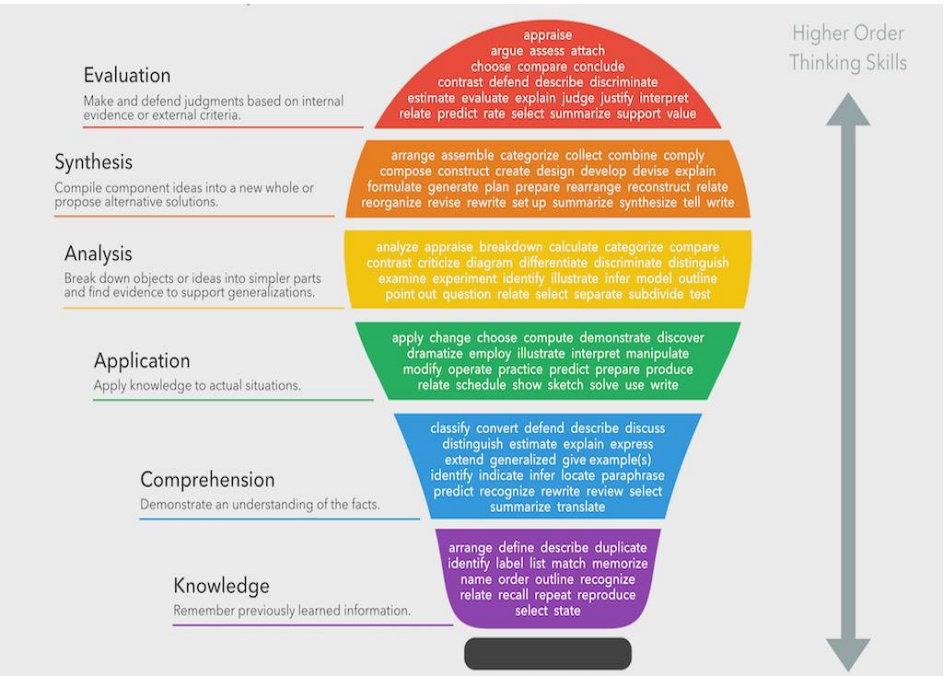
What Is Integration, and Why Is It So Important?



With respect to integrative learning, one might look to **[Bloom's Taxonomy]** of learning in the cognitive domain, which classifies six levels of thinking, from lower skills to higher order skills.

From and integrative learning perspective, we could define the *process of integration* (or synthesis, which can be considered a synonym for our purposes) as *"approaches used to combine ideas, perspectives, and knowledge from disparate fields in order to envision more complex and creative solutions to complex issues."*

It's easy to see why the old cliché *"the whole is greater than the sum of the individual parts"* is a fitting metaphor for integration.

Integration is more than just the "adding up" of various insights, ideas, or perspectives from diverse sources. Strictly speaking, adding various insights is more akin to a *multidisciplinary* endeavor. Alternatively, integration implies that the end result is something more, a more complex and innovative discovery or revelation, and one that yields insights that couldn't have been arrived at without the blending of disparate disciplinary insights.

As you proceed in this course, you'll have an opportunity to experience many ideas that are the result of integrative thinking. You'll also learn how

central concepts (from a wide range of disciplines) can be applied across a number of different contexts to yield new insights, innovations, and solutions to vexing problems. You'll also be given some tools that will allow you to replicate this integrative process in your own life to make better decisions, learn more effectively, and work more productively with others.

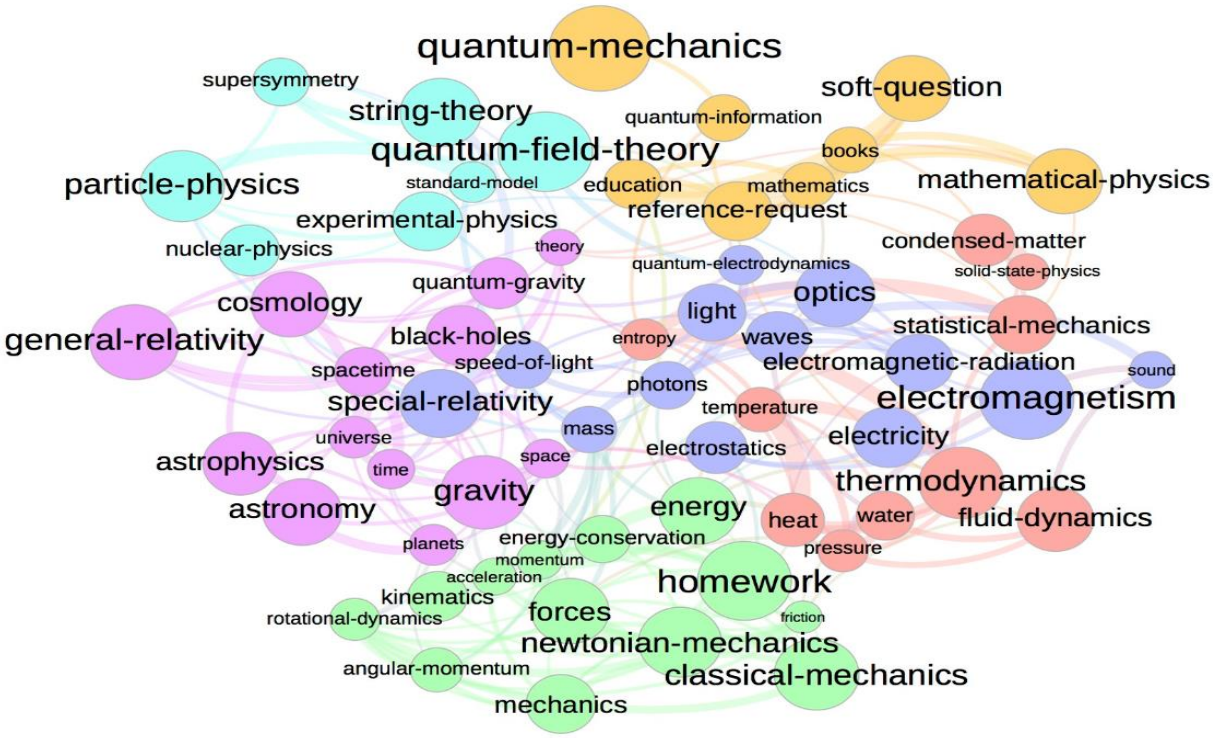
Taking a deeper dive into the idea of integration, let's explore a few different ways in which interdisciplinary scholars conceptualize integrative processes:

