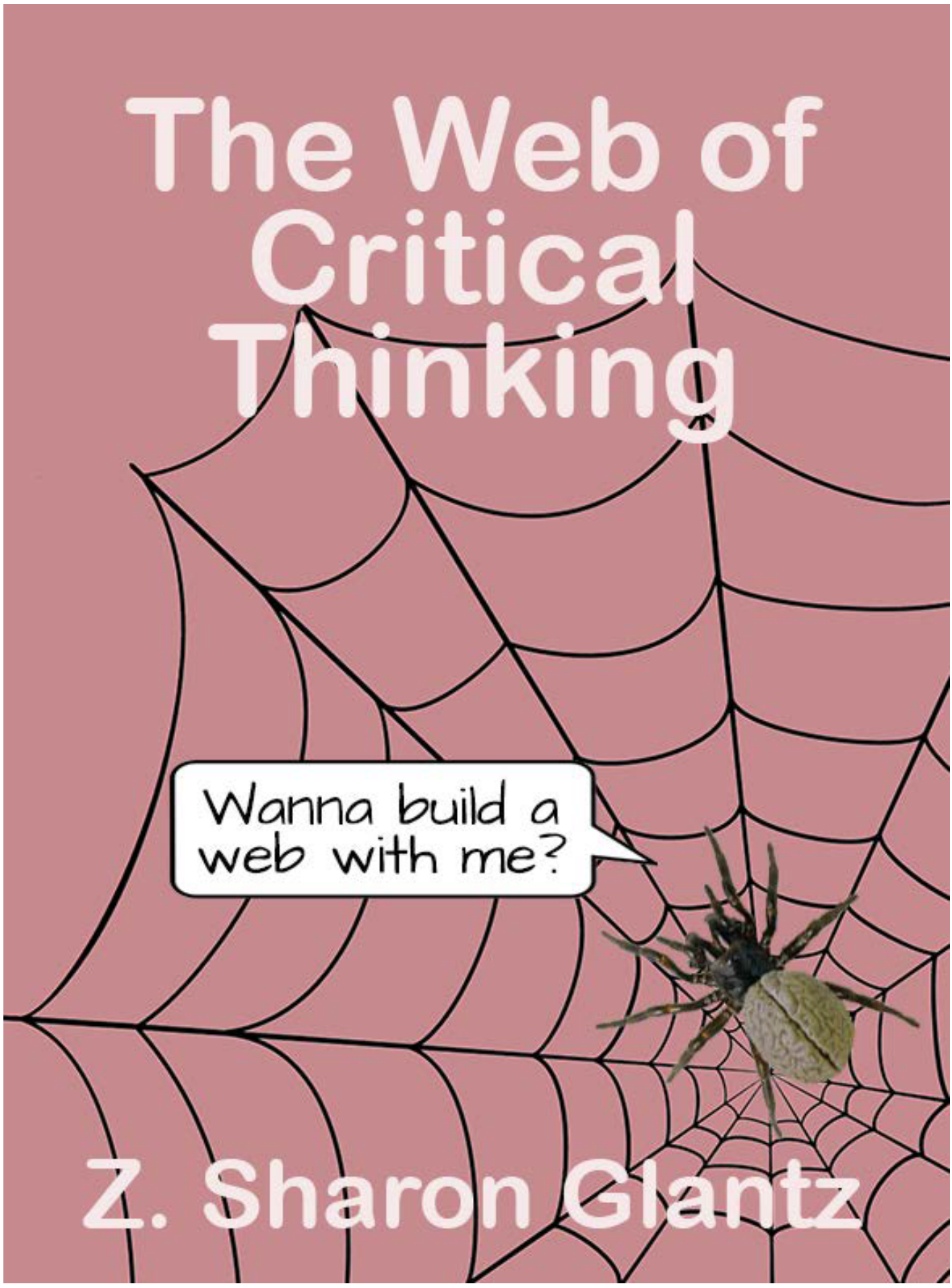
The Web of Critical Thinking



Z. Sharon Glantz

INTRODUCTION

The Dramafied Web of Critical Thinking is process of developing critical skills using visual learning tools that can be applied to all areas of study and geared towards learners entering higher education. Comics help identify the characteristics of the critical thinker and demonstrate strategies for developing critical thinking skills through the drama of the characters; thus the use of the word “dramafied.” Although presented in a linear progression, the Dramafied Web recognizes that learners who have grown up using the internet have a cognitive flexibility that supports nonlinear thinking, multidirectional research and the interconnectedness of knowledge. Each step of learning the Dramafied Web is supported by models presented visually to give learners a deeper understanding when developing their skills. The use of visual tools assumes a future of educational technology that seamlessly integrates media into pedagogy and curricula.

