The Integrative Continuum: Thinking About Interdisciplinary Integration On a Sliding Scale

This article will probe deeper into the concepts, ideas, and examples associated with interdisciplinary integration. We will answer the following questions:

- How might interdisciplinary integration be conceptualized as a continuous variable?

- What are the various levels of integrative / interdisciplinary interactions?

- What is likely to happen at each level?

An important point to remember as you are reading this article is that there are various ways to conceptualize the nature and extent of interdisciplinary integration, but these efforts all share one common characteristic:

The whole is greater than the sum of the individual parts.

Well-structured integrative approaches always lead to solutions not possible through the application of just one disciplinary perspective. As you think about the various levels of integration presented here, be sure to consider your own academic or applied experiences and how those experiences may be classified in terms the level of integration achieved.

The Integrative Continuum

Interdisciplinary Integration as a *Continuous Variable*

Now that we have explored the basic concepts associated with interdisciplinarity, it is important to consider that it's not always appropriate to "label" a specific initiative or approach as "very integrative" or "not very integrative."

It may be helpful to consider integration as a continuous variable – with an opportunity to move along the continuum to the ideal point, given the vision, goals, and constraints of your project, initiative, or end goal in mind.

It's also important to consider at this point that an integrative approach is not just associated with effectively structuring and implementing team projects. Effective integrative efforts and interdisciplinary work has the potential to change the very structure of disciplines themselves – and the very nature of knowledge and learning as you will explore further in another course reading.

In order to gain some additional insight into the power of an integrative approach, let's imagine an "integrative continuum" along which interdisciplinary activities happen. We'll explore five levels along this continuum, using examples from both industry and academia, and moving from little or no integration toward highly integrative initiatives.

Level One – No Interdisciplinary Integration

Level One – Separate Disciplinary Contributions Addressing an External Imperative

Group interactions between multiple disciplines that address only external imperatives could be considered basically multidisciplinary in nature. The notion of one final product with multiple parallel and/or serial disciplinary contributions and no meaningful interaction between contributors is a multidisciplinary approach.

This approach is low on the interdisciplinary integration continuum. Adopting this model implies an external imperative or project that does not require a team-based approach, or possibly a lack of understanding or skill in terms of facilitating a more integrated effort.

Following would be some examples of "level one" interdisciplinarity:

- A mechanical engineer and an artist working on separate aspects of the same project.

- Nurses, doctors, assistants, address hospital patient needs individually.

- Computer programmers working on individual subroutines without understanding the overall application being developed.

- A media buyer and copywriter working on different aspects of the same advertising campaign.

No attempt at integration is made, therefore "level 1" can't really be considered an interdisciplinary approach. It is, however, a very common approach in industry and can also be seen in academia in a number of general education types of courses (such as American Civilization).

Level Two – Developing Awareness

Level Two – Awareness of Potential Opportunity

Understanding interdisciplinary integration opportunities begins with an individual's realization that different disciplinary tools or insights might be helpful in the pursuit of worthwhile goals. This is the start of integrative thinking at the individual level (versus the group level). One begins to ask questions such as:

- What kinds of tools, methods, or techniques have been developed in other disciplinary domains that might help me in pursuit of my own goals? (We will be diving deep into this when we explore some of the mental models / tools a little later in the course.)

- What similar, complementary, or analogous ideas might other disciplinary domains provide that would help me with respect to

enhancing my own expertise and achieving my own learning goals more effectively? (We will also be diving deep into this question when we cover integrative process tools, such as analogical reasoning, a little later in the course.)

- What contrary or conflicting ideas might other disciplinary domains provide that would help me expand my perceptions or change my perspective with respect to my own knowledge?

Taking notice of the perspectives and resources associated with other disciplines is the first step at integrative thinking. *Cross disciplinary* thinking falls within this level, which is the next step up on the interdisciplinary continuum. Following are some examples of "level two" interdisciplinarity:

- Using the internet (initially developed for government / medical disciplines) to sell goods and services → *Using tools originally developed for one disciplinary domain to help in pursuit of other goals.*

- A sales manager reading some psychology / motivation research and considering what that might mean in terms developing strategies for improving salesperson performance → *Recognizing and examining theories and models of another discipline – without necessarily changing or modifying your own thinking or behaviors within the context of your own discipline.*

- A student learns about Prochaska's Stages of Change Model (associated with addiction recovery) in a counseling psychology course, and sees some possible connections between the model and developing better study habits → *Recognizing and examining theories and models in one domain – without necessarily changing or modifying your own thinking or behaviors within the context of your own life.*

- Noticing over the course of your studies that in Economics, human beings are considered autonomous, rational, self-interested – but in Sociology, human beings are considered to be shaped and controlled by social forces → *Recognizing and examining conflicts between the assumptions and perspectives of two different disciplines.*

Level Three – Changing Your Thinking / Behaviors as a Result of Contact with Other Disciplinary Perspectives

Level Three – Modifying Disciplinary Thinking as a Result of Interaction with Another Discipline

Level three is the next step up on the interdisciplinary continuum, and it's where the tangible benefits of interdisciplinarity really begin to emerge. It's important to understand that this level can be achieved in a number of different ways; interdisciplinarity at this level happens in practice as well as in theory. The result is a change in the ways of thinking and behaving with respect to the disciplinary expertise, knowledge, or practice in question.