Integration Approach 1: Integration to Develop Overarching Conceptual Frameworks

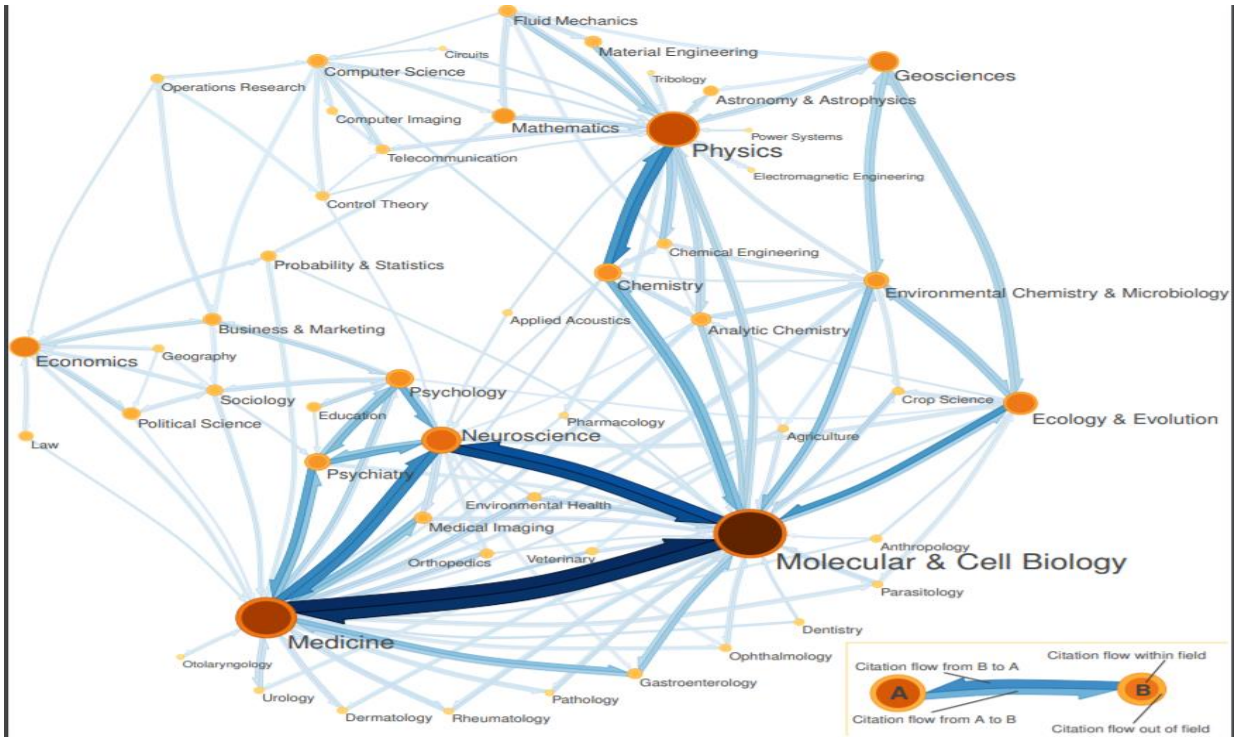
Integrative efforts, at their highest level, seek to find "common ground" among a broad array of disciplines. A map analogy may be useful here. Picture a map of the United States in your head. Locate Los Angeles on that map. Now locate New York. If you were to describe to someone how to get from Los Angeles to New York on your mental map, what would you say? Probably something like, "Move to the right (east) a good distance, and then up a bit (north)." Does that sound about right? Probably so – we share that common model. OK, how about if I asked you to think about Psychology, and to place that on your "cognitive map." Now thing about Physics, and place that on your cognitive map. If I were to ask you to describe to someone how to get from Psychology to Physics, what would you say? That's a much more difficult question, isn't it? It might start with a cross-disciplinary question like, "What kind of knowledge might the *psychology of physics* (or the physics of psychology) represent?"

