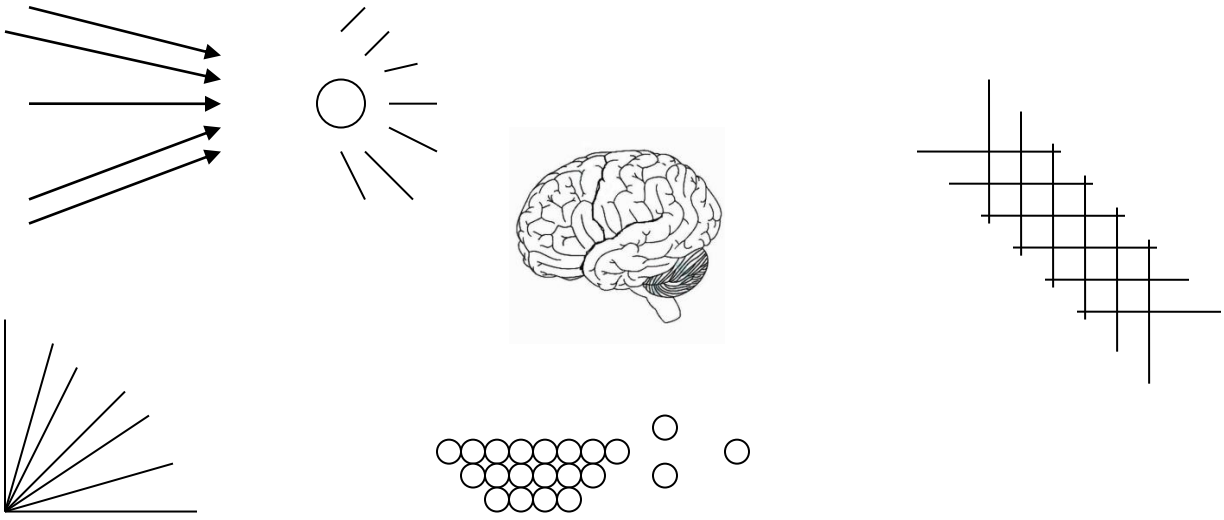
HOW TO CREATE AND EXPLORE COGNITIVE-NET

Some Tips

Some Pathways

A SECRET TO INSPIRE YOUR CREATIVITY

Altaf Qadeer Ph.D.



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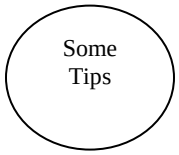

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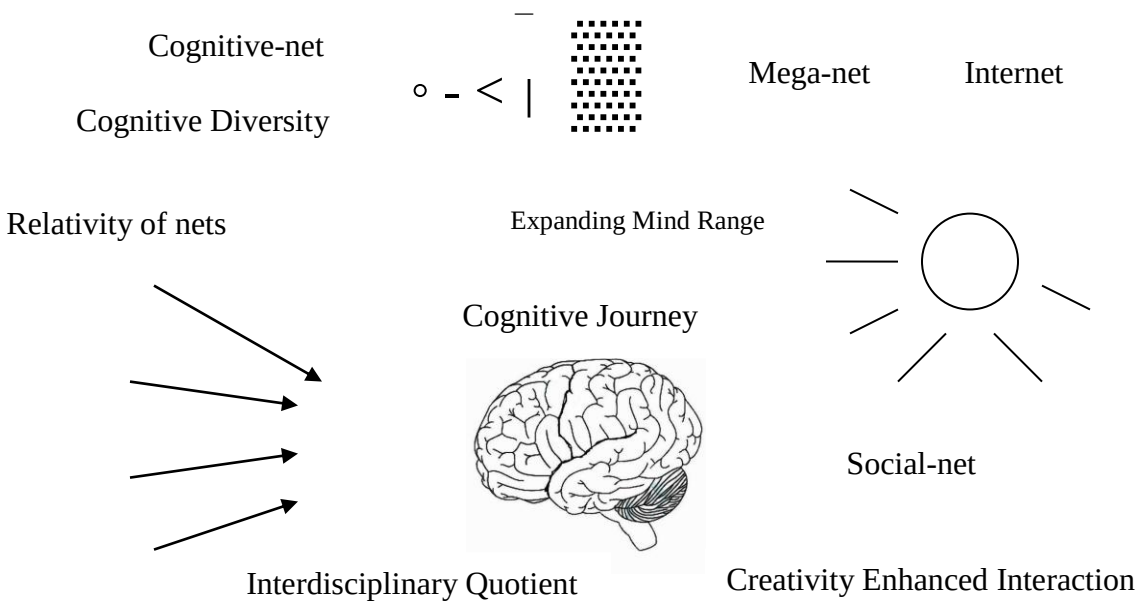
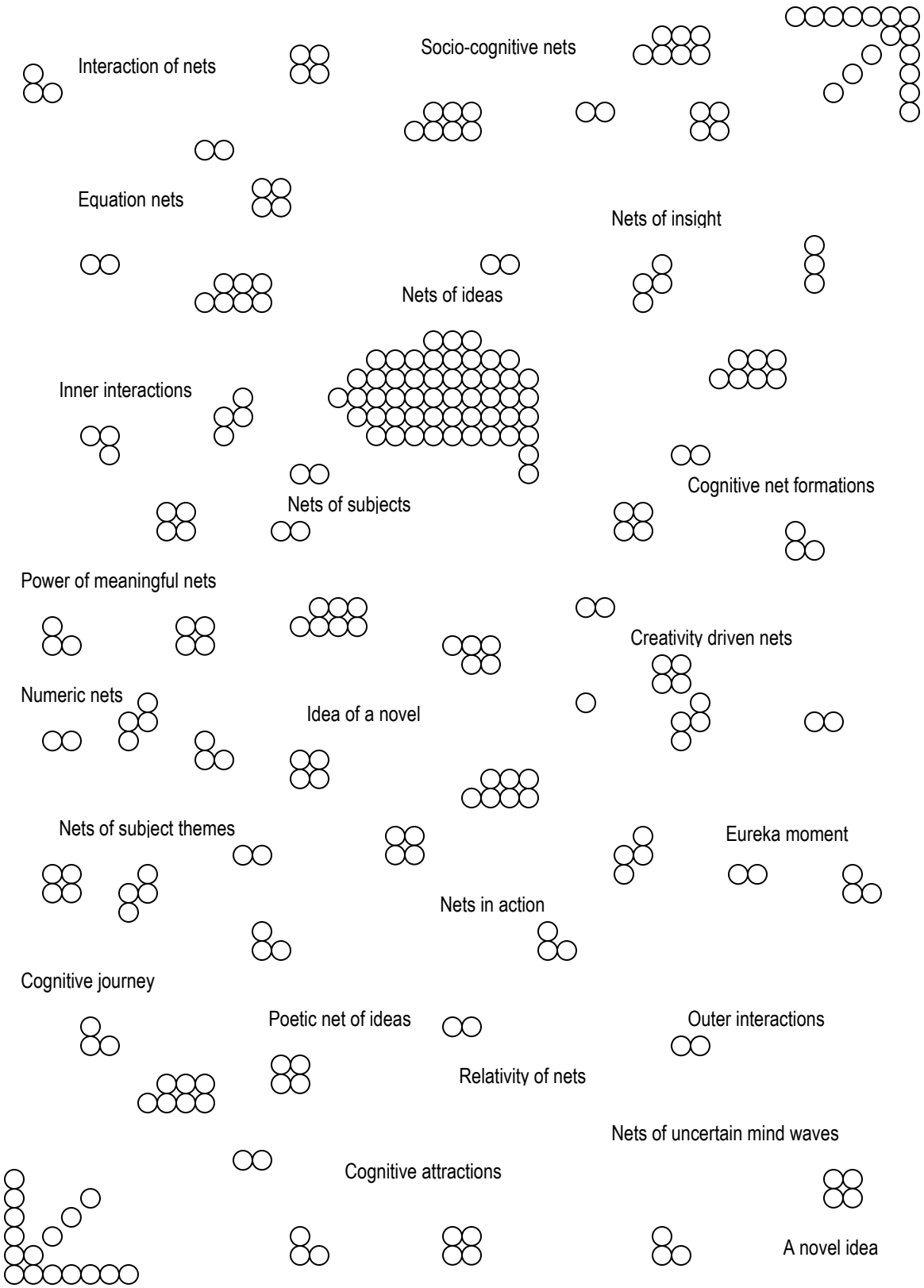
World of thinking, a world of ideas
World of ideas like drops, waves and oceans
World of thinking is a world within many worlds
Making nets of ideas and remaking to redefine
World of thinking is knowing without knowing
And sometimes not knowing what is known
And at times knowing how it was known
Predicting what will be there, tracing what was here
And at times just wondering how we came to the known
World of thinking is powerful to know infinity without reaching that far
Saying in words, 'words can not describe'
A language of emotional infinity sings between the minds
An urge to know, a desire to create
A power to fly in the opposing wind of questions
In the galaxies of ideas, searching new stars
Either awake or asleep
Even when we don't know the answer
Somehow a feeling of a solution emerges
And yet leaves us with many wondering questions




