ Ambrose, Bridges, DiPietro, Lovett, Norman¹⁵ define learning as a process that leads to change as a result of experience. Important in this definition is the understanding that learning is a process that the learner does to themselves as they interpret their experiences (see Note 2).¹⁵ This highlights the importance of curricula in creating the experiences that the learner will change through, consciously or unconsciously.

PRACTICAL IMPLICATIONS

To begin to consider the practical implications of a deeper understanding of learning, it is useful to consider knowledge more specifically within the context of practice and to consider the broader meaning of this understanding. Cutrer, Pusic, Gruppen, Hammoud and Santen¹⁶ describe three knowledge domains (content, procedural, and conceptual) within the context of teaching and learning in medical education. Content, or declarative knowledge, represents the information that must be

learned so that it can be quickly drawn into working memory and used in application. Procedural knowledge involves the learning and application of a skill, such as performing a muscle performance test. Conceptual knowledge is understanding within a context. Conceptual knowledge not only provides for how to apply content and procedural knowledge, but also for how to interpret the meaning of one’s knowledge across varying contexts. McDaniel and McDaniel¹⁷ provide, in this issue of *JHR*, practical and evidenced-based examples of how to deepen learning of traditional content and procedural knowledge in physical therapy. These important principles set the stage for a curriculum that can progress the learner in the conceptual knowledge among the varying contexts and increasing complexities of clinical practice.

It is also the deep conceptual knowledge that distinguishes a profession, as it is not just a unique body of knowledge that is required, but the search for meaning and purpose of knowledge and its application in service to others. It is this deeper understanding that also connects learning to the humanities, as both represent the search for meaning amongst ambiguity. The humanities help the learner see beyond the black and white and into the grey of practice.

MOVING BEYOND ‘IT DEPENDS’

As faculty we are quite comfortable with the question of how to optimize movement, but *why* one might want to optimize their movement and how optimization may have different meaning across individuals and cultures is far more nuanced, and far more meaningful. In the classroom, we often get as far as “it depends” as the response to the most thoughtful questions, and then we all have a good laugh. As a profession we must move beyond “it depends” as a punchline and embrace dealing with uncertainty explicitly as a milestone to

strive for during a professional formation that results in the ability to thrive and adapt among the ambiguities of practice and life.

THE WIDENING GAP BETWEEN CURRICULA AND LEARNING

The organization of schools, including universities, in developed countries has not necessarily maintained an alignment with the developing understanding of successful learning.¹³ Most faculty were, and still many learners are, “educated” by way of teaching and curricular traditions, which may, increasingly, be misaligned with an education guided by what is known about learning.¹³

Physical therapist education has not been immune to its teaching and curricular practices being guided by tradition. Faculty, who may enter academic physical therapy through a research or clinical background grounded in objectivism and a positivist approach, tend to teach the way they were taught. Without an intentional focus on the science of learning, the physical therapy profession faces the same widening gap between how our learners learn and what is known about successful learning. Additionally, the lack of an intentional commitment to the learning sciences makes it harder to resist other pressures in academic physical therapy that may weaken professional formation and the development of the adaptive learner, such as reducing program length (a lack of spacing), blocking content (a lack of interleaving), or shifting situated learning opportunities to the end of one’s education (a lack of contextual or situated learning) to ease administrative or financial burdens.

What follows in this article is a description of the broad implementation of the learning sciences within a larger curriculum renewal initiative. Additionally, specific examples are provided for how programs can start to

infuse the learning sciences at the start of the process before other changes have occurred. Reasons for the importance of implementing the learning sciences in the guiding of curricula are given with a call to action to academic physical therapy. This description is presented during the process as a mechanism to try to understand how an explicit consideration of the learning sciences may guide curricula, and to open the process to the critique of the health professions so that we may all learn from the experience.