While this may sound a bit esoteric, I assure you that it isn't – and there are quite a few people working hard to ferret out the many and varied "connections" between academic disciplines as a means of discovering new, more complex, ideas and associations that could lead to great insights and innovations. These people are working to develop *overarching conceptual frameworks of knowledge*. Are you interested to learn more?

As you might imagine, mapping out integrative connections between concepts *within* a discipline is a much more straight-forward task than trying to map integrative connections *between* disciplines. Mapping connections within Physics, for example, might yield something like this:



Pretty interesting, right? Now if we step back a little further to gain a broader perspective, and try to get a sense of what the overall knowledge



map of the sciences as a whole might look like, we might see something like this:
Wow! Pretty mind blowing! You can begin to see how the social and natural sciences are coming together. The map was creating using an *information flow* approach to mapping large networks. The colors and thickness of the connections is a function of the research journal articles that were referenced by scholars and researchers searching across various disciplines. For example, you can see that a lot of folks who are doing research in medicine are checking out research in the field of molecular & cell biology – which makes a lot of sense.

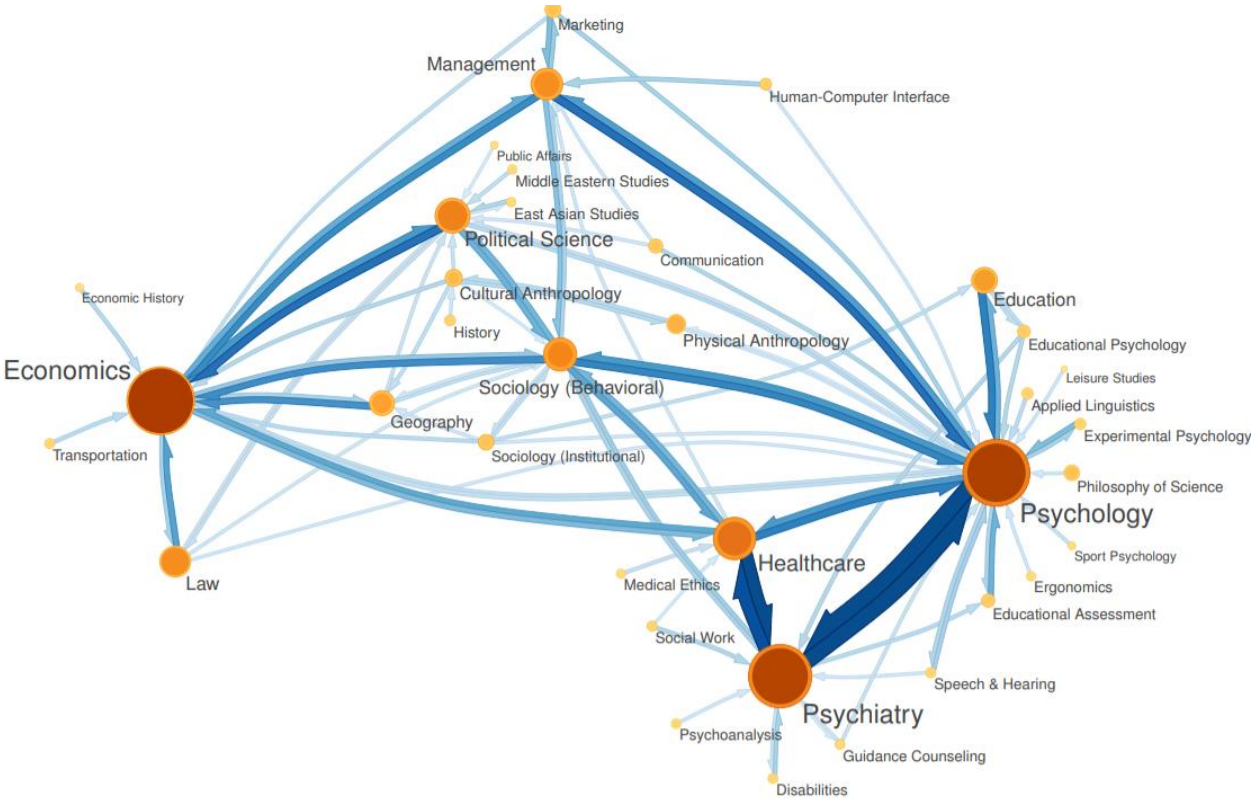
So, back to our *psychology of physics* example. On the map above, both psychology and physics are on there, but it doesn't look like there are any direct connections between the two (yet). It looks like psychology and physics are connected through neuroscience – and that connection makes sense if you think about it. And if you were looking into ideas associated with the *psychology of physics*, the neuroscience literature might be a good place to start! Are you beginning to see how integration through the development of overarching conceptual frameworks could be useful to knowledge production?