CRITICAL THINKING IN EDUCATION

Critical thinking is an advanced level of mental activity based on reasoning and a crucial tool for learning and leading a valuable life. (Phrakhruvisitpattanaporn 2012) Diane F. Halpern (2014) suggested critical thinking is more than thinking about thinking, but a conscious process defined as:

> … the use of those cognitive skills or strategies that increase the probability of a desirable outcome. It is used to describe thinking that is purposeful, reasoned, and goal directed—the kind of thinking involved in

> solving problems, formulating inferences, calculating likelihoods, and making decisions, when the thinker is using skills that are thoughtful and effective for the particular context and type of thinking task.

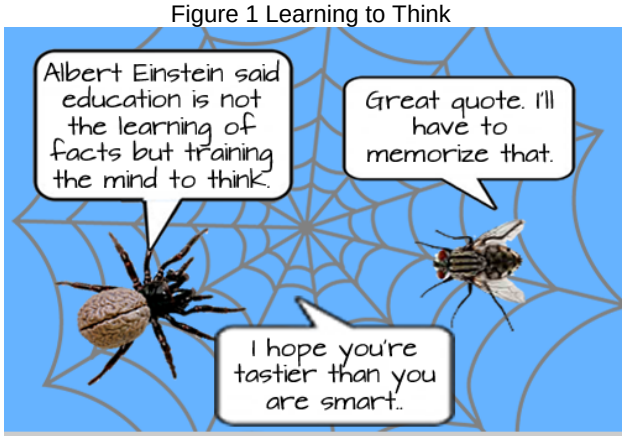
In learning, the meaning of “knowing” has changed from being able to recall information to being able to find and use information. (Simon 1996). Due to advances in the internet and other media, greater amounts of information are available for consumption. Evaluation and effective use of that information requires critical thinking and cannot be separated from how learners view their information universe. (Weiler 2004) Additionally, people tend to gravitate toward prejudice, over-generalization, common fallacies, self-deception, rigidity and narrow-mindedness (Paul 1997). Critical thinking skills overcome these problems in thinking by retraining the intellect.

Common Core Standards (2009) used by a majority of the states focus on helping early learners develop critical thinking skills. However, in 2011, the Collegiate Learning Assessment (CLA), a standardized assessment that measures critical-thinking skills in traditional colleges, showed that 45% of the learners in the study demonstrated no significant improvement in critical thinking, complex reasoning and writing during their first two years of college. The Dramafied Web supports the learning of critical thinking for learners of this age bracket.

VISUAL LEARNING

The internet and other media reinforce visual learning and can support skills development in critical thinking. The importance of images and visual media in contemporary culture has changed what it means to be literate. (ACLR 2011). In the past, shortcuts to understanding complex ideas relied upon narrative, metaphors, analogies and other literary tools. Graphs, charts and other representations of data continue to be central to presenting supporting evidence. Today, visual imagery serves a similar purpose. When a thought is expressed as an image, object or text presentation, that thought is understood in a deeper sense. Real learning happens when the ideas are not simply expressed in the form in which they were originally delivered, but also in new and varied forms. (Gwanger 2009)

Figure 1 Learning to Think



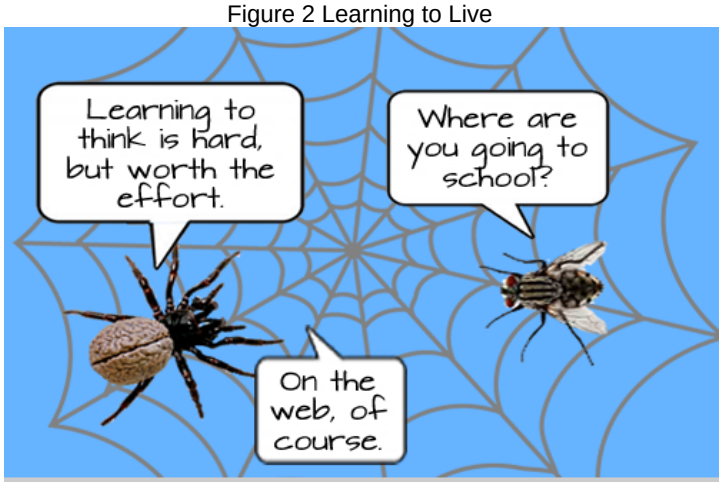
EDUCATIONAL TECHNOLOGY

Educational Technology (edtech) is the future and relies on both visual and verbal learning. Learners require both visual and verbal thinking skills and need explicit