Interaction of nets
Socio-cognitive nets
Equation nets
Nets of insight
Nets of ideas
Inner interactions
Nets of subjects
Cognitive net formations
Power of meaningful nets
Creativity driven nets
Numeric nets
Idea of a novel
Nets of subject themes
Eureka moment
Nets in action
Cognitive journey
Poetic net of ideas
Outer interactions
Relativity of nets
Nets of uncertain mind waves
Cognitive attractions
A novel idea

Introduction

If our power of creativity is inspired we can accomplish beyond our current levels of accomplishments; the question is how we can make it happen? Human thinking processes have worked amazingly to make impressive discoveries, including substantial progress in the understanding of our own world of thinking. We think in our own world, which is also influenced by many known and unknown factors along with inner and outer interactions. It is a complex process and various fields are on the journey of exploring it. Making progress to enhance our ways of applying thinking processes in more effective ways can be helpful to excel in our careers, learning, and social worlds. Over a period of time this journey of learning about our own potential and shaping it to provide maximum benefits reaches many new horizons. This interesting journey has close links with the progress in many related fields of study which contribute to the thinking aspect of human activities.

The era began with the work of cognitive psychology, cognitive science, education sciences and interdisciplinary studies has made a tremendous impact in various fields of learning, understanding ideas, career paths, empowering creativity skills and improving personal excellence. How can it provide inspiring pathways with innovative approaches? Can it help to inspire creativity? Where someone stands in life, if it is compared with this question, how many nets of learning and the nets of social forms have shaped a person? Just a short thought experiment can be interesting to see various ways and the formations of invisible nets that shaped our numerous aspects of life. Nets of ideas, nets of people influences, nets of concept formation, nets reshaped with nets, and the interactions of inner and outer world evolves wonders. Some details will be discussed later. Although a great deal of research is accomplished, on the other hand some basic questions are yet at the centre of debate in this field.

Interestingly the evolution of new subjects is also on the rise for providing innovative study options.

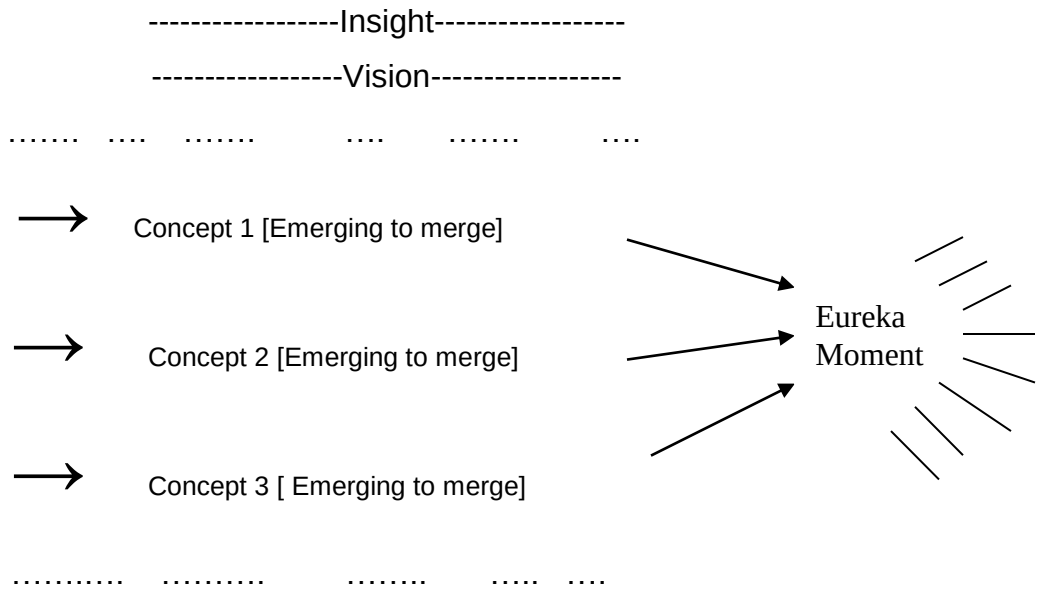
The patterns of cognitive diversity and the progress in various fields of study

Our variety of ways to look at the same events and analyzing them in our own ways, leads to constantly venture through new theories, research and practice avenues. Cognitive diversity potentials can be highly powerful if applied effectively, as individuals and as groups. It is a way for innovation, creativity, inquiry processes, and personal career growth in many fields of activity. Scientific research has progressed immensely with the wide range of cognitive diversity. Those aspects include changing patterns in observations, comparisons, developing and redefining theories, experimenting with the improved form of research tools, and innovative techniques of looking at problems and questions.[1] Human cognitive diversity and cognitive-net patterns are not only a crucial way for science advancements but they also play a role in other subjects, such as language, geography, and history.

In the expanding universe of the human mind, new ideas have certain links to connecting ideas with ideas and in exploring new ways, making new discoveries, progressing in learning, and achieving further for our careers. Weaving the nets of ideas, like joining the drops, merging waves and connecting oceans can help to make new discoveries with our cognitive diversity and forming innovative cognitive-nets. Many times inventions come about when we immerse into the world of forming creative cognitive-nets. This idea is also supported by some studies conducted on related themes. Carlin Flora and Dean Simonton have explored in detail about the ability of certain people to make remarkable discoveries. They have also observed in some people a unique ability of making visualizations and three dimensional icons. This form of pictorial manipulation may help to integrate various ideas and reach new horizons. Einstein has also

described his habit of using pictures and diagrams in forming new ideas and later using words to share the ideas.[2]

The history of many inventions also reveals the ways in which pioneer approaches were the result of joining various ideas or material objects in an innovative way. This notion is also a hallmark of the new cognitive waves of paradigm shifts. The links between a magnetic compass and something acting from space, gives an example of linking ideas by young Einstein. From time and space links and the net of relevant ideas to the monumental theories of Einstein on relativity, interesting ways of converging and diverging ideas can now be seen by an observer.[3] The relativity of nets of ideas is an intriguing cognitive power! From the biography of Abdus Salam, *Cosmic Anger* by Gordon Fraser, many examples of making the links of ideas in a breakthrough pattern can be observed. Alongside many other cognitive ways of making nets of ideas, Abdus Salam developed innovative approaches and theories to link certain ideas; in particular explaining the connection between the weak and electromagnetic interactions —a unique way of nets of ideas brought a Eureka moment. In his wonderful ways of progress, Abdus Salam later became a Nobel Laureate is physics.



Some landmark inventions by well-known scientists were also a result of finding a medicine by chance (which may not be the real aim of an experiment or an activity). An example is the work of Alexander Fleming to discover the famous medicine penicillin. Alexander Fleming discovered penicillin by a chance of connecting certain situations. Bacteria had grown on the plate but not in the area where mold had formed. Eventually this chance of connecting the events led to the discovery of penicillin.

Some inventions which are considered work of ordinary people (not of well known scientists, with their quintessential performance) also have this factor observable to some level of research parameters. Inspired by the need of situation, they started to reconnect resources in a new meaningful way, and a new invention came to hand. The examples are in large numbers, just thinking of a few to understand this concept. The invention of the microwave oven by Percy Spencer, the invention of liquid paper by Bette Nesmith Graham, the start of Velcro when George de Mestral (who walked in the woods, then he had to remove the burrs from the coat of his pet and how he connected the nets of ideas to make such micro hooks to join two pieces). From the lens of observing the net of ideas, many more landmark moments of human history can show the wonder of linking various ideas to envision a focussed view of a creative moment. It can even redefine and reorganize a way to learn something with profound understanding or making a leap for our own socio-economic progress. It is an inspiring way to think, a theme to conduct more research and a tool to use vigorously in our education world to enhance the potential of the learners, in conjunction with other effective tools (It is not the only way, however it can be helpful along with all other pathways). Searching in our minds, about the ways of making cognitive-net patterns, social-net patterns, comparing with other examples, making web charts or graphics to make visual comparisons, exploring historical indicators, can all be useful to a certain level of an achievable focus. Conceptual links, making graphics of our ways of connecting ideas and a

metacognition analysis of our unique cognitive styles can be self-explored, shared in group activities, and applied for possible new ways of cognitive breakthroughs, within some given parameters of an activity framework. How an inspiring seed for cognition flourishes in a favourable environment is one of the keys to maximize our pioneer approaches. And some times inventions and the moment of understanding ("yes now I got it!") are like a sudden moment—a Eureka moment of timeframe, without knowing how a flash of time led to a discovery, it could be in an unexpected place (while some work is going on in the back of our mind).