Before we go any further with our exploration of the *psychology of physics*, let's take a moment to dive deep into the terrain of knowledge maps. To learn more about connections between disciplines, click **HERE**. (http://www.eigenfactor.org/map/maps.php)

In the site referenced above, scroll down and read through that entire page carefully, and you will notice some incredible examples of integration at the highest levels. When you're finished, continue on reading here…

Was that amazing? Let me take a moment to walk you through it again, with some commentary along the way…

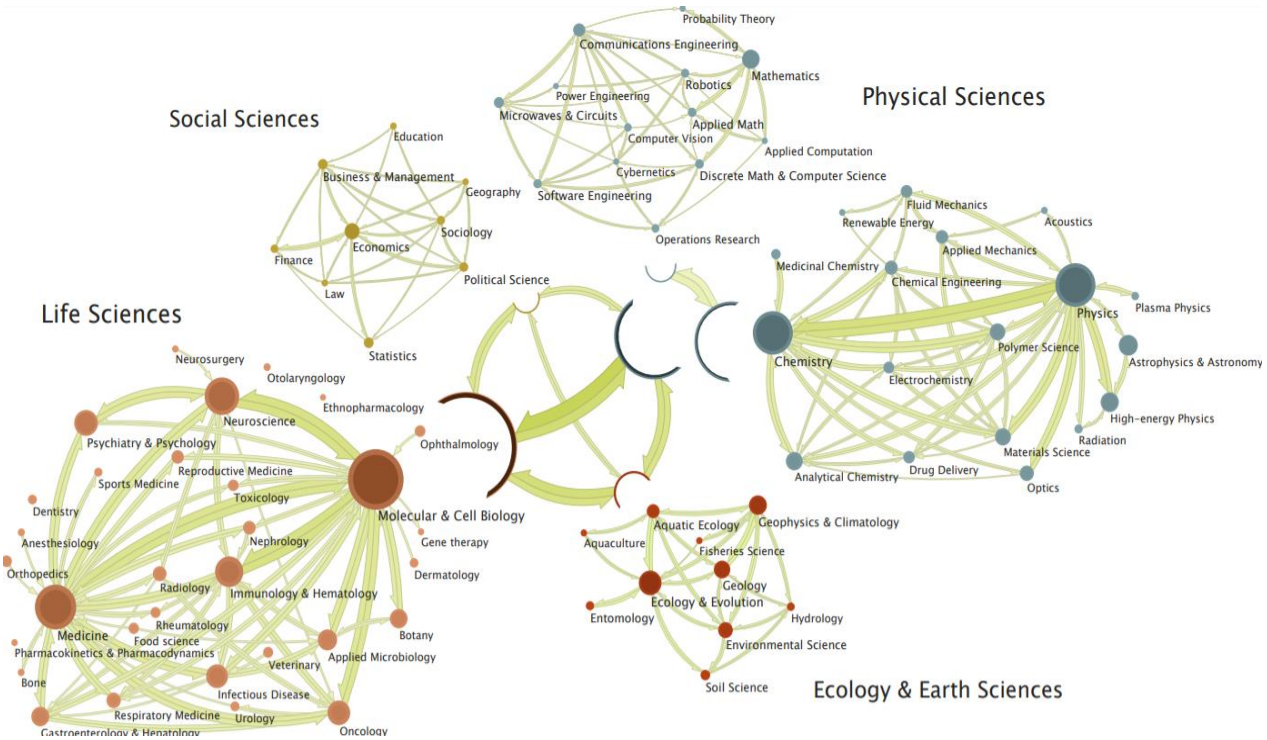
The next knowledge map you came to after the sciences knowledge map was the social sciences knowledge map:



Here we see psychology, along with a number of other disciplines, from psychiatry to economics. What's interesting is that there is an emerging field called "behavioral economics" that can't really be identified on that map – *yet* – but it would be there if the above knowledge map was current. In fact, when we get deeper into the course (when we cover cognitive biases), we will be drawing heavily on the behavioral economics literature!

Continuing to scroll down in the page yields a knowledge map of computer science, then a knowledge map of medicine. And then, **jackpot!** We come to a *hierarchical map of the natural and social sciences*.

At this highest level, knowledge splits into four separate domains: the life sciences, the social sciences, the earth sciences, and the physical sciences. The physical sciences are further subdivided into a chemistry and physics cluster, and a mathematics and engineering cluster. Each domain or cluster is yet further subdivided in fields, indicated by the colored discs. Remember your investigation is academic disciplines and how knowledge is organized in the university? You should see a strong connection / similarity there. That should come as no surprise – we are looking at the terrain of knowledge!



