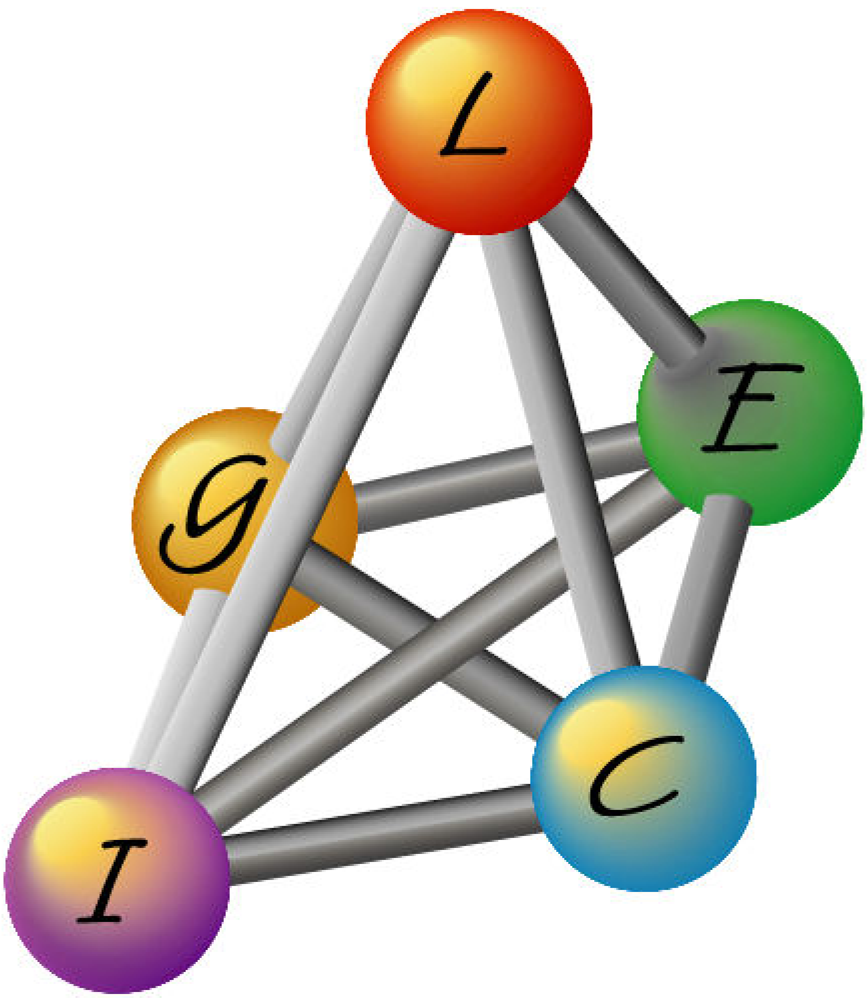
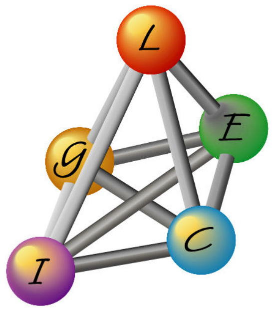
The Learning Molecule

A Brief Introduction

A new view of the learning process that illuminates both the complexity and beauty of how we learn, teach, design content, construct learning environments and establish goals.



Overview



What if we could deconstruct the learning process into discrete elements, understand their interactions, measure their impact on the larger process – and then use that information to improve outcomes?

This is the central thesis behind The Learning Molecule model for education and training.

For centuries, educating (transfer of knowledge for meaning) and training (transfer of skills for producing) has been an art, with the occasional scientific analysis into aspects of the activity.

For a time, one practitioner will focus on a single aspect of the learning process and declare it 'most essential'. One might say that Dr. Bloom's Taxonomy is focused exclusively on the Goals of learning – get *that* right and you have the most important thing. Or one might say that Gardner's Multiple Intelligences is focused exclusively on a single aspect of the learner's abilities – get *that* right and you have the most important thing. Or perhaps you subscribe to either of the dominant pedagogical models of Constructivist (as advanced by Dr. Piaget), or the well-entrenched Instructivist model still used today. Get that right and, well, you get the picture. Of course, if you are a textbook publisher, you might argue "No, it's all about the content, silly." I argue that this is a "Can't see the forest for the trees." flawed view of the system.