THE LEARNING SCIENCES IN CURRICULUM RENEWAL

Renewing the physical therapist curricula with an outward focus on society requires many considerations beyond the traditional development of curricula.¹⁸ A complete description of this process will not be explored herein; however, it is necessary to give an example to illustrate the importance of the consideration of the learning sciences at the beginning of the process. The following is an excerpt from a Vision for Curriculum Renewal focused on societal need at the Program in Physical Therapy at Washington University in St. Louis:

... Despite this progress in our professional identity, the society we serve faces many increasing burdens. The structure of healthcare is in flux and the search for strategies to slow cost and improve patient outcomes is intensifying. Our growing understanding of health and its social determinants continue to lead us outside of traditional models of care, for which few providers are prepared. Those in academia face additional challenges, as the public demands a more tangible purpose to our methods and for educational credentials to be delivered at a reduced cost and increased flexibility.^{18,19} Traditional models of higher education, including professional education, are being challenged by an improved understanding of the learning sciences [emphasis added] and technological advances. In

addition, we are at the beginning of one of the largest demographic and geographic shifts in our nation's history, which will change the needs of both our future students and patients....

Highlighted in this vision, which was developed by one DPT education program to focus the curriculum outward toward society, is the acknowledgement of the growing understanding of how individuals learn. To ensure that the learning sciences would permeate every aspect of curriculum renewal, a Learning Sciences Consideration Team was formed. The consideration teams for curriculum renewal were the first teams formed and the only teams, beyond the Leadership Coalition, created that span the entire curriculum renewal process (Figure 1). Their purpose is to ensure the new curriculum is not only developed, but continually responsive to important considerations that are both internal and external to traditional curriculum structure and development. Leading with the Learning Sciences Consideration Team prevents a possible reactionary approach to external pressures that may weaken the continued development of curricula and our profession. The charge to the consideration team on the project described here was to review the literature on the science of learning and make recommendations for strategies that would maximize learning at curricular and content levels, as well as general recommendations that could be applied by faculty and learners at any level.

INFUSING LEARNING SCIENCES PRINCIPLES INTO CURRICULA

The learning sciences team began with the evidence-based principles summarized by Ambrose, Bridges, DiPietro, Lovett, Norman¹⁵, Brown, Roediger, McDaniel²⁰ and Sawyer¹³ along with a collection of evidence produced since these texts were published. The development of recommendations at the

beginning of the curriculum renewal process allows the science of learning, and not tradition, to guide architecture and design decisions.

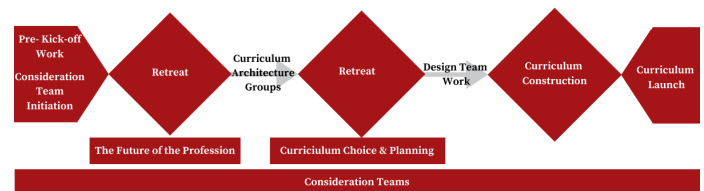


Figure 1

In addition to the development of future curricula, McDaniel and McDaniel¹⁷ aptly describes, in this issue of *JHR*, the immediate benefits from the use of learning-science principles, such as retrieval practice in a learner's study habits, as well as a faculty member's instruction strategies that can be applied within any curricular or teaching practice. The immediate benefits of retrieval practice can be implemented by the learner regardless of curriculum, and can increase the ability of the learner to practice elaboration, and form a deeper understanding of conceptual knowledge.

While it is true that other principles such as spacing and interleaving can also be implemented at any time by the learner, one can see how curriculum begins to facilitate or inhibit the learner's ability to do so. For example, without a return to content over time or with courses provided in isolation of one another, the application of many learning-science principles are left to individual learners to know about and implement on their own. In fact, when content is blocked and delivered over short time periods, the implicit curriculum may be in conflict with the science of learning.

To begin to infuse learning-science principles into the existing curriculum and to have these principles guide the development of the new curriculum, conversations with faculty and learners were initiated. Faculty conversation is necessary to develop a shared understanding around any recommendations to ensure a consistent and evidence-based approach to curriculum design and in delivering this consistent message to learners. Learner conversation is important to make learners aware of these important principles and the discomfort they might encounter with first using them. These conversations are especially important when making recommendations in the learning sciences due to the often counterintuitive nature of what is needed for learning versus creating comfort and familiarity.²⁰ McDaniel and McDaniel¹⁷ describe, again in this issue of *JHR*, the importance of these conversations within the context of physical therapy. To initiate these conversations and create space for an ongoing dialogue, the learning sciences are a theme in curriculum renewal faculty development and have also been added to the yearly orientation activities for learners. The following are examples of the initiation of these conversations.