practice to represent, interpret and manipulate the visual aspects of their knowledge in multiple forms. (McLoughlin 2001) Coming of age in an environment saturated by technology where the digital world interacts more and more seamlessly with the "real" world means that the learners of today are accustomed to seeking and building knowledge in a technology enhanced environment. (Casares 2011)

Online learning, in particular, is touted a key delivery mode that will address the majority of the drivers of change. However, the current usage of edtech is fragmented and is reminiscent of the early days of the internet when making pretty was a novelty and enough to attract and engage visitors. Edtech requires new pedagogy that uses visual learning tools to capitalize on how the internet has altered the way learners think, obtain and use knowledge, whether they are in a traditional classroom, blended classroom or studying online.

Figure 2 Learning to Live



Spyder was somewhat reclusive and very busy keeping alive. However, he figured if he could think better, survival would be easier.

COMICS AND GRAPHIC NOVELS

Comics and graphic novels have become a useful tool in the classroom. They do not happen in the words or in the pictures, but somewhere in-between in what is sometimes known as the marriage of text and images. (Sabin 2010). Using comics in education has particular benefits to learners: (Yang 2008)

Motivating. Pictures spark the attention of learners and put a face onto complex ideas.

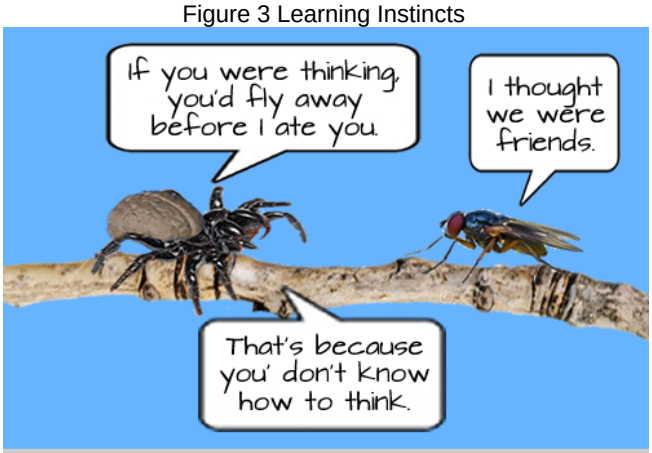
Visual. As journalist Tess Flanders said in 1911, a picture is worth a thousand words.

Permanent. Like text, comics are static, allowing learners to control the pace and pattern in which they internalize new knowledge.

Intermediary. Comics bypass resistance to embracing new knowledge and offer inspiration and confidence for more challenging texts.

Popular. Graphic textbooks are considered a serious genre in literature, especially as more of them are turned into films.

Figure 3 Learning Instincts



Spyder felt sorry for the fly. It had misunderstood kindness for friendship. Learning to think was changing how he acted on his instincts, but only to a certain extent.

Comics are an effective teaching tool. As visual shortcuts they help learners understand complex ideas quickly and efficiently. The characters put a face on ideas and can give voice to learners' concerns as well as address the emotional struggles that occur when enhancing critical thinking skills. The stories told will sustain the attention of learners and provide a through-line for coursework to better assure retention and completion. The dialogue in comics emphasize the power of language in the context of argument.

CRITICAL THINKING CHARACTERISTICS

Before engaging in the process of critical thinking, learners need to cultivate the characteristics of a critical thinker. These characteristics point to strategy and intention as opposed to qualities and abilities. Therefore, anyone can develop these characteristics.

Table 1 is a sample that gives learners a list of critical thinking characteristics. Spyder is a spider with a human brain who wants to develop critical thinking skills. He associates the characteristics of a critical thinker with those of a spider. In contrast, the fly demonstrates the thinking of someone who lacks critical thinking skills.

Table 1 Characteristics of a Critical Thinker

Intellectual Humility. Critical thinkers recognize there are limits to their current knowledge. They research and synthesize new information, giving credit where credit is due. They are also aware of the biases and prejudices that shape how they think and seek ways to remedy their ignorance to assure better thinking outcomes.