The Learning Molecule Model asserts that there are five aspects to the learning process and ten interactions between them all – that, if properly quantified and applied, can fully describe the process. However, it also asserts that not only are all the "atoms" relatively equal in value, but that the interactions or "bonds" between them are as important as the atoms themselves. It is a "forest view" that is built on trees, branches and leaves.

By leveraging specific and individual research into each "atom" and each "atomic bond" – compiled into a comprehensive expert system – with adaptive and granularly constructible content – then individual learning instances for individuals and groups can be optimized for both process and outcome. This is a holistic view.

The Learning Molecule is comprised of five "atoms." The "L" atom shown at the top of the molecule, represents the Learner. More specifically, it represents attributes about the learning modalities of a learner. The "G" atom represents the Goals of the learning. The "E," or Environment, atom represents the learning environment factors. "C" is the symbol for the learning Content or subject matter/domain. Finally, the "I" atom stands for the Instructional methods available to the learning process.

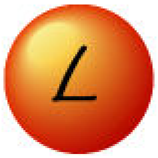
Each atom has its own taxonomy of categories and subcategories and specific factors and associates values.

Between each atom are "bonds" which define interactions between those two atoms. For example, the bond between the Instruction and Content atoms (or the CI bond) represents research into such things as "when the subject domain is 'art history' – these are the known instructional prescriptions. Or when the learner's dominant cognitive control (an aspect of their Learning style) is "field dependent" and the Goal of the learning instance is "synthesize" then the best Instructional prescription is "X".

This complex system we call learning cannot be fully described or quantified, today, with our existing knowledge, research and technologies. However, it is my sincere hope, that by creating this model and a framework for quantification, measurement of outcomes and the commensurate feedback loop – we can begin the long road to a more complete understanding, science and rigorous application for the benefit of learners of all ages, abilities, environments and goals.

The Learning Molecule "Atoms"

Learner



The "Four P's":

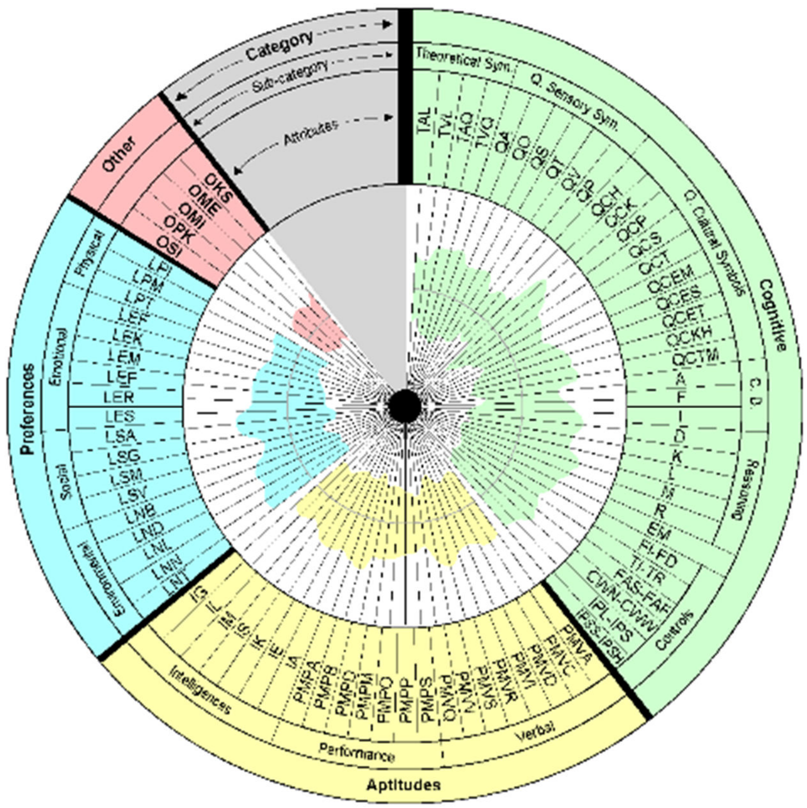
Perceptors – how a learner gathers (perceives) information about both the world around them and their inner world.