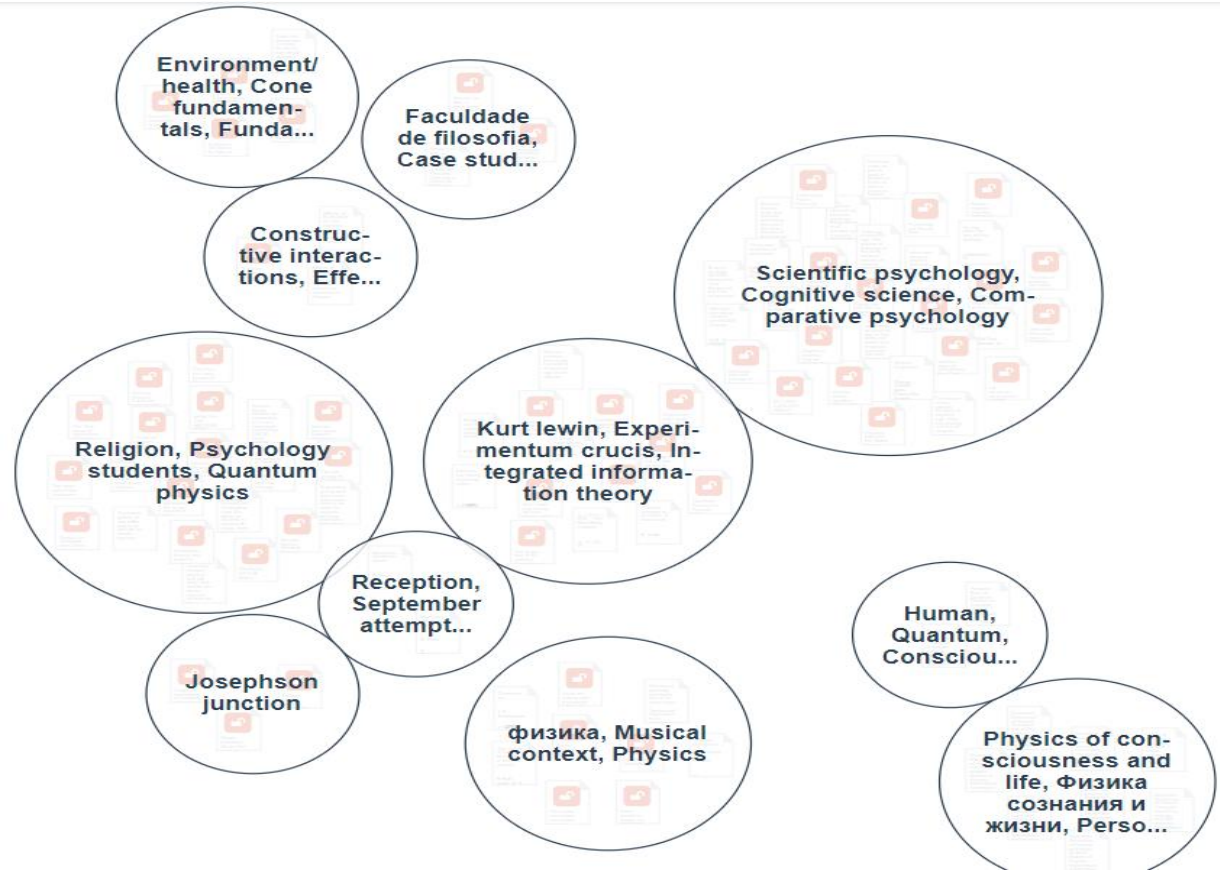
Wow! What you are looking at here is a wide angle view of the *world map of knowledge*. Revel in its magnificence, but we're not done with this website yet. There's one more fascinating bit of information still to digest.

Scrolling a little further down, you will witness the birth of an *interdiscipline!* The field of *neuroeconomics* didn't exist in 1997 (in fact my Microsoft Word spell checker still doesn't recognize the word), but as you can see, by 2010, there were some deep connections forming between the disciplines of economics and neuroscience. And indeed, in 2018, behavioral economics and neuroeconomics have resulted in some incredible new knowledge about cognitive biases and decision-making, and a deeper and more complex set of ideas about economies (on the micro and macro scale), major enhancements to decision theory, investment analysis, and associated public policy implications than could have ever been imagined by either of those discrete fields in isolation!
(By the way, you can also play around with making your own knowledge maps by going to mapequation.org.)

Alright, let's take a look at another approach to knowledge mapping as it relates to our original example, the *psychology of physics*. There's another organization seeking to revolutionize discovery of scientific knowledge

through the development of a visual interface that dramatically increases the visibility of research findings across disciplines. You can learn more about them **HERE**. (https://openknowledgemaps.org/about)

Using Open Knowledge Map's **search feature**, I was able to create a knowledge map for the *psychology of physics* (just by typing "psychology of physics" into the search window). Here's what it came up with:

