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Review Article

The Devil is in the (Mis) Alignment: Developing Curriculum for Clinical and Translational Science Professionals

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Abstract

This paper explores various challenges associated with designing an effective transdisciplinary curriculum and proposes an approach grounded in the concept of constructive alignment and transformational leadership for developing curriculum for clinical and translational professionals. The proposed approach is based on the premise that alignment amongst program outcomes, learning objectives, content, activities, and graded assignments – which has been shown to be of great importance to the success of a unidisciplinary curriculum – is even more important in a transdisciplinary curriculum. Curriculum design efforts might significantly benefit from a different leadership model, whereby the transactional model of individual experts governed by a single leader is replaced by a team model guided by transformational leadership outcomes, in which the vision, mission, objectives, and ultimately accountability are all shared. Perhaps through this type of transformation, individuals engaged in the process feel responsible for not only representing (and for being accountable for) their own domains of expertise, but for elevating the overall status of the entire program of which they are part, through the improvement of the learning experience created for students.

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INTRODUCTION

Is designing a transdisciplinary curriculum more difficult than designing one that is grounded in a single discipline? Perhaps the answer to this question is "it depends," since not all curricula are created equal. While it is often suggested that *the devil is in the details,* an alternative view – when it comes to transdisciplinary curriculum design – is that *the devil may actually be in the (mis)alignment.*

This paper explores various challenges associated with designing an effective transdisciplinary curriculum and proposes an approach guided by the constructive alignment concept outlined by Biggs [1] and transformational leadership outcomes identified by Bass [2,3] for developing curriculum for clinical and translational professionals. We make several assumptions in our discussion about the special needs of these professionals. First, academic education in translational science requires a profound sensitivity to the needs of learners who may already be well versed and established in unidisciplinary knowledge and techniques [4]. Second, unidisciplinary as well as multi- and interdisciplinary curricula are only marginally successful in preparing learners with skills and competencies when dealing with multilayered complex human problems [5-13]. Learning to address complex issues is only achievable in transdisciplinary engagements that are less bounded by disciplinary constrictions and grounded in real life problems and experiences [14,15]. Third, as such, translational curriculum that attempts to maintain a transdisciplinary approach should be designed to assist professionals in transitioning from traditional science approaches to ones that cross thematic boundaries and foster collaborative science contributions [16]. Fourth, redesigning curriculum is an active, iterative engagement exercise that – guided by a vision grounded in transformational leadership outcomes [2] - has the potential to draw closer faculty, students, and staff into an integrated system of learning that values cross-course and cross-disciplinary engagement [17,18].

The proposed approach is constructed around our experiences grounded mainly in graduate online programs, where faculty who are teaching courses are also the ones developing curriculum. In addition, the main premise of our argument is that alignment amongst program outcomes, learning objectives, content, activities, and graded assignments – which has been shown to be of great importance to the success of a unidisciplinary curriculum [19] is even more important in a transdisciplinary curriculum. We will explain the unique role of alignment to a transdisciplinary curriculum in more detail later in this paper; in addition the critical role transformational leadership plays in the way collaboration take place amongst individuals working on the curriculum.

The significance of alignment in developing an effective curriculum

English identified three major components of any curriculum: *written* (that which is conceptually formulated); *taught* (that which is delivered through coursework); and *tested* (that which is evaluated through graded assignments or standardized tests) [20]. Various studies have investigated the alignment between these three components, namely: (a) *written – taught* [21-24]; (b) *taught – tested* [25-29]; and (c) *tested – written* [30-33]. In a meta-analysis of these studies focusing on research involving curriculum alignment, Squires concluded that student achievement can be improved significantly by ensuring alignment amongst learning objectives, content, activities, and graded assignments [34]. Measuring the quality-related impact of alignment can be evasive, reflecting the wide range of variables that potentially affect teaching-learning outcomes. However, a systematic review of the literature conducted by the Quality Matters program (an evidence-based approach to improving online teaching and learning) described four emerging themes of impact from quality practices such as alignment. According to Shattuck, these include positive impact on (a) learner satisfaction, (b) student learning, (c) professional growth of educators, and (d) broader organizational impact through discussions of policies and practices as a faculty(35).