Processors – once a learner has gathered information – how they **process** it for meaning, understanding, storage and recall.

Potentials – the innate abilities of a learner in various areas.

Preferences – those "soft fuzzy" **p**references of a learner about their learning environment and process.

Every learner therefore has an aggregate of these characteristics (actually as many as 78 may be measured) that define how they best gather, process and use knowledge. Shown adjacent is a sample radar chart for all 78 characteristics:



Content

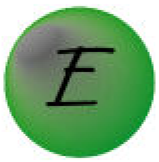
The P's and T's:

People, Places, Processes

Time, Things, naTure: Abstract/Conceptual ← Continuum → **Real/Concrete**

The major subject domains can be categorized by some combination of these P's and T's. For example: Math is about processes, time and things and its nature is Abstract, but sometimes applied to the concrete. Geography is about places, peoples, time and things and its nature is toward the Real side of the nature continuum.

Environment



Synchronous vs. Asynchronous

In vs. Out of classroom

Solitary vs Group

"Soft" factors as background music or not, etc.

Sometimes a learning environment is controllable, sometimes not. Its impact on the content and instruction can be great. Conversely, optimizing the environment for the unique needs of a learner – can be great. This atom quantifies these concerns and more.

Goal

(Bloom's taxonomy)

Intrinsic vs Extrinsic motivations

Internally vs Externally defined

Learning to **Create** (evaluation, some synthesis)
Learning to **Think** (synthesis, analysis)
Learning to **Do** (application)
Learning to **Know** (know, understand)

Much research has gone into how important it is to define the goals of any learning instance. This 'atom' quantifies not only how important a goal is – but how the goal is important.

Instruction

Structured vs. Unstructured

Instructor controlled vs. learner controlled

Abstract vs. Concrete

Deductive vs. Inductive

Much more…

There has probably been more research and study in the various methods of instruction, than any other aspect of education or training. This 'atom' stratifies and quantifies the many choices of how to instruct.

Atomic Interactions:

Each of these "atoms" represent a known body of knowledge about that aspect of the learning process. Between each "atom" are "bonds" or interactions that represent the known body of knowledge about how those two aspects of learning interact.

The ten interactions:

Ref	Interaction	Symbols
LC	**L**earner : **C**ontent (content adapted to a learner's styles)	L C
LE	**L**earner : **E**nvironment (environment adapted to a learner's styles)	L E
LI	**L**earner : **I**nstruction (instructional methods adapted to a learner's styles)	L I
LG	**L**earner : **G**oal (goals adapted to a learner's styles)	L G
CI	**C**ontent : **I**nstruction (content adapted to methods of instruction for a learner)	C I
CG	**C**ontent : **G**oals (content adapted to goals defined for a learner)	C G
CE	**C**ontent : **E**nvironment (content adapted to a learners' environment)	C E
IE	**I**nstruction : **E**nvironment (instruction adapted to a learner's environment)	I E
IG	**I**nstruction : **G**oals (instruction adapted to a learner's goals)	I G
EG	**E**nvironment : **G**oals (environment adapted to a learner's goals)	E G

These ten individual sets of interactions have literally millions of possible combinations of the different sets of characteristics.

Fortunately, there is a considerable body of knowledge about these interactions. The ERIC Clearinghouse (eric.ed.gov) holds abstracts of over a million research reports of which a substantial portion are dedicated to the CI and IE interactions. Such topics as "The optimal instructional techniques for teaching Euclidean geometry." or "How to teach Euclidean geometry in an online versus classroom environment."

The body of knowledge is not very rich for LI or LE interactions. There is some information on LC interactions.

Nevertheless, while the body of knowledge is light – it does exist. The most disappointing aspect is that what does exist is not used hardly at all because of a variety of factors which include: teacher awareness, teacher time to study and apply this knowledge, teacher motivation, access to the information and more.

Conclusion:

This briefest of overviews of The Learning Molecule is not meant to provide a sufficient explanation for the reader to go forward in the adoption of the model. However, it is my earnest hope that it catalyzes your curiosity, ignites your imagination and motivates your mind – to learn more. And, perhaps, just perhaps, you have a contribution to make to the model as well?

Please feel free to reach out to me via my website at www.JoeChiarella.com to, ahem, learn more. ☺

Respectfully,