Imagine two people are having a dialogue one person is "A" the other is "S".

S says- Whenever I see my grandfather's picture his voice comes in my mind, his words of wisdom capture my attention. I really remember him with his voice when I see his picture in my room.

A- Obviously you love your grandfather a lot. So when you see his picture, you connect to his voice in the world of your memories.

S- Yes

A-What if whenever you see his picture in your room, his voice also comes electronically in the room.

S- That will be fabulous

A- We can invent something, picture frames in which there will be a system you can record the voice of that person who is in the picture. There will be an electronic system which will turn on the voice when you will come in front of the picture. We can have many pre-recorded messages in his voice. You can also change the messages according to the occasion and your mood.

Invention ideas often begin with human social and cognitive nets. New ideas for inventions can also start from visualising certain shapes, their properties and characteristics. Creative people also have to go through criticism; they find it as a slight bump on the road to reach a better way to the destination. An ongoing willingness along with a mind and heart for creativity can be an inspiring tool for our everyday accomplishments with our unique ways.

The message for the next generation of inventors and discoverers can be inspired in many ways. By giving our younger students a hope with the light of perseverance is indeed very powerful. Gradually our talents readjust and redefine; their super cognitive-net will hopefully come with time, in its own shape and style. Children can be encouraged—at some point they can also make their potential empowered to explore their full extent of cognitive diversity and the power of making their own cognitive-nets in the large picture of many aspects of education. A positive way of search for new ideas and a strong willingness can create the links of all those factors that can redefine what we might be trying to accomplish. In our learning of concepts, how difficult concepts become easy to understand at a certain moment of time. Some ideas connect and reconnect and eventually a big bang of ideas is evolved. At times it happens when certain ideas don't connect and a new highway of ideas is found nearby to reconnect the new islands of thoughts. The more you think about how our cognitive diversity and forming of cognitive-nets is a power around us, more insights emerge along with the other factors of progress. Our amazing self-study tool, the metacognition, can help to reflect, our ability of self-talking can show to some extent how our oceans of ideas meet. (Imagine as if we are watching the videos of our certain aspects of life in our mind). The power of making smart nets! The stronger, multiple, and meaningful nets can impact our learning, social and economic growth, if it is applied with insight and vision. Through a thought experiment interaction of the inner world of mind and the outer world of social nets in a reasonable way, the superhighway of creativity shows wonders (trying to think of a super-metacognition path). The creative journey begins even at the earlier age. Nobel laureate of today was an elementary level student one day.

Subjects and careers coming with various combinations of fields

Knowledge has many forms, frames and formats. It comprises even many ways in the same way, the same way in many ways, traveling on and existing learning

highways for the new lands of concepts, quantum nature of creative journeys and the new visions of discoveries. Our history of learning and innovation is full of combining and distinguishing various domains of knowledge. With the amazing formation of subjects and specialities of focus, various fields of studies have made the landscape of our education and research. Look at the few examples in the following fields. The combination of linguistics and computer based technologies led to the dawn of a new field named computational linguistics. Psychology, computers, linguistics, neuroscience, philosophy have played a key role to work for the development of cognitive science. The further integration of fields has started a field as computational cognitive science. Social science field of study combined with neurology has started to collect data for social-neuroscience. “Social studies of science” is also a field which studies science and society aspects with many historical perspectives. The list is very long to name all subject cross pollinations; one can hypothesize there will be many more new combination of fields which can make our fields of knowledge acquisition and application far more interesting (and challenging). It is also an inspiration to extend our creativity to look for the new possible subject study pathways. And one possible lens is to look for some creative options through our socio cognitive-nets.

This process of cognitive diversity and cognitive-net is not only concomitant to the fields of studies and subjects but it also relates to our individual ways of thinking about them. On an individual basis our ways to reach for innovative approaches, enhance creativity, and work on challenging problems can be inspired by looking at our pathways of cognitive diversity and cognitive-nets. Another important factor is the interplay of our social-nets, to develop an inspiring attitude and excel in positive ways.

The economics, careers and cognitive-nets

From IQ to EQ, MQ and BQ

Are we going to look for "Interdisciplinary Quotient" as well?

The world of next generations of technology based automation will also make new combination of fields with new type of careers. Carl Benedikt Frey and Michael Osborne, of Oxford University, estimate that about 47% of the fields and occupations can be taken by Internet automation revolution, in a short period, possibly from one or two decades.[4]

The changing pattern for our economy and education is also a call for our educational institutes to constantly update their overall teaching and learning.[5] Along with the exponential change in the automation of a large number of professions and fields—It can also be estimated: the growing need for the integration of subjects, fields, and studying the cognitive-nets. The relation of cognitive-nets to theory, research and practice can make it challenging and possibly useful for many domains, fields and their mutual interactions. The educational institutes will have to look for introducing the components of the subjects which will be impacting society for the new kind of job markets. Can we introduce "Socio cognitive economics education"? Many more questions and arguments will influence the curriculum in view of the automation and jobs. The field of education is emphasizing about EQ (Emotional Quotient), BQ (Body Quotient), MQ (Moral Quotient) along with more conventional IQ (Intelligence Quotient). Perhaps the next wave of social, economic and education needs will look for "Interdisciplinary Quotient."

The generations of students which are learning in the technology based environment, will possibly have a stronger link to the computer related interactions. How will it redefine the in-depth links of human and computer interaction? How may it change our cognitive diversity styles? As we will further

move in a job market world with higher enrichment of Internet technologies, our way of thinking and living with technologies will require new ways of education and analysis. Our linguistic changes with the dawn of computer age are already a topic of research in many relevant fields.

The technological revolution in the job markets will possibly flourish to many jobs in the specific technology based fields. Students with relatively less interest in math and science will also have their needs to be addressed. Perhaps some avenues for a new form of social, technological and cognitive turn of pedagogy will have to be assessed. The socio-economic frontier will raise question to reconsider what we teach and how we teach in view of the changing job markets. The curriculums of the countries may need stronger collaboration in these fields for stronger ways of transforming human and machine skills. A comprehensive view can help to find out, the strategies and curriculum contents which are working and where the need for change is necessary. Research studies will be needed to explore the multiple interfaces between the cognitive-nets, social-nets and Internet.

The focus of technology and the student interest is bringing many new pathways and challenges for education. In my teaching observation, it was interesting to observe the higher level of motivation of students to learn about how their mobile or cell phones work. What are impacts of the knowledge of various subjects on a cell or mobile phone! Students perceived this aspect of science, technology, math, history, geography and language close to their current passion and made some intriguing lively links. It was clear that the miniature universe of information shining in the hands of students can establish links to many subjects of learning.

To inspire students to study the fields of science, one approach came with the combining of subjects. The approach of combining subjects is also echoed in the educational institutes as SMET (Science, Math, Engineering and Technology), then a more refined form came with the acronym STEM (Science, Technology,

Engineering and Math), and with the voice of adding more subjects came the acronym STEAM (Science, Technology, Engineering, Art and Math). Do we want to add more subjects? May be some people will suggest to change this acronym further in the future with the need for adding more subjects. While working with the themes of STEM the links to other subjects such as language, history and geography are already in place in many educational institutes. What is another way to look at combining various subjects, fields and our innovative pathways?

I will give some more possible ways of knowledge combination fields for making possible progress in a variety of areas and domains.