FACULTY CONVERSATION

Developing a shared understanding among faculty around the science of learning and its use within curricula requires time for conversation. The faculty development for curriculum renewal, therefore, was developed to allow for this time. This faculty development was developed using some of the very principles that were to be recommended. Experts from cognitive, psychosocial, and brain sciences were consulted to develop sessions that utilized learning-science principles, such as spacing effects and elaboration.^{21,22} In other words, a single, passive “workshop” is not sufficient to develop an

understanding around recommendations that would suggest the antithesis of this for a faculty’s learners! As such, this faculty conversation is ongoing through the curriculum renewal process and involves multiple pilot projects to produce experience for the faculty to draw from in its construction of new knowledge about curricula.

LEARNER CONVERSATION

Making learners aware of successful learning strategies requires ongoing conversation due to the often counterintuitive feelings associated with the struggle of true learning. To do this within an existing curricular structure, sessions were added during orientation activities that create touchpoints for returning to the concepts. Similar to the faculty conversation, these activities were developed using learning-science principles, such as spacing, elaboration, and concrete examples.²¹⁻²³ In addition, the activities that the learners completed provided examples about which learning-science principles a learner may already be using, or where they could be counseled if difficulties arose. This has provided a more individualized and evidence-based approach toward assisting the struggling learner.

RECOMMENDATIONS AND A CALL TO ACTION

That a focus on learning in physical therapist education is needed would seem, at first, to be simply understood. Recognition of the need for learning sciences across the continuum of learning in physical therapy was made explicit in the recent work by Jensen, Hack, Nordstrom, Gwyer, Mostrom³ However, as the science of learning evolves, the practices of teaching and curricula in our profession may be moving further away from what is known about the best practices for successful learning. Our profession faces growing pressures that make it tempting to make decisions

directly opposing the science of learning in the structuring of education in academic physical therapy. Compressing and blocking of content or moving situated learning to the end of curricula are in direct contrast to the principles of spacing, interleaving, and the construction of a learning environment that can create the intentional, sequenced, and frequent situated learning experiences needed for deeper learning and professional formation. Expecting individual faculty, or the learner as an individual, to implement strategies for learning within a system that may be structurally moving in the opposite direction widens the gap between the implicit and explicit curriculum and places our profession’s goals of serving society at risk.

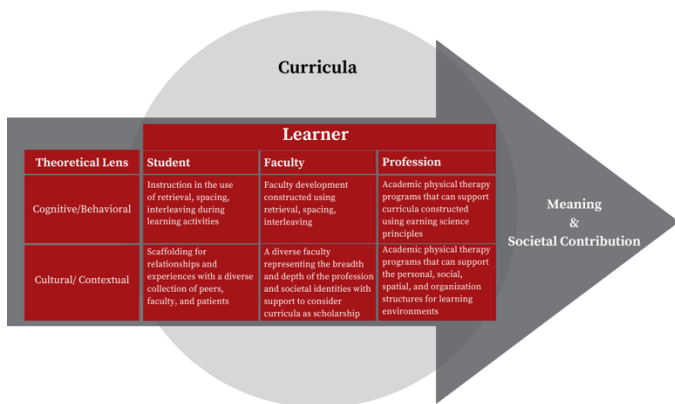


Figure 2

Academic physical therapy programs must move beyond the level of the individual in their expectations of the understanding and implementation of what it takes for successful learning and create curricula grounded in the learning sciences. Curricula that position the student, faculty, and profession as learner, and consider the plurality of learning theories, can help us all reach a deeper sense of what it means to be a physical therapist serving society (Figure 2). Programs must include faculty with expertise in the learning sciences who not only teach, but contribute as scholars to the growth of the learning sciences within the

context of academic physical therapy. Only a true commitment to the infusion of the learning sciences into the preparation of academic, clinical, residency, and fellowship faculty can make excellence in physical therapist education *stick*.

Note 1: A common text used in physical therapy education, *Motor Control: Translating Research Into Clinical Practice*, 4th Ed, provides an introduction to motor learning theories that include ecological theory and consideration of the environment. However, there is a clear focus in the book on cognitive/behavioral theory.

Note 2: This provides for the full spectrum of theories despite that at first it may seem to skew toward the behavioral lens that Murphy describes, given that what the learner does to themselves is moderated by the interpretation of the environment and whether this interpretation is determined by the individual or the social and environmental constructs that surround them.

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