Challenges associated with achieving alignment within a transdisciplinary curriculum

Pedagogical challenges associated with designing an effective curriculum in higher education – especially in undergraduate education - are usually accepted to be greater for domains that involve more than a single discipline [36]. However, the added complexity does not necessarily arise from the need to include content from various disciplines, but more so from creating meaningful alignment amongst activities students are asked to do within and across courses that constitute the entire flow of the curriculum [1]. Often, we observe that those who are asked to develop courses in higher education may not have adequate time or proximity to thoroughly examine and reflect on how the course fits into the overall flow of the curriculum in which it is positioned and how learning objectives, content, activities, and graded assignments align with one another.

Furthermore, we believe that the constraints of time and proximity may get in the way of allowing instructors from all disciplines represented in the curriculum to be involved in the process of curriculum design. This limitation, in itself, can present a major problem for content experts from different disciplines, who are working together to design a common product, since it might be fair to state that a curriculum can be deemed transdisciplinary only to the extent that it is designed, delivered, and assessed using a trandisciplinary approach [36]. Since transdiciplinary approaches involve "going between, across, and beyond different disciplines, suggesting innovation through synthesis," it is imperative that a truly transdisciplinary curriculum should not only incorporate "discourse, interdependence, reciprocity, and shared vocabulary" [37] in the way it is offered, but it should also be designed and built using an approach that is grounded in these very same constructs.

MERITS OF FACULTY MEMBERS WORKING TOGETHER IN COLLABORATIVE FASHION

Instead of each content expert taking exclusive responsibility for developing a course entirely on their own – which often results in these individuals' world views, values, and epistemological assumptions giving shape to the courses to which they have been assigned –there might be greater benefit in having a team of content experts work together in a collaborative fashion. Such collaboration might allow these individuals to become much more than the sum of their parts and to *collectively*: explore the content of every course; understand each course's contribution to the overall program outcomes; and design a learning experience for students that builds on and complements every course's contributions along the program of study

This team orientation toward curriculum development is one that can model for students the very *ethos* of what

transdisciplinary and collaborative science is about. Faculty teams constructing and contributing to individual course design and student activities can foster psychological and structural empowerment. Additionally, these teams can promote holistic learning across teams of faculty by establishing shared goals and a common vision [38]. This modeling of collaborative work by a teaching faculty can positively impact students. Specifically, students may become more comfortable with not only faculty team teaching but also the awareness that knowledge specialists in their field can work together to tackle complex problems, each providing specialty while integrating knowledge simultaneously [39].

USING THE CONSTRUCTIVE ALIGNMENT CONCEPT TO BUILD TRANSDISCIPLINARY CURRICULUM

More and more graduate level academic programs are emerging to explicitly provide transdisciplinary approaches to solving the most challenging techno-social issues of our times [40-42]. However, there seems to be limited literature on how to create constructive alignment in curriculum that governs the way these graduate programs are offered [43].This might be an opportune time to consider an approach grounded in the constructive alignment approach, as an effective way to align program outcomes, learning objectives, content, activities, and graded assignments in a transdisciplinary curriculum.

The concept of constructive alignment is considered an extension of the notion of: creating new meanings from existing experiences [44]; Piaget's work in cognitive psychology [45]; learning through the social construction of knowledge and reality [46]; and learning as a process through which transformational change takes place [47].Constructive alignment takes a systems view of the teaching / learning environment and focuses on the way learning objectives, content, activities, and graded assignments are integrated – guided by the fundamental question of what students should be able to do, as an outcome of their learning experience [1]. The concept of constructive alignment proposes that students – prompted by their learning experiences –can construct new meanings about themselves and the world around them, given that learning outcomes, assessment evidence, and learning experiences are designed in a way that creates meaningful alignment [5]. Furthermore, studies investigating the effectiveness of integrating experiential team interventions into academic coursework conclude that instructors can go beyond simply disseminating declarative knowledge to enable skill building and competence development [48].