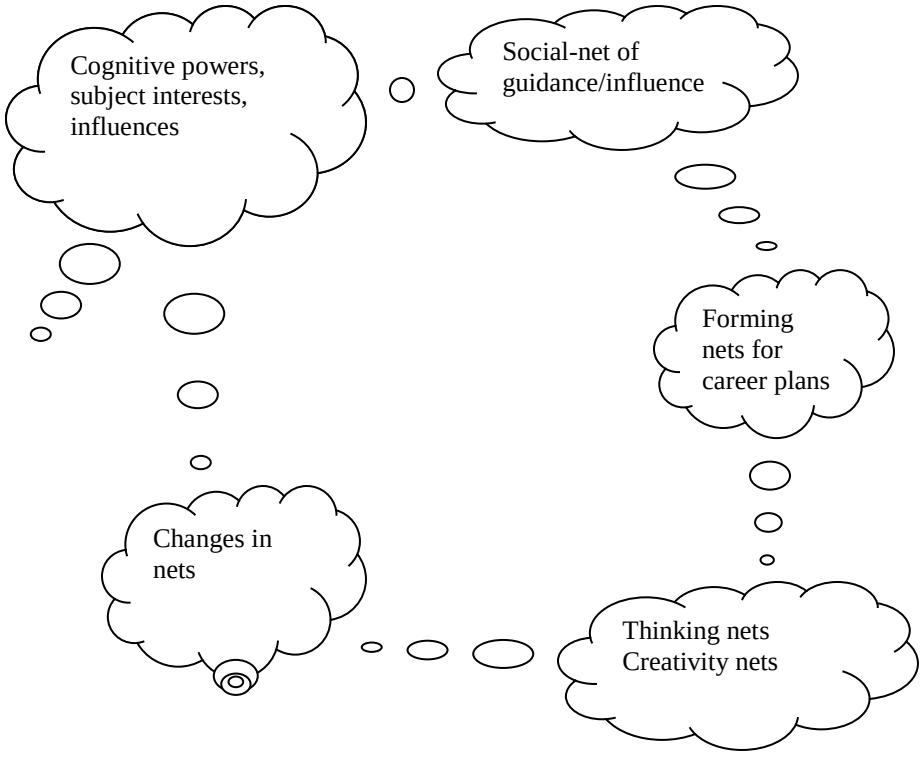
Exploring our cognitive-nets

> "….successful innovation depends less on how smart you are than how connected you are…."
>
> ----------Mark Thomas and Stephen Shennan, University College London

Our ways of working with our brain and mind is a fascinating world, whether we are always aware or not of what takes place there at every second in our life. From billions of neurons, what can happen if they are not connected for interacting with each other as they work for interaction? The connectivity is crucial for learning and understating. A powerful knowledge activity emerges with the connectivity of those neurons. Those ventures can further lead to conceptual heights and new discovery fronts. Without making those connections, neurons are not so powerful with knowledge nets and cognitive journeys. Think of letters, words, sentences, paragraphs, and how they form the world of books—how connectivity plays a role!

Thinking of all our learning, career paths, plan making, innovative mental journeys—they all have some type of knowledge nets, which may vary in formats

and types. Out of many other factors, it is the combination of various nets which lead to various short term and long term accomplishments, some time knowingly and some time not knowingly. Our cognitive-nets are with us in multiple forms of activity, interaction, problem solving, and thought experiments. The large possible ocean of examples around the world of human learning and discoveries can have an interesting journey in our own world of thought experiments. The research of such events in the human history, and exploring examples from our environment can provide strong foundations to work further.

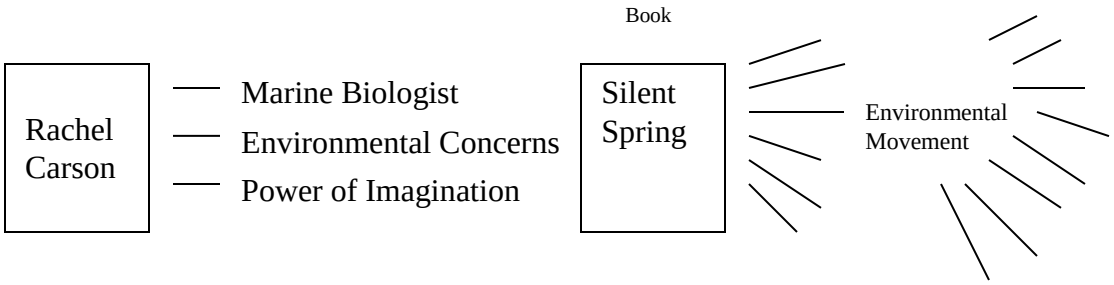


We can search examples in why we are working in a certain field, how various nets of skills and social environments are shaping newer nets with the changing relativity of mega nets of the inner and the outer world. The intermixing of subject knowledge in a meaningful way and skill combinations plays a role. Some one with some interest in math and some interest in language may have developed an interest to work in the field of computational linguistics. Combining the idea of

a car and bike, and the invention of an electric pedal-powered car bike, binary math and electromagnetic computation to the new breakthrough in the field of computers—several examples can be explored.

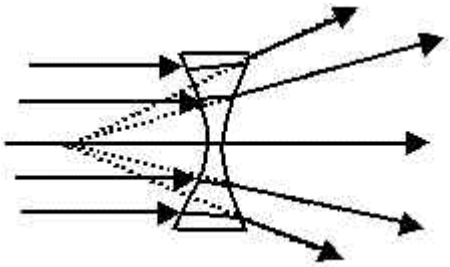
Our learning of a number of subjects is also filled with making nets with various other subjects, fields, and areas of activity.[6] Cognitive-nets work between subjects within subjects and from a very basic level to higher level of information interactions. Human concept attainment and cognitive-net relations provide beyond imagination outcomes and challenge our capacity to face the challenges. We make connections and distinctions of multi-level internal and external interactions. Our choice of careers is also full of making nets of ideas, fields, interests, influences, needs, demands and more. Cognitive and social aspects both have influences with changing frames. Cognitive-nets are in small and large forms in our lives for various ways of learning, teaching, innovation and career paths. When it comes to solving a problem, we also go through many cognitive-net interactions and process (sometimes knowingly or even unknowingly).

The range of such examples can be seen in many forms in a small circle of fields to the broader circles of fields. It is interesting to see how the combination of fields worked for certain individuals in their career and life goals. One example (which my students elaborated many times in their small group work) is the book *Silent Spring* and the author of it. Rachel Carson was trained as a marine biologist. She got concerned about environmental issues. Her landmark book *Silent Spring* played a historic role in making a milestone for the environmental movement. Think of cognitive-nets between various fields, science, writing, social responsibility, power of imagination (and perhaps those we may not even be aware of). In many instances, the unique combination of the net of ideas have transformed into a memorable work in the human history. Indeed an intriguing world of cognitive-net and cognitive diversity has potential to explore new universes of creativity, inventions, discoveries and understanding along with other remarkable pathways.

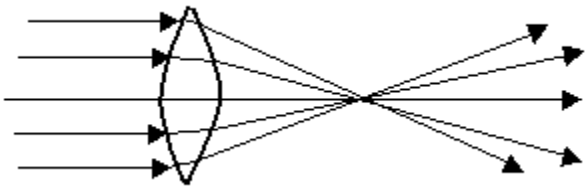


How our vision of creativity is inspired by converging and diverging ideas from the nets of many other ideas? There are many factors; just one aspect is discussed here. Think of a large net of cognitive waves working with a smart focus to enhance our vision for a given inquiry question. Considering the role of concave and convex lenses, the converging and the diverging patterns of light are an example of focussing various ideas to one point and then expanding them to reach an innovative idea; it could also be a brilliant wave of creativity, an understanding of an idea or an effective pathway for a career.