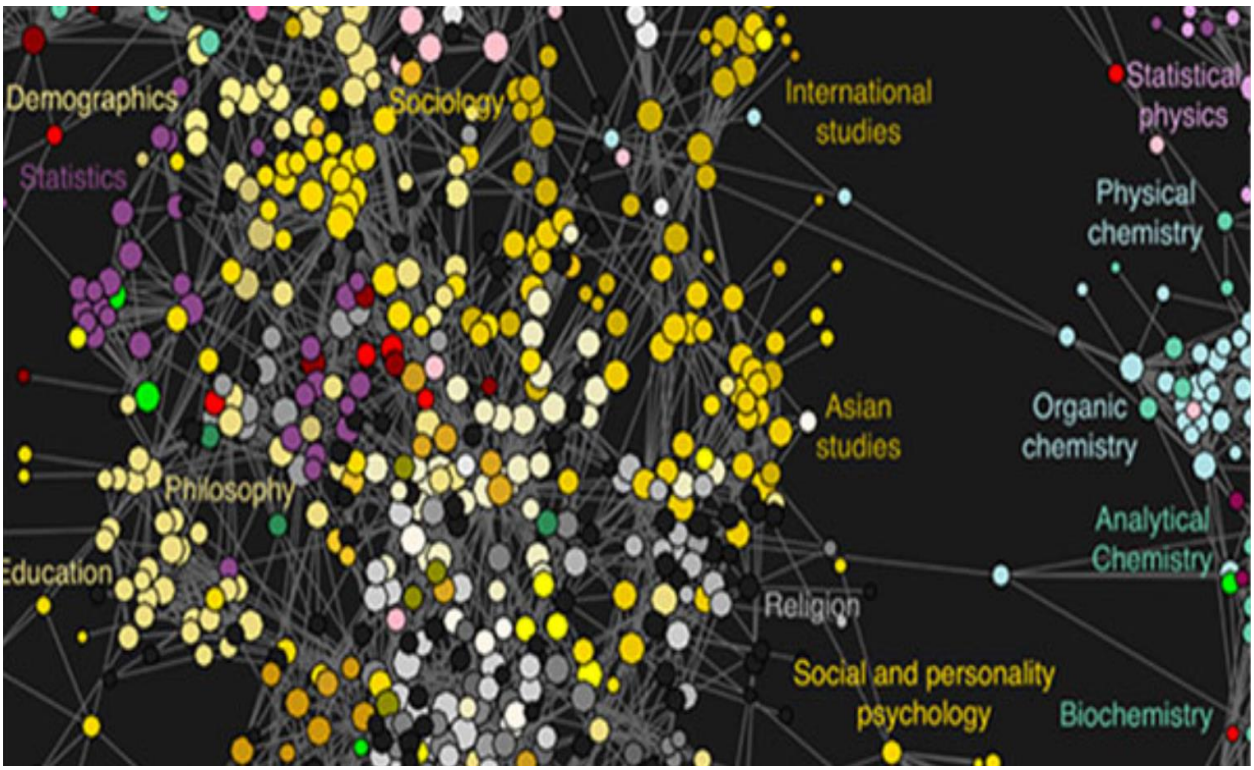


You can check it out in more detail **HERE**. When you click on that link, you can see that each of the circles above can be zoomed in on, and consist of links to research publications in the various domains indicated. This would be a good place to start if we were serious about integrating ideas across disciplines to come up with a sense of the *psychology of physics*. Isn't that amazing? We may be on the verge of developing our own interdiscipline right here, right now – all thanks to an approach to integration that involves *developing overarching conceptual frameworks*!

Alright, I have one more resource to share with you before we move on to other avenues of integration. For this I'll bring you back to the idea of a

"world map" of knowledge. Read this brief New York Times article – **[The Map of Knowledge](https://www.nytimes.com/2009/03/16/science/16visuals.html)** (https://www.nytimes.com/2009/03/16/science/16visuals.html)

As you can see, this map encompasses both the sciences *and* the humanities, and (in its entirety) it might be the most thorough representation of the integrated nature of knowledge that is currently available.



Integration Approach 2: Integration associated with "Tearing Down the Walls" of Traditional Academic Disciplines

Another approach to integration is one that could change the very foundation and structure of higher education. Proponents of a more integrated curriculum are looking into ways in which higher education could build a more integrative curriculum across majors, and in doing so, eliminate (or seriously revamp) many academic majors as we know them.

This means that when your children go to college, they could be in for an *entirely* different experience that the one you are having! Take a moment

now to read the following two readings from the Chronicle of Higher Education (if you have yet to do so):

- *It's Time to End College Majors as We Know Them - The Chronicle of Higher Education* (PDF) Click **HERE**

- *Should Colleges Let Ailing Majors Die or Revamp Them_ - The Chronicle of Higher Education* (PDF) Click **HERE**

Some interesting visions for the future of higher education, right? It's easy to see the connection between the content in the last module about transferrable skills and the contemporary workplace, and what we are talking about now. The integrative challenge is how to get there.

Selingo talks about the need for academic institutions to create "T-shaped" learning experiences for students - where vertical bar of the "T" represents deep understanding of one subject (the current conception of the major). But just as critical is the horizontal stroke, which allows people to work across a variety of complex subject areas with ease and confidence.