Proposing a new model to build transdisciplinary curriculum

Constructive alignment, as an approach, has started finding its way into curriculum design over the past decade [6,7,49]. However, its application has been somewhat limited to curriculum that focuses on a single discipline. Due to the similarities between unidisciplinary and transdisciplinary curriculum design – and based on the literature reviewed up to this point -it might be suggested that expanding the use of an approach that is grounded in constructive alignment, as depicted in Figure 1, to drive curriculum development in a transdisciplinary program may be equally beneficial. When employing this approach, it could be argued that a team-based collaborative approach – as opposed to a single content expert developing each course – might be much more effective Figure 1.

As depicted in Figure 1, it might be useful for team members to be mindful of two major considerations that drive course design, which is the basic building block of any curriculum: (a) *constructive alignment* amongst programs outcomes, course learning objectives, constructs presented in the course, activities in which students are asked to participate, and graded assignments by which students' learning will be assessed; and (b) *common institutional policies* that ensure uniform practices are employed not just throughout the flow of each course, but also across all courses within the program of study. The first consideration is represented by the vertical alignment in Figure 1, whereas the second consideration is represented by the horizontal alignment in the same figure. While the horizontal alignment – which involves the formulation and application of various processes, policies, and best practices that are common to all courses being delivered as part of the curriculum flow (such as policies governing academic integrity, accessibility, student support, and grading) – is definitely an important consideration, the focus of this paper is on establishing the vertical alignment.

The initial step in ensuring such vertical alignment is to ascertain that each course in the curriculum has learning objectives that align with specific program outcome(s) or accreditation standards, if relevant. The second step is to make sure that each content element (construct) presented in the course aligns with specific learning objective(s) stated for the course. The third step involves making sure that each activity students are asked to do aligns with and supports specific course content (constructs.) Finally, the last step is to ensure that each graded assignment for the course aligns with and assesses specific course objective(s) [34,50,51].

When creating vertical alignment, it might be helpful for the team to employ certain tools to facilitate this process, so that members can collectively advance their thinking in a systematic and organized manner. For example, the team may use an alignment matrix, such as the one depicted in Figure 2 to ensure that each learning objectives for each course maps over to specific program outcomes and – just as importantly – all program outcomes are covered by at least one learning objective in any given course Figure 2.

After aligning course learning objectives with program outcomes, the team may use another matrix, similar to the one depicted in Figure 3, to map constructs, activities, and graded assignments in each course to the learning objectives developed for that course – to ensure that all learning objectives are effectively covered with what students are asked to learn, do, and be assessed in that course. By approaching vertical alignment in this manner, the team can develop a level of collective understanding that allows each member to evaluate whether or not program outcomes can be met realistically through the courses offered in the program Figure 3.

Once this vertical alignment is established for each course, then the team should look at the way the entire curriculum flows