Diverging Rays
Concave Lens



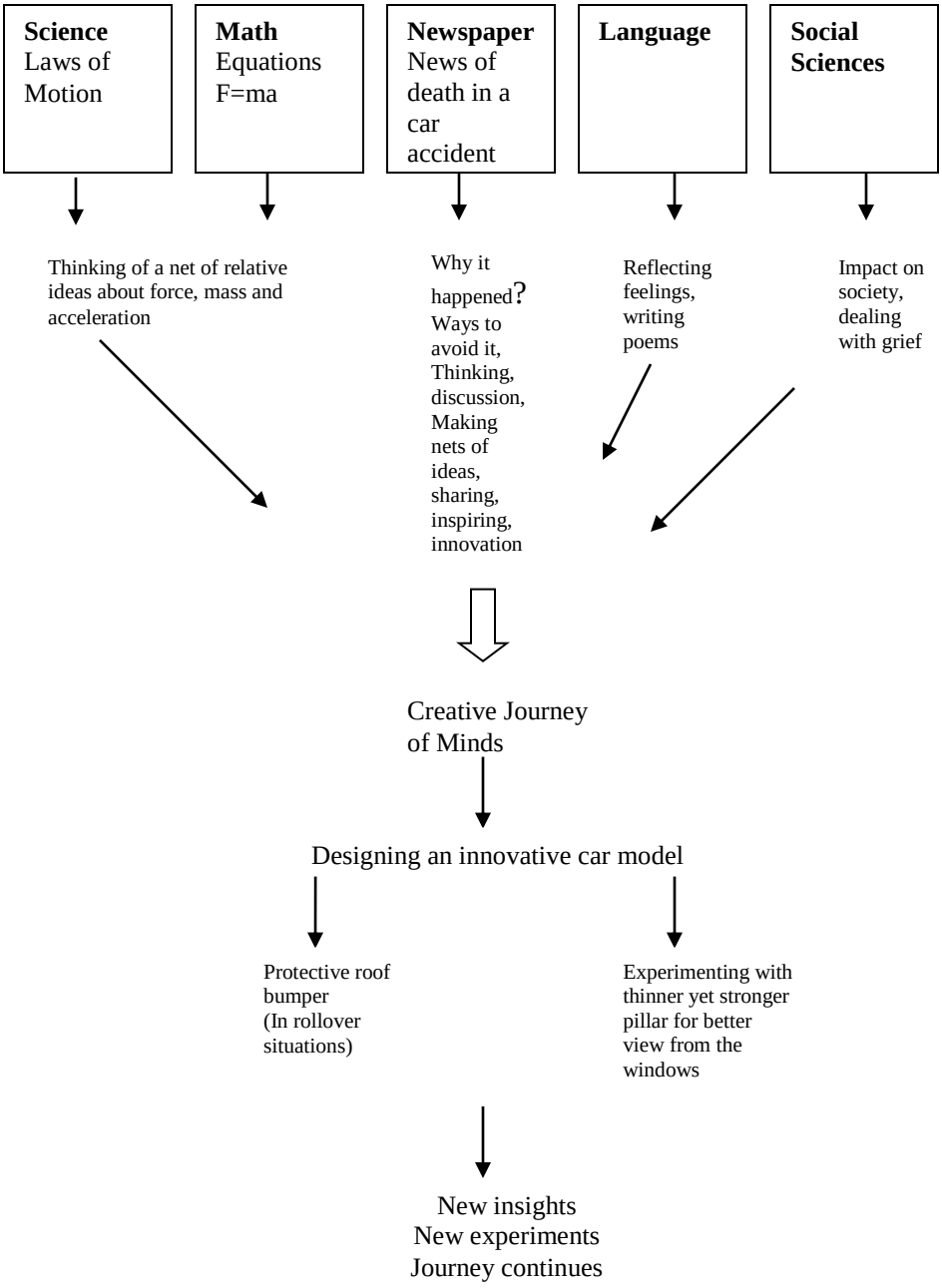
Converging Rays
Convex Lens



(In the world of rays, the focus of lenses is also applied to help for better vision). Considering this example, making a focus of the net of ideas can facilitate to possibly reach the visionary goal. For our thought experiments it can also provide an invisible powerful lab for making and breaking nets to reach creativity goals. It can also provide an invisible focus of ideas in the converging and diverging nets according to the need of the activity.

This analogy can also help to find our ongoing ways of forming cognitive-nets for social, academic, and other needs. The mega world of nets has some visible and invisible forms. Some of them we can think in our mind easily, others may not be so clear to imagine. By giving more emphasis on our thinking and making intelligent thinking nets, perhaps we can enhance our learning and working by our self-designed journey of the mind and the desired paths of real life.

How can this process of thinking and comparing helps our students? While working with many students, it was observed, the role of making cognitive-nets between subjects: within a lesson theme and within ideas has been helpful in finding new cognitive journeys for innovation and meeting the needs of our changing society. Some school and higher level students find it useful in selecting career paths, as they explored they had some interest in computers and also some interest in biology so going to the field of computational epidemiology was an inspiring option for them. In the same way examples of the fields of social-neuroscience, cognitive science, computational biology, computational linguistics and social studies of science can also be introduced to prospective students for making a choice of a field which could be a path of excellence for them. There is also a growing need to consider new combination of subjects for the formation of new skies of creativity.



Perhaps it is time to explore the effectiveness of introducing a summary of the main focus of those fields (some examples given previously) in relatively earlier school grades so that students have a broader view of future subject and career pathways. This process may also address the question of supply and demand for future careers, as well as it might provide a better scope of career selection for students. The wave of technological transformation will also need a

transformation of how we think and compare various fields. What will be our new subject connectivity nets? In the long run it may inspire the innovation models for new type of subject connections. From making and deconstructing our cognitive-nets and social nets we can learn many hidden details and explore innovative ventures.

The role of comparing cognitive-nets to study various problems and challenges has shown considerable interest by many students, in my frontline interaction with various age groups of students. By making extensive cognitive-nets, students were able to reach a certain level of creativity and came up with some innovative ideas. It allowed students to see their own imagination growing to make intelligent connections of ideas. How some combination of the nets of ideas raise a challenging problem in one subject area or a field of study, and how they can extend their ever-emerging cognitive-nets to come up with unique ideas and solutions. Students' interest varies and some reflection is based on the interactions of certain groups, which may not be generalized to all groups. Evolving an inquiry based question to find an innovative solution is facilitated to some extent by this approach. The distinguished way of our certain ways of thinking and collaborating leads to a certain level of cognitive diversity.
It is hard to find a variety of formal studies conducted on this topic to link theory, research and practice.

Some examples of effective teaching practices are discussed here; which worked in the given groups and may not be generalized. Teaching math by connecting kinaesthetic learning and the abstract concepts of mathematics was experimented. For instance, using a mat (with numbers written on it), and students were able to stand on them. This process facilitated the understanding of some mathematics concepts in a broader sense. It was named "MathMat". Children were facilitated with the concepts of math as they stood on the floor and moved on the squares of the floor which had some numbers on it. In this technique of connecting ideas of math with kinaesthetic learning, students were

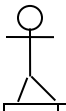
able to learn about the concepts of mathematics such as area of a shape, perimeter, angles, graphs, odd and even numbers, prime and composite numbers, and patterns. Students also used certain color codes for odd and even numbers and prime and composite numbers to observe the distinctions of abstract ideas with more observable situations. We may not exactly be able to determine to what extent our imagination can give a glimpse of how does the nets of ideas of the abstract world of symbols interface with the concrete world of numeric dimensions.

In another technique, students designed “math soccer game” in which they used a board with empty squares, some counters with numbers written on it. As they achieved a number designated for that goal number, they were able to score a point. The designated goal number, such as 100 or 1000, can be varied according to the level of the skills of students. As the word *al-jabr* means “the act of completion” and how equations are solved by finding the unknown with the help of the known, which opened an era of math marked by Algebra. Sometimes our nets of ideas have a wave of making and breaking nets, balancing and unbalancing in the thought experiments, to find the unknown with the help of the known. An invisible world of processing ideas: linking the outcomes of thought experiments to transferring ideas to abstract equations (which can also reach to create the dimensions of geniuses!)

Math Soccer

100							0							100

MathMat



1	2	3	4	5	6	7	8	9	10
									100

The more we explore, it gets even more intriguing with the world of joining the power of ideas, thinking of cognitive-nets in and around us in various forms and levels.

Inner world nets and the physical world nets

The world outside of our mental world also presents many types of physical nets, for example, consider a plant, how many links can be traced (seed, stem, leaves, flowers, fruits, air, water, temperature, and more). Think of the inner nets which we might be making while linking ourselves with the outside net of physical

connections. How our knowledge about trees and plants is making invisible connections with the physical world of a tree. Interesting and intriguing universe of connections—and there are many ways to explore, predict and extend innovative journeys of thoughts. Our thought experiment world also makes nets of comparison and makes formats to test hypothesis of multiple natures. Sometimes a new wave of cognitive seed comes with the power of creativity and further nets (inner and outer world) make it a worthwhile work. This discussion also highlights the need for conducting research studies to find the best ways for applying it in our education world to inspire creativity.

We may not know how quickly our galaxies of cognitive-nets move, make and break during the whole day and also during our sleep. Creativity awakes silently in sleep! The new research studies conducted on human brains, using special type of scans (fMRIs, PET Scans, high-density EEGs) provide some intriguing details of our activities during the sleep. We are also very creative during our sleep as some time we start our sleep with a problem and we solve it by the time we are awake.[7] The exact details of what happens in our brains and mind are still open for research.

The process of our creativity is not a linear process most of the time, but it is a sudden moment of discovery, something as lightening or a wave or reaching a new planet without the feeling of a long journey. This process of creativity was also named “quantum leap” by some authors. There are other interpretations by some schools of thought about this phenomenon. Astonishingly, there are many examples about the creativity and innovation moments which show unexpected time and place for the Eureka moment in the life of those individuals. The following are a few examples: Archimedes discovers in a bath tub about his famous discovery of buoyancy, Marcel Proust was eating a cake, when he came up with a few retrospections which shaped his net of ideas to write an outstanding novel. Friedrich von Kekule finds out about the bonding of Benzene

molecules while in sleep, and Henri Poincare discovers his mathematical solution while stepping in a bus.[8]

The level of human creativity can obviously be different among various people, but some people have made interesting historical inventions in their ordinary life interaction, which is perhaps partly due to the reason, how they observed the problem and a possible solution from a creative dimension. From another perspective we can think of making a unique pattern of cognitive-net and showing their cognitive diversity in the form of a pioneer approach. If we try to make a diagram of how those inventors connected their various ideas to lead to a new cohesive invention, we might see some paths of creativity. In this search we may find, which factors were mutually connected by those inventors to find a creative path. The complete elaborated picture of all aspects of the cognitive-net and cognitive diversity may not be discovered, yet some aspects of how those invention oriented minds applied their creativity can be understood for some given parameters. With some detailed exploration and multiple formats of data collection, there is a possibility to explore how people formed certain net of ideas and how it can inspire the creative paths of others for future inventions.