Each of the following examples represents a level three interaction:

- A mechanical engineer develops new design techniques for the development of submarine hydraulic systems based on his interaction with acoustics experts and submarine logistics / maintenance experts – resulting in the development of quieter, more streamlined, and easier maintained / serviced hydraulic assemblies. → *Working collaboratively on a project which required developing one or more of the participating disciplinary contributions for the project's successful completion. One discipline (or area of expertise) provides challenges to another.*

- A counseling therapist researches gerontological data regarding cognitive differences between people of different age cohorts, and modifies her counseling techniques for old-age clients.
  → *Borrowing concepts, ideas, theories, models of one discipline in order to advance another discipline / practice.*

- Revisiting a historical thesis regarding some feature of Greek culture on the grounds of botanical, mineralogical, or linguistic evidence. (Advancement of a discipline through revising previously held hypotheses in light of new data from another discipline) → *Borrowing*

concepts, ideas, theories, and models of one discipline in order to advance another discipline.

- Charles Darwin borrowed the concept of artificial selection from plant biology in the development of a theory of natural selection and human evolution (analogical reasoning) → *Borrowing concepts, ideas, theories, models of one discipline in order to advance another discipline.*

- Extending an example from Level Two interactions discussion above, suppose the student learns about Prochaska's Stages of Change Model (associated with addiction recovery) in a counseling psychology course, begins to adapt the model in ways that suggest strategies to help her improve her study habits, and starts employing these strategies → *Borrowing concepts, ideas, theories, models of one discipline in order to develop new skills in another area of life.*

Level Four – Moving Toward Unity of Knowledge

Level Four – Building at the Interface of Two or More Disciplines

Level four is high on the continuum of interdisciplinarity. The goal here is to develop a common "picture" or "understanding" around certain issues through integrative group processes and cross-pollination. The formation of "interdisciplines" in response to technological breakthroughs and other driving forces would also be at this level on the interdisciplinary continuum. Both theoretical and applied advancements in our collective knowledge, as well as many scientific breakthroughs happen at this level. In many cases, the result is an actual change in the nature of an academic discipline – and a change in what gets taught in terms of the concepts and theories of that discipline.

Each of the following examples represents a level four interaction:

- Sharing concepts and ideas associated with medicine, physiology, psychology, and spirituality as a means of addressing a "whole person" approach to health and happiness – the development of integrated approaches to healthcare. → *Developing a common "picture" or "understanding" around certain issues through integrative group processes and cross-pollination. Disciplinary contributors all begin to see the strengths of their own unique disciplinary perspectives, as well as specific opportunities for collaboration and unification of knowledge around an end goal.*

- The Manhattan Project creating the first atom bomb not only required a high level of interaction between team members with different types of expertise, the project also required major theoretical and applied developments in physics and chemistry. → *Working collaboratively on a project which requires theoretical and applied developments within one or more of the participating disciplines for the project's successful completion.*

- Mechanical engineers, computer scientists, and cognitive psychologists working together to develop intelligent machines / robots – Artificial Intelligence. → *Not only can each expert within their respective disciplines enhance their own expertise in light of contributions of the other disciplines, but the development of a common "picture" or "understanding" around clearly defined goals, and effective integrative group processes / cross-pollination can potentially give birth to a new "interdiscipline" and innovation within the each of the represented disciplines.*

- The emergence of fields such as environmental engineering, ocean engineering, biophysics, psycholinguistics, educational psychology, and genetics represents significant collaboration and integration between disciplines. → *The formation of "interdisciplines" in response to technological breakthroughs and other driving forces.*

Level Five – Shared Vision / Unity of Knowledge

Level Five – Connecting, Blending, And Unifying Different Disciplines – *Shared Vision*

Level five could be considered at the top of the continuum of interdisciplinarity. It may be somewhat difficult to differentiate between Level 4 and Level 5 interdisciplinary interactions – both are at the extreme high end of the continuum. One possible way to view the difference would be that, while Level 4 interactions are primarily driven by technological advancements and other external forces, Level 5 interactions bring various disciplines together around a shared vision – the desire to develop our collective knowledge in the most effective and efficient manner.

Level 5 interactions are concerned with discovering interrelationships between entities examined by one discipline and entities examined by another – and seeking to unify that knowledge.

Level 5 is also where the "big questions" about the overall nature and structure of knowledge happens – mapping out common ground and connections between disparate disciplines. You'll learn more about this in the next reading (the integration narrative).

Level 4 and Level 5 both share significant opportunities for advancements in our collective knowledge and the opportunity to achieve important scientific breakthroughs across disciplines.

Each of the following examples represents a level five interaction:

- The re-conceptualization of genes as parts of chromosomes, thus uniting genetics and molecular biology. → *Discovering interrelationships between entities examined by one discipline and entities examined by another and seeking to unify that knowledge through a common cause.*

- Understanding human behavior – unites disciplines such as cognitive psychology, neuroscience, sociology/social psychology, education/life-span development, developmental physiology/psychology, and cultural anthropology. → *Exploring interrelationships between entities examined by one discipline and entities examined by another in an attempt to build a more inclusive understanding - seeking to unify diverse domains of knowledge through a common cause.*

Comparison - Levels Three / Four / Five

LEVEL THREE	LEVEL FOUR	LEVEL FIVE
Modifying Ones Disciplinary Thinking as a Result of Interactions with Another Discipline	**Building at the Interface of Two or More Disciplines**	**Connecting, Blending, and Unifying Different Disciplines –** *Shared Vision*
Project-based collaboration requiring the development of one or more of the participating disciplinary contributions for the project's successful completion.	Developing a common "picture" or "understanding" around certain issues - collaboration and unification of knowledge around a compelling end goal.	Exploring interrelationships between entities examined by one discipline and entities examined by another in an attempt to build a more inclusive understanding.
Borrowing concepts, ideas, theories, and/or models of one discipline in order to advance another discipline.	The formation of "interdisciplines" in response to technological breakthroughs and other driving forces.	Interdisciplinary interactions seeking to unify diverse domains of knowledge through a common cause.