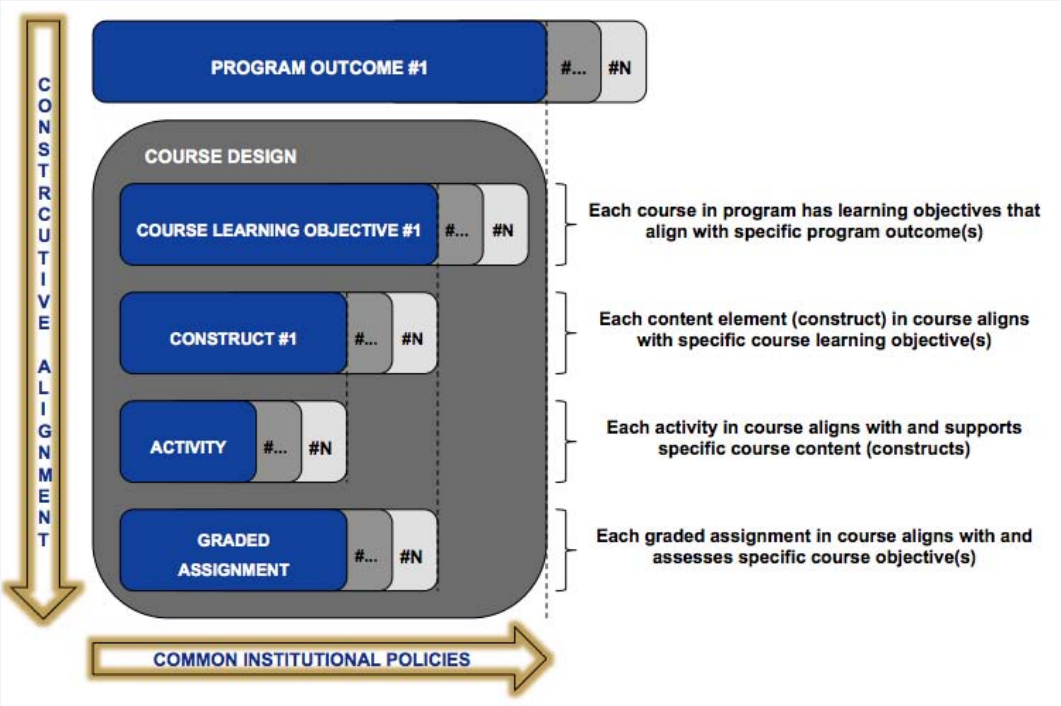

Figure 1 Employing constructive alignment in course design.

		PROGRAM OUTCOMES		
COURSES		Outcome 1	Outcome #	Outcome N
Course 1				
	Learning Objective 1	X		X
	Learning Objective #		X	
	Learning Objective N	X		
Course #				
Course N				

Figure 2 Mapping course learning objectives to program outcomes.

– one course at a time – to determine how each course builds upon the student experience created up until that point in time and its unique contributions, as students move into and out of each course along the program of study. Rather than random conversations through which this exploration could take place, it might be more effective for the team to employ a systematic approach to carry out this effort.

Figure 4 depicts a framework that might allow the team to effectively identify synergies across the curriculum - comparing a pair of courses at a time – by looking for complementary components from each course that emphasize or co-develop similar skills in students that help achieve the same program outcomes Figure 4.

The process described, though depicted in a linear stepwise process is actually more cyclical and iterative than one might initially perceive. It depends on a fundamental approach toward knowledge sharing and can lead to group cognition about the *gestalt* of a program and what it is attempting to achieve in its execution. The process also depends on continual discourse and rearrangement based on changes in content, context and also institutional and climate demands. It therefore provides for faculty, students, and staff two main outlets for growth and

	COURSE LEARNING OBJECTIVES		
	Objective 1	Objective #	Objective N
CONSTRUCTS			
Construct 1		X	
Construct #	X		X
Construct N		X	X
ACTIVITIES			
Activity 1	X		X
Activity #		X	
Activity N	X		
GRADED ASSIGNMENTS			
Assignment 1	X		
Assignment #		X	
Assignment N	X	X	X

Figure 3 Mapping constructs, activities, and graded assignments to learning objectives.