In my teaching interactions, it was observed, in an inspired environment and with some effort that students have shown reasonable interest to find details of the paths of inventions using the nets of ideas and by applying cognitive diversity. This idea of inspiring in an inspiring environment, enlightening our inner and outer world, sharing exemplars of creativity, and reaching to the new islands of our own creative world can be a powerful way to explore our talents. It is a time to study those processes in greater detail, design new learning materials with this focus, and inspire the world of creativity to a new level of applied pathway. For our new frontiers of the world of creativity, social and economic challenges, perhaps this type of collaboration will be useful to a certain extent.

Effective teaching practices
Examples of effective cognitive-nets

It is hard to comprehensively trace and track all forms of cognitive-nets and social nets, yet some techniques in teaching and learning have been useful to apply the benefits of such collaboration. Using some forms of charts of web-diagrams, tree diagrams, flow charts, and Venn diagrams is one way to locate the stages of cognitive-net formation. In my front line observations, when students of various age groups, from school to university, are inspired to trace, transform and create cognitive-nets, there were encouraging moments for critical thinking and creative transformations. Over a period of time, most of the students tried to see the changes, improvements and projections of their cognitive-nets for effective ways of applying them in a variety of settings. The use of making nets of ideas in the lesson plans, comparing them before and after teaching provided a graphic reflection of cognitive paths. This process varies according to the need of the learning focus, time period available, and the overall environment of interactions.

It can be commonly observed that, students tend to keep no record of some of their creative tasks accomplished; probably one reason could be that it is not encouraged or it is considered something of a small nature. The creativity can be of multiple natures, from a small creativity task or something that is remembered well. People show creative skills in cooking a dish, writing a new piece, making a new joke, designing something with unique features, solving a problem with a smart approach, and the list of the forms of creativity is endless. A famous mathematician and physicist, Carl Friedrich Gauss was only 7, when his teacher asked him to add all numbers from 1 to 100. Gauss replied in a few short moments—5,050. What was the smart net of numbers he made in his mind? Imagine the imagination of creativity! He grouped the numbers into 50 pairs, like 1 and 100, 2 and 99, and extended further. The value of each pair came to be 101, so he multiplied 101 by 50 and got the answer 5050 (Appendix shows a net

of numbers). Maybe this example will open a new range of insights in solving math problems in creative and smart ways. Human creative powers have various manifestations. One possible pathway to enhance creativity skills is to maintain a portfolio of students with their creative accomplishments. It can be something to inspire their future work and to share it for mutual success. For the continuum of insights for new tasks: discussing and analyzing paths of creativity and by exploring the intelligent combinations of the nets of ideas.

It was noticed in the teaching practices that one way cognitive-nets have worked well in making concept understanding helpful, is by looking at (a) previous forms of cognitive-nets (b) exploring more with research from various recourses (c) reforming the new set of cognitive-nets. The same techniques can be extended to various other domains of performances.

Making links from one domain to another is also considered a form of higher order thinking, as explained previously. Students who applied cognitive-nets in tracking and tracing processes were also able to make connections relatively easily between domains, topics, themes and subjects. Creative thinking pathways helped in making critical thinking an interesting venture. Reminding students about thinking of our own patterns of connecting the ideas in mind, metacognition of forming nets, and with making graphics on paper facilitated the process of making a wider variety of cognitive-nets and social-nets for useful purposes. There is a need to conduct research studies from mixed method research to explore how effective those strategies could be for the given population groups.

Transforming skills and ideas from one topic/subject to the other in order to promote higher-order thinking

(Compare the common strand of finding the unknown with the help of the known in the following strands of math, language, and science)

Game:
Guess the name of a person I am thinking of or a number I am thinking of
You can ask only 20 questions
My answer will only be *Yes* or *No*, so phrase your questions accordingly (making inferences)
When you say the name, the correct name has to be given and the game is over.

In a story or text what inferences can you make
(Finding the unknown with the help of the known)

By guessing! Why this happened? What else is possible? Think of text to text, text to self, text to world.

In Math, how you discover with the help of what is given.

2 + X = 8
How we can encourage more than one correct answer in the class, look at this question.

\+ + = 10

\+ + = 20

In science how we test a hypothesis to find if it is correct or not (Scientific method)
A summarized example is given.
-Observation
-Making a hypothesis
-Testing your hypothesis (right or wrong)
-Making conclusions

What are some common cognitive tasks/ thinking approaches in the disciplines discussed previously, which are leading to transdisciplinary level ?

Nets of ideas/ nets of subjects/ socio-cognitive nets

Thinking questions:

How do we find the unknown from the known information?
What are some common cognitive ways and knowledge frames in various fields?
How various subjects have a closer and a distant link to each other?
How our cognitive-net strategies can help in making rich links between (and within) various fields and promote innovative skills (In a wide range of thinking levels)

……

Use of one word in various subjects and perspectives

The word “energy” is used in everyday life and in science.

What do you understand by the word Energy?
In how many ways is this word used?

Students write their definition(s) of Energy.
Then they explore from the textbook(s) or other resources, and then they re-write the definition.

Exploring a net of ideas to facilitate the thinking process

A way to make a cognitive map of learning in various domains!

My definition(s) of energy	**The definition(s) of energy that I explored**	**My new definition (understanding) of the word energy**

One way of learning dynamics of socio-cognitive nets
(A range of other dynamics/nets are possible)

……

Making a corpus of our cognitive-net for specific purposes

Research on cognitive diversity styles is only conducted at a very limited scale and there are many methodological questions yet to be resolved. In linguistics, the research on working with a data bank of words (or also called corpus) has proved to be helpful in analyzing various trends in language and the usage of it. There is a possibility of making a data bank of the ways in which people make various forms of cognitive-nets, social nets, how various types of cognitive diversity is observed, and how possible extensions can be reviewed. Perhaps

this type of corpus of cognitive-nets can be analyzed, in multiple perspectives and in a linear study to compare the changes over a period of time. This type of data bank may not show all possible trends, however, some patterns of examples can be gathered to analyze further. The research into connecting social cognitive-nets and the inner connections can also be an interesting and challenging question for the future studies of social-neuroscience. Depending on the age groups and the needs, people can also make their own track of forming various cognitive-nets and review it personally for a number of needs to explore pathways, effect of choices and the impact of changing parameters. The start of a Master's level program in "spiritual psychology" at Ivy League level shows an interesting move in combining subject knowledge and exploring the new dimensions of interdisciplinary focus.[9]

An international project for the comparative study of multiple factors of cognitive-net patterns, combinations and differentiations can be started to explore in-depth patterns in various demographic areas. The role of education, culture, language, economic parameters, and social interactions can also be examined to some extent to find commonalities and variations, which can perhaps provide vision for further research. Obviously the data will have some limitation and all aspects will not be reachable.

The authors of poems and novels also make a number of links to the inside and outside world and eventually a remarkable artistic work comes which may inspire the cognitive-nets and the cognitive diversity of the readers and the influence can go even beyond. It will be very difficult to exactly measure such meaningful influences of artistic works; some indirect indicators can provide a glimpse of it.
It was interesting to observe during the teaching interactions that a variety of students made graphics on the ideas of a poem. After this activity when many graphic patterns were available, the moments of observing the cognitive variety of the students' understanding were collectively inspiring. The patterns of commonalities and the differences and the variety of views on reasoning

provided multiple dimensions to enrich the learning process. The arrows used to connect ideas of various types of nets were named Arrow-net Diagrams.

Nature of science and making nets of ideas

There are many ways to describe *Nature of Science* (NOS) and the aspects which make science a subject with wider scope and broader thinking dimensions. The nature of science includes aspects as how science is in the form of a body of knowledge, the way in which science presents a way of thinking or investigating, the interactions between science, technology and society.[10] These multiple dimensions make science a subject interacting with many subjects and interacting with many nets of ideas.

One of the motivations to introduce the Nature of Science (NOS) is to understand the scope of science in various realms. A number of studies conducted on NOS are about exploring the frequency of the occurrence of the indicators of the nature of science. It also helps to find the multiple ways of the bigger picture of science in our curriculum. From a converging and diverging way of looking at how ideas are linked and distinguished, the importance of exploring how we form cognitive-nets becomes more evident in our curriculum.