Another learning model is "humanics," which blends technical, social, and data skills, and in the process develops "higher-order mental skills" like critical thinking, systems thinking, entrepreneurship, and cultural agility, enabling people to easily toggle among various jobs and tasks.

Embedding these kinds of integrative connections and changes into the landscape of higher education is no easy task. The question that institutions of higher learning are grappling with is, *"How do we most effectively **integrate** the development of a broad array of skills into various college majors – or redesign majors completely – in degree programs that are not only already established, but difficult to change?"*

Accepting radical change isn't generally something that college faculty and administrators are keen on. Even at Arizona State University, when President Crow introduced his plan for the New American University, there was a lot of push-back. Fortunately, his vision and leadership prevailed, and the results are now being seen – with **ASU ranked the most innovative university** in the country in recent years.

As you read, another university (University of Illinois) has been updating and reinvigorating a number of traditional majors by combining them with computer science. These new "CS-plus" majors are housed not in computer science or the College of Engineering, but rather in the partnering departments – which helps a little with faculty resistance, but it's still a difficult transition to make, and time will tell how effective this approach will be.

In many cases it comes down to the culture of the university, and the culture of the individual colleges and schools within the university. Again, ASU stands out here. Take a close look at President Crow's vision for the New American University by clicking **HERE**. Explore the links on that page, and pay particular attention to the ***design aspirations***.

Notice that Design Aspiration 6 is to "fuse intellectual disciplines." Click **HERE** to gain a little more perspective on what that means. Here, you can really see the focal point of intellectual fusion is integration in its many forms. I'd also like you to check out the brief video trailer for President Crow's book, Designing the New American University, which you can find by clicking **HERE** (*https://vimeo.com/121802968*).

By this point, I hope you are beginning to understand how intellectual fusion, integration, and interdisciplinarity are all interrelated concepts. I hope you are also beginning to see how deep and layered the idea of "integration" can be.

Integration Approach 3: Intrapersonal Integration

As you read in the previous approach to integration, from an educational perspective, there is a concern that many institutions of higher learning focus primarily on developing students to become experts in specific disciplines. This leads to a curriculum that is congested with discipline-specific coursework with little room for a diversity of general education courses across different fields. Advocates of integrative learning fear that the beneficiaries of this single discipline-centric education will lack certain transferrable skills that are critical for success in the "real world."
Given this concern, what can college students (or anyone for that matter) do in order to learn how to think more integratively? What tools and techniques exist to help one become a more integrative thinker and learner? Answering these questions is the domain of the form of

integration known as "intrapersonal integration" (or the integration of ideas within your own mind), and includes:

- Connecting ideas between different domains as a means of learning more effectively (constructivist learning, problem-based learning, and learning transfer, for example)

- Employing multiple frames and perspectives (perspective-taking) as a means of developing a deeper understanding of an issue

- Fusing discrete concepts and theories across disciplines and domains by employing tools that help facilitate integration – such as analogical reasoning, abstract thinking, and theory borrowing – as a means of developing new insights, perspectives, questions, applications, and solutions to complex problems.

We will be exploring all of these ideas associated with intrapersonal integration in an upcoming module.

Side note: Conversely, the approach to integration known as *"interpersonal integration"* asks what steps can individuals take in order to most effectively collaborate with others in an integrated manner, generally as a member of a cross-functional team. I'll introduce that form of integration as *Integration Approach 4: Interpersonal Integration,* and we'll also take a deep dive into that approach later in the course.

With respect to intrapersonal integration, it's helpful to refer back to Bloom's Taxonomy here, which points out that the highest order thinking skills are those of synthesis (integration) and the ability to critically evaluate propositions across a number of different perspectives. Sadly, as we have seen, there is usually little room for teaching these skills in a single discipline-centric curriculum.

Connecting ideas between different domains as a means of learning more effectively includes the problem-based learning approach to learning more effectively. In recent years, many educational institutions have embraced the notion of *problem-based learning* – an approach to learning that focuses students on the complexities of bringing their expertise to bear on complex, multi-faceted real world problems. Medical and dental schools, in particular, tend to be big proponents of problem-based learning.

This approach is grounded in the theories of learning associated with some of the greatest educational reformers of the modern age; scholars such as John Dewey, Jean Piaget, and Lev Vygotsky, all of whom were advocates of a more experiential, constructivist, and social foundation on which all education should be grounded. In this regard, we also see the idea of transferrable skills and an appreciation for the higher order thinking skills represented in Bloom's Taxonomy.

The idea of perspective-taking also plays a prominent role in this particular conceptualization of integration. The habit of considering alternative perspectives, employing multiple approaches to framing a problem or issue, and using higher order thinking skills all contribute to one's ability to form a more comprehensive view of the reality of any situation; a broader, more holistic understanding of the question, problem, or opportunity at hand. As we get into "mental models" a little deeper in the course, you'll begin to see both the opportunities and challenges associated with perspective-taking.

With respect to the tools that help facilitate intrapersonal integration, we are talking about a teachable set of perspectives, skills, and knowledge that allow one to think more effectively, in an integrated fashion. Take a moment to watch a brief video about integrative thinking by clicking **HERE** (https://vimeo.com/203013303).