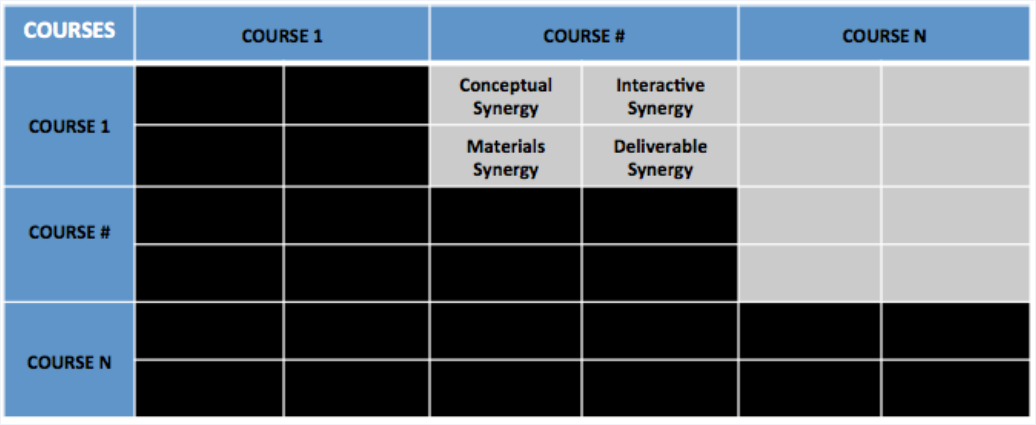

Figure 4 Identifying synergies across courses.

collaboration. First, the process flow establishes an ongoing discourse on the interactive nature of course content within a program of study, which ensures that course material remain relevant and cross-disciplinary. Second, the process tests and engenders transformational leadership amongst instructors, thus encouraging collaboration and discouraging unidisciplinary engagements for students based on course boundaries.

The potential role of transformational leadership in creating alignment

The potential role transformational leadership could play in enabling and facilitating the alignment process outlined above is promising. In describing the transactional – transformational leadership paradigm, Bass states that the paradigm "views leadership as either a matter of contingent reinforcement of followers by a transactional leader or *the moving of followers beyond their self-interests for the good of the group, organization, or society* by a transformational leader" [2]. Furthermore, Bass emphasizes that superior outcomes occur when – under this leadership paradigm – followers broaden and elevate their interest, developing awareness and acceptance of the purpose and mission of the collective [47].

Based on several decades of empirical research, the distinction between transformational and transactional leadership style has been found to be valid [52]. What distinguishes transformational leadership from transactional leadership - which may be described

as "using a carrot or a stick" [2] to motivate followers to attain prescribed goals - is that transformational leadership allows group members to: (a) expand their vision and involvement; (b) develop a strong awareness regarding the mission of the group; (c) think beyond their self-interests [2]. Furthermore, under the guidance of transformational leadership, group members seek ways to: (a) set collective goals; (b) collaborate to solve problems; and (c) remain accountable for achieving shared objectives [53].

There are several empirical studies that suggest the effectiveness of transformational leadership in enabling better student outcomes in K-12 schools [54-56]. However, the investigation of transformational leadership, as it pertains to curriculum development is somewhat limited [54] especially in higher education. Perhaps, this is not surprising, given that curriculum development (or revision) is generally carried out by content experts who mainly work in isolation on their own courses – with limited collaboration taking place across the entire spectrum of the curriculum.

CONCLUSION

The discussion presented up to this point in the narrative suggests the possibility that a different leadership model might be required in curriculum design, whereby the transactional model of individual experts governed by a single leader is replaced by a team model governed by transformational leadership, in which *the vision, mission, objectives, and ultimately accountability are all shared*. Perhaps through this type of transformation, individuals engaged in the process feel responsible for not only representing (and for being accountable for) their own domains of expertise, but for elevating the overall status of the entire program of which they are part, through the improvement of the learning experience created for students. Most importantly, any transdisciplinary curriculum should help create a learning environment in which students can successfully solve complex issues that are not necessarily defined by disciplinary boundaries, but are situated in a connected web of experiences that pulls from multiple disciplines.

By collectively accepting that the devil might indeed be in the *(mis)alignment*, those working on curriculum development (or revision) may move away from being overly obsessed with *the details of their own domains of expertise* to show greater interest in one another's domains. Such collaborative efforts are likely to produce courses that are not only far superior to what each member could have possible produced on their own, but also flow much better across the intended program of study. Most importantly, the collaborative spirit in which the curriculum was constructed has the potential to create a much more enjoyable and rewarding learning experience for students, as well as a gratifying teaching experience for instructors. Employing a transformative model that is designed to achieve alignment has the potential to not just transform each course for the better, but to also lead to the personal transformation of faculty and students.

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