Some parameters of collecting data on how students reflect of their formation of cognitive-nets in a given context

One possible way of data collection is from the participants' dimension of recognizing and reflecting their own ways of making (or not making) cognitive-nets. If the participants are provided opportunities to explore their patterns or ways of making cognitive-nets (within a topic, within one subject, across the curriculum and beyond prescribed curriculum), perhaps the doors will open for enormous possibilities to explore new ideas and to some extent recognize our ways of exploring ideas. This model is partially an attempt to highlight some aspects of the inner world links and the links of the outer world to promote

creative thinking skills. The data collection on this way of interaction of cognitive-net formation and recognition may also include various patterns of student made labeled diagrams (such as web diagrams, tree diagrams, flow charts, arrow-net diagrams) which indicate their ways of looking at their nets. If there is sizeable data available from reliable sources, the data of the corpus of cognitive-net, within given parameters of the prospective research studies, can provide helpful insights to think further.

Some parameters of collecting data on recognizing a cognitive-net factor from a textbook / other resources / other form

The other possible dimension is that students and researchers explore and recognize the patterns of cognitive-nets, which are given in a book or a particular resource being analyzed. A corpus of a data bank of such cognitive-nets can also be possible to analyze various critical parameters.

If we have large scale data from various resources and from large cross-sections of the population, some hypothesis can be made for the next stages of analysis. Moreover, application aspects in teaching, learning, career progress, and social growth can be analyzed and integrated.

Narrative inquiry and cognitive-net structures

Narrative inquiry method is applied in social sciences to understand and analyze certain aspects by the narrative written by someone about the aspects of a life journey or an issue. It is now a developed field ranging in a large collection of data from various people. The narratives also have some forms of cognitive-net links described in words. Perhaps analyzing the life story by making web diagrams of connections can help to highlight the combination and differentiation aspects of the social and cognitive-net paths. This step might be useful in analyzing certain aspects of the life and work of the participants, for their own guidance and also for showing pathways to others. A narrative with words can

not be replaced by web diagrams, as both have their own focuses and styles. The web diagram format will provide some form of data in a concise form, which can perhaps also fit the style of our current world of communication and electronic media. For researchers, educators and individuals this possible set of data can be a source for analyzing career choices, life goals, and consider the possibilities to enhance achievement plans.

In the high-tech age, one possibility is to design an Internet application (App) so that people can make a summarized view of their life journey, a net of personal skills and traits, or any specific venture over a period of time: a current list of new subject and career choices, using a specialized form of web diagrams. This App may also help to see how education, skills, interests, choices of new subjects, and growing job trends and business can help to guide and prepare effectively. On the other hand it may also highlight some aspects of cognitive-net and cognitive diversity of individuals to develop possible pathways with more specific formats of understanding, along with conventional ways of working on it. Perhaps this type of visual net pattern of self skills, personal history of learning, personality traits, and conceptual traits; will help to shape paths of progress and enhance potential for personal innovation. Some guiding tools can be provided to show pathways and extend the application process. (Sounds like a ‘selfie of socio cognitive nets’!)

Designing a game to facilitate the understanding of cognitive-nets, and other forms of net

-In order to introduce school level students about the concepts and the deep levels of cognitive-net and other forms of connections between the conceptual fields and the subject scopes, a game can be designed and tested.

-The game can be designed using the pieces of plastic or cardboard or magnets

(I have conducted some experimentation with this type of game at a smaller scale using cardboard pieces and magnets, and it worked well with students to explain ideas in the context of that activity. In one of my experiments, I asked

students to reflect about the connections between various concepts, using arrow-net diagrams and lexeme cards.)

-The pieces can have the names of concept related terms, words and special shape arrows
-Students can use this game to make a pattern of connections between the subjects, concepts and disciplines of academic, social and environmental aspects
-Students can also show the change in their understanding over a period of time (such as before and after applying it).

-Various patterns made by students can give opportunity to observe the complexity of connectivity between the ideas of students to discuss and share more insights

- Along with making patterns of cognitive-nets about the core of the idea (in the inner circle), then students make cognitive-net connections/ combinations for critical thinking/ inquiry question possibilities

In the broader application, the role of nets in thinking, analyzing, applying and in research will benefit from some comprehensive research works. Perhaps it is time to write a detailed book on this topic with selected chapters written by experts of various fields! Examples include the social cognitive-nets, science education cognitive-nets, math cognitive-nets, inventions and cognitive-nets, languages and cognitive-nets, cognitive diversity. Also multiple data from a range of perspectives, along with theory, research and practice links to cognitive-nets are additional examples. It can be refined according to the available parameters to conduct research in a given environment.

Cognitive-net, cognitive diversity and Internet pathways

Human mind works with an exponential number of cognitive-net combinations to explore ideas and solve problems in many unique ways. There is interplay of multiple aspects of learning, memory use and applying the analytical mind power. In the age of Internet, a large number of human minds work closely with the patterns of information understanding from a massive body of text, and visuals; an era marked with the automation of knowledge sharing and adapting the ways in which human and computer interaction takes place with an ever-changing pace. The world of human and computer interaction makes it an interesting time in the human history to compare the patterns of cognitive-net and the Internet with a new power of the effects of the two on each other in a wider environment of information sources. This type of prospective studies will be a way to explore the inter-effects of Internet and the human mind network for better understanding. Also it will be a way to explore new discoveries applying most current research tools. Perhaps we can gain insights to embark a new field of study. The parameters of “cogno social connectivity studies” can be viewed in relation to the other works. The world of Internet is empowered with making exponential links and nets, can we empower our skills by making multiple and meaningful cognitive-nets![11] It appears that by exploring our cognitive-nets, (including inner processes like meta-cognition and outer processes like social and outer world interactions), seeing the examples of other lives, designing nets of concept formation, analyzing the underlying wisdom of certain nets and patterns, we can inspire our learning and creativity to some extent.

One way to inspire our learning and creativity is evolving around a culture for the awareness and meaningful application of making the nets of ideas, social interactions and interacting with cognitive powers (self and social frames of net). In the mega-world of the information expanding universe of internet, sometimes we make our own sub-internets for social and cognitive purposes, which may suit

our needs. In this process we are also constantly going through an evolution of adapting socio-cognitive language of human and machines.

A world vigorously communicating with human and machine nets, a world interacting beyond calculations between the symbols and transforming them to meaningful messages, has made it important to recognize various forms of visible and invisible nets around us. A time when the nets have more meanings than before, has opened new dimensions for reconnecting our education with the powers of theory, research and practice.

Cognitive journey of creative thinking

The wave of learning or a creativity journey goes through changing patterns of multiple dimensions. In our ongoing habits of going through this process we may or may not be aware of the changing paths of ideas and nets. An effective way is to see when we have to note the tracks of our creative cognitive journey and when we have to leave it to go somewhere in our world of thoughts and it surprises us on the way back with the lightening of the first seed of a new idea. In the next stages of this cognitive journey the seed flourishes in the congenial environment.

In the teaching practice it was interesting to observe during the delivery of the lesson plans when we placed an emphasis factor on creative thinking, the outcome was inspiring. The dimension of cogno-creative interactions was found useful to inspire students' creativity. One example includes that students were given the task of designing a science project with at least one creative factor in it, instead of just remaking a conventional model. Students were also introduced to the real life stories of how ordinary people (not well known scientists) were able to connect the net of ideas for making combinations of certain material objects, which led to a new invention (some examples are given previously). By expanding the mind range of creativity, the discussion among the students

ignited a passion to make something innovative, which eventually formed an interesting science project. In math, students were asked to work in groups and design a math game to facilitate the understanding of a concept of math. The cognitive journey of students while going through various stages inspired creative thinking. The learning environment to embed conceptual understanding in multiple ways extended conceptual net working of all students.

For language learning conceptual net work, students were introduced to read newspaper articles and look at the pictures carefully for a few days; they made a list of certain lexemes, which reflected their selection. Then students were asked to write a poem using those lexemes. In the next stage students shared their work and many more links were drawn by making a graphic comprehension of the new ideas flowing in the classroom. This activity brought multiple creativity thinking factors in the class, with creative variations and combinations of net of ideas. How well does our curriculum and teaching strategies incorporate the dimension of enhancing students' creativity? How often students use cogno-creative interactions? More insights can be drawn by thinking abut this aspect.