Pretty interesting, right? The tools mentioned there are only a subset of the tools you will be learning to use throughout this course. These integrative thinking skills mold the promise of helping you in many different ways – from helping you learn and remember more effectively to helping you come up with creative solutions to complex challenges you may be facing. I hope you're looking forward to learning more about them as the course progresses!

Integration Approach 4: Interpersonal Integration

The final approach to integration that we will consider in this course is interpersonal integration. This is integration associated with effective team processes, primarily in organizations. For most students bound for the professional world, this will be the kind of integration you will be experiencing most often. The video segments regarding the Boeing 777 Design-Build teams provides a window into how organizations are

realigning in order to integrate more effectively. Here we see people from very different professional backgrounds engaged in processes that help them collaborate more effectively as a means of "solving problems before they become problems" – in fact, one of the primary benefits of effective interpersonal integration is to achieve the team's desired results in the most effective and efficient manner possible. That is why many organizations are embracing the idea of interpersonal integration more enthusiastically than academic institutions!

It's interesting to note that the process of interpersonal integration *(creating an environment where people from different professional backgrounds can work effectively in an integrated fashion – Process Engineers, Manufacturing, Finance, Marketing, etc. in the case of the Boeing example)* is still something that most organizations struggle with. And that's one reason why individuals with the right mix of skills, knowledge, and interpersonal characteristics – those able to think integratively and work integratively with others – will continue to be in high demand. The remaining modules of this course are targeted to launch you on a path to achieve those objectives!

In contrasting these four broad approaches to integration, one can see significant differences in the way that the idea of integration is being conceptualized:

- Integration as an approach to draw lines between domains of knowledge in order to push the boundaries of our current knowledge base (through knowledge mapping and the evolution of interdisciplines)

- Integration as an approach to restructure the foundations of academic disciplines and create the universities of the future

- Integration as an approach to bring specific thinking skills to bear in the experiential realm in order to get to the reality of an issue, solve a problem, or come up with innovative new ideas

- And, finally, integration as an approach to collaborate more effectively with others.

Individual Characteristics associated with Effective Interdisciplinary Integration

We learned (in the last module) the kinds of skills, knowledge, and personal characteristics that are highly sought by employers in the contemporary workplace. In reviewing the literature on interdisciplinarity, we can see a powerful alignment between these two domains; The skills needed to be an effective interdisciplinarian and the skills needed to maximize your level of success in the contemporary workplace.

Following is a list of 15 skills / personal characteristics suggested by the literature on interdisciplinarity as the skills critical for those seeking to become effective interdisciplinarians – with respect to both the intrapersonal and the interpersonal domains of integration:

1. *Sense of adventure:* A desire to "cross boundaries" and explore unfamiliar terrain; An interest in exploring new ideas, cultures, and experiences.

2. *Mastery mindset:* A strong **mastery goal orientation**; less concerned about relative performance than about "rolling up the sleeves" and really learning about an issue.

3. *Effective learner:* Learns quickly and effectively. Learning how to learn is a skillset that can be developed.

4. *Ability to keep your ego in check:* Arrogance or a sense that you are "above" other people are traits that do not work well in interdisciplinary collaboration.

5. *Humility / cultural humility:* Humility in this case implies the ability to be respectful, considerate, and interested in learning more – as opposed to making assumptions about others, being a know-it-all, acting superior, and thinking one understands more than one actually does.

6. *Empathy:* **Empathy** is the experience of understanding another person's thoughts, feelings, and condition from their point of view, rather than from your own.

7. *Tolerance for ambiguity:* The desire and ability to seek out and consider a wide variety of perspectives; an understanding that knowledge is often *relative to a context* and *acquired through inquiry*.

8. *Open minded:* Being receptive to other perspectives; the ability to understand, respect and value other discipline's central assumptions, epistemological basis, and methodologies.

9. *Aspiring polymath:* An interest in learning and gaining some expertise in a number of different fields. *Interdisciplinary work requires analyzing and learning about different fields order to improve understanding and construct an integrated framework*.

10. *Interpersonal communication and team skills:* The ability to communicate effectively with others, and some skills and perspective associated with the ability to work well in a team environment.

11. *Creativity:* Skilled at employing various approaches to creative thinking – a skill that can be learned. Researchers have identified major links between creativity and integrative thinking.

12. *Abstract thinking skills / analogical reasoning skills:* Skilled at abstract thinking and the ability to reason through analogy. These are also learnable skills, many of which we will cover in this course.

13. *Dialectical thinking:* The ability to hold diverse and opposing or contrasting perspectives in your mind as a means of finding a common ground. Like dialectic, integrative process entails clarifying and resolving differences in order to produce an integrated solution to the issue at hand.

14. *Desire to collaborate:* The desire to work with others in team or project-based environments.

15. *Passion for integrative thinking:* A keen interest in developing the skill sets associated with integrative thinking and collaboration.