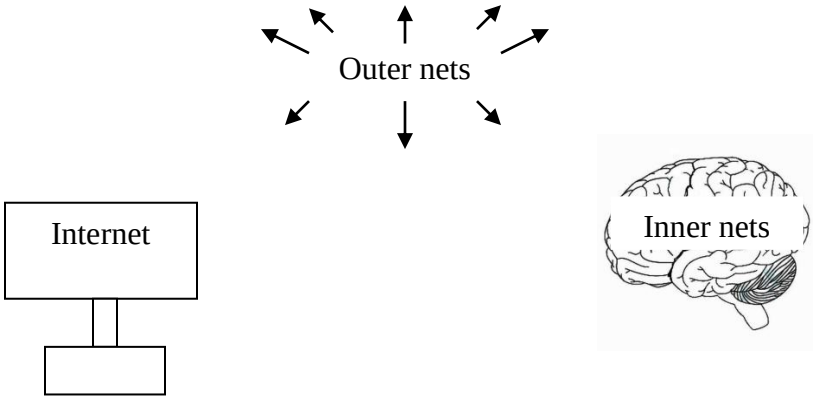
The intelligent combination of nets of ideas and making variations of nets for the workable goals can possibly transpire creativity moments. One brain with many worlds and many worlds in one brain can be inspired in multiple forms of interactions as well as forming reasonable nets.

Our current understanding of education sciences shows that in order to make a creative mind work at its best, the dimension of providing a flourishing environment is also important. An understanding of creative minds and their ways of accomplishments can be beneficial if these elements are applied properly. Children are born with mind powers that may or may not match with the nets of learning nets available to them. A flourishing pathway includes protecting our intellectual and cognitive environment (in the given limitations of the research activity).

The need to present the scholarly works with simplified language and with easy to understand pictures is one way to inspire creativity among various generations. Albert Einstein said “the whole of science is nothing more than a refinement of everyday thinking.” Some higher level encyclopaedias and dictionaries also make their children versions. Extending this way further think, can we also provide a simplified form of research journals for children? Mainstream journal articles which may have some inspiring themes for children, can be presented in simplified language with easy to understand pictures. The selection of topics with the match of students’ interest can possibly make it easy to link the conceptual paths of scholars and children minds. In some places I have experimented at a smaller level and noticed that higher elementary grade students were inspired to read the actual work of the scholars and reflected their views.

Forming a cognitive network with smart inner and outer powers

With our high level of willingness, we can make smart nets and try to achieve excellence for the desired goals in life. There is a need to research, and connect further with meaningful ideas, form magnificent cognitive-nets, and analyze cognitive diversity to open new pathways of learning. Perhaps new theories can be formed with our growing insight for multidimensional understanding of various nets.



Relativity of various nets

In order to inspire our minds about innovative and profound understanding paths, our motivation plays a pivotal role. By looking on the positive side, with strong faith and perseverance, we can make an efficient use of our faculties. Our ability to do self-talking can help to rearrange paths and nets of challenges to reach the oceans of insights. Self-talking gives a chance to make personal analysis in a safer environment of self check (a 'selfie' which is just for self) in the inner world place when we are away from our day to day demands of interactions in our surroundings. Many teachers may have observed that by keeping their students inspired and happy in learning, the accomplishments are exponential, the formation of new nets of inner and outer worlds become fascinating (on a side note, an interesting word can be *Happy-o-pathy!* happiness in education, education in happiness). Imagination of new power of imagination with our versatile creative power, desire to reach new dimensions, forming rich nets of ideas, redefining social net dimensions, making knowledge dynamic in interactions—it can also empower us to make pioneer approaches. Isaac Newton said "to myself I seem to have been like a boy playing on the sea-shore…whilst the great ocean of truth lay all undiscovered before me."

NOTES

1 There is still very limited research work accomplished on cognitive diversity styles. The work of Maria Catherine Schilpzand of 2010 from Georgia Institute of Technology *Cognitive Diversity and Team Performance: The Roles of Team Mental Models and Information Processing Mechanisms* shows data along with some detailed discussion on this topic. The links between human cognitive diversity and the history of science have some fascinating patterns. There is a need to explore this dimension of cognitive activity from multiple perspectives. Stephen Lenhart of the University of Arizona has published a detailed research work on this idea in the year 2011, under the title *Cognitive Diversity and the Progress of Science.*

2 Carlin Flora and Dean Simonton have conducted extensive studies on this topic. They have also researched about the Nobel Prize winners. They have also discussed the ability of some people to work with visuals in their mind. For details the magazine *Discover* 2011, winter, page 3 provides interesting comparisons. Robert Weber has discussed the habit of Albert Einstein in his book *Pioneers of Science, Nobel Prize Winners in Physics*, Page 64. It is a way in which Einstein thinks in ideas and diagrams and shares his thoughts later in words.

3 Ronald W. Clark in his work *Einstein The Life and Times*, published in 1982, page 27 and 28, has discussed about the young Einstein surroundings and influences, including a magnetic compass given by his father and intriguingly Einstein made links to how the needle stays in the same direction, so something from space is doing this. The passion of violin by his mother and Uncle Jakob played to hunt for an animal and then named it when found, as an analogy for Algebra, finding the value of the unknown. A comprehensive analysis is difficult to make but some insights can be drawn on making connection of ideas.

4 The changes to our jobs and economy are coming at an astonishing rate. Carl Benedikt Frey and Michael A. Osborne have discussed this challenge in their paper *The future of employment: How susceptible are jobs to computerisation*, published on September 17, 2013.

5 The change in our economy and subject study pattern is now bringing challenges for our universities. More details of this issue are discussed by some experts in an article *The future of universities*, The Economist, June 28, 2014.

6 Many authors have considered the links between the higher-order thinking and the transfer of knowledge and skills. Susan Bookhart has also discussed this notion in the book *How to access higher-order thinking skills in your classroom,* with many examples and arguments. It is also important to consider that in order to make certain inventions and reach remarkable conclusions; the human mind needs to work with the higher-order thinking as well as the lower-order thinking. One can question, is it not so that the thought process and learning goes to both levels frequently. Perhaps it is also like a complex net of ideas which have various ways of interconnecting and disconnecting links, to reach the required results. More research is needed to explore these nets of cognitive levels and human ways of learning. The need to explore the ways of nets of thinking interacts and the ways of reaching certain commonly known hierarchies can also provide some useful results.

7 Modern neuroscience tools are helping to study the activities of what our brain does during sleep. A detailed article was published in the magazine TIME, *The Science of You*, page 98, July 2013.

8 Some examples given in the *Encyclopedia of Creativity,* volume 2. Page 494, Academic Press, 1999 indicate that creative and insightful moments come like a flash. Margaret A. Boden has discussed more examples in the book *The Creative Mind: Myths and Mechanisms.*

9 The rise of interconnecting studies of subjects is coming in various combinations. *Maclean's* magazine has referred in an article about the Ivy League level program in spiritual psychology, in the issue of April 13, 2015.

10 The research on nature of science (NOS) has collected data about how science is taught and presented in our learning environments. The categorization of NOS indicators has slight variations by various authors. Some forms of NOS seem to be somewhat overlapping, for example "science as a way of thinking" and "science as a way of investigating".

11 It is interesting to discover that some diagrams of neocortex in the study of National Institutes of Health look like grids and nets. How research studies will show links to these nets and comprehensive human activities remains a work in progress. A connectome refers to a comprehensive map of neural connections, more like a wiring diagram. Also according to the *The Brain—The Ultimate Guide*, now scientists are not just looking at one particular area of brain but also analyzing the multi-level circuits which connect our areas of brain. The importance of nets is gaining interest in research.

APPENDIX

1+100=101
2+99=101
3+98=101
4+97=101
5+96=101
6+95=101
7+94=101
8+93=101
9+92=101
10+91=101
11+90=101
12+89=101
13+88=101
14+87=101
15+86=101
16+85=101
17+84=101
18+83=101
19+82=101
20+81=101
21+80=101
22+79=101
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83+18=101
84+17=101
85+16=101
86+15=101
87+14=101
88+13=101
89+12=101
90+11=101
91+10=101
92+9=101
93+8=101
94+7=101
95+6=101
96+5=101
97+4=101
98+3=101
99+2=101
100+1=101

[101 multiply by 50= **5050**]

The sum of all numbers from 1 to 100 is 5,050. This is one way of making a net of numbers in mind to solve this question.

Imagine how we can inspire our minds to make some innovative nets of numbers and the nets of ideas to inspire our creativity.

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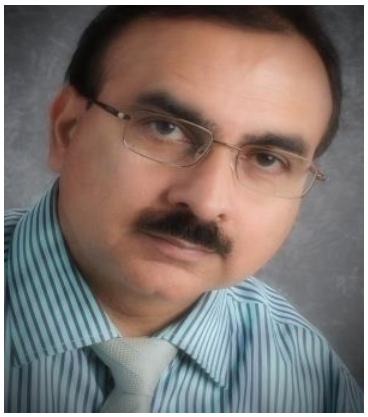

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