Even with eight eyes, I can't see everything and I know there is so much more to see! I'm a bit near-sighted so I have to see things up close. I think about what I see and then seek out more because there's so much more to know that I don't yet know.

Truth and Honesty. Critical thinkers are willing to consider ideas that may undermine their self-interest. They follow the evidence wherever it leads but recognize how context can shape the truth. They recognize that being truthful and honest requires ongoing self-monitoring and a willingness to modify their thinking strategies.

The hair on my legs helps me smell, touch and sense vibrations so I know the truth of my surroundings. I can't pretend to be anything other than who I am because I wear my skeleton on the outside of my body.

Systematic. Critical thinkers determine a strategy for collecting new knowledge so they can see an issue from differing points of view. Not all critical thinkers use a linear approach or a hierarchical structure to organize and understand new knowledge, but they do find systems that work to support their unique ways of thinking to integrate and synthesize that knowledge.

Because I only eat liquids, I spray digestive juices on my prey before consumption. So no, I don't bite. This process tells me a great deal about what I'm putting into my body. I'm very particular about that.

Courage. Critical thinkers pursue knowledge beyond their comfort zone. This process can be scary and provoke strong emotions. However, they are brave enough to meet these emotional challenges, confront difficulties and overcome obstacles even in opposition to others. They know that thinking can be risky and dangerous, and are willing to do what is necessary.

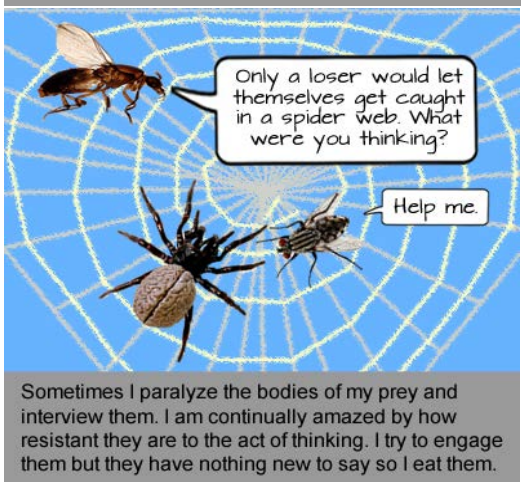
Perseverance. Critical thinkers recognize that confusion, ambiguity and unsettled questions are part of the critical thinking process. They are willing to move forward, backtrack and reshape their claims and arguments. They develop incubation strategies to let their ideas grow and to synthesize old and new knowledge. They know there are no easy answers and do the work accordingly.

Open-Minded. Critical thinkers value conflict and disagreement. They pay attention to their emotional reactions but do not allow them to distort the evidence that supports differing points of view. They recognize that sometimes they either have to accept ambiguity and paradox or reach for a bigger idea that brings opposing ideas together. They know that committing to beliefs doesn't mean they can't be open to changing their minds.

Mental Flexibility. Critical thinkers make calculated decisions as part of categorizing or synthesizing new knowledge. However, they also need the agility to regroup or reorganize what they know. Letting go of untrue or unworkable knowledge and thinking learned in early childhood is challenging. Critical thinking skills make the process easier.

Empathy. Critical thinkers not only learn to think from other points of view, but understand the emotions behind those thought processes. They put themselves into the hearts and minds of those who think differently. The insights are both mental and emotional. Empathy also requires skills in setting boundaries and separating thoughts from feelings.

Reasoning. Critical thinkers make a claim, find evidence, make arguments and draw conclusions. Sometimes they collect data and apply formulas. Other times they create models based on theories. They foresee the possible consequences of adopting a particular point of view. Both logic and experience contribute to their analyses.



Self-Confidence. Critical thinkers know that the process of critical thinking will eventually produce results. Their confidence in the process reinforces their self-confidence, especially during periods of chaotic thinking, confusion and frustration. They learn to trust that their mental and emotional intelligence will help them embrace and synthesize the knowledge needed to support the critical thinking process.

A pencil thick piece of my silk could stop an airplane -- that's how strong it is. I know that wherever I go, I will find a place to build a secure home. With that sense of security I feel more confident about venturing outside my comfort zone into the unknown.

Integrity. Critical thinkers are true to their own way of thinking yet hold themselves to a high standard of producing evidence to support their claims. They will admit to discrepancies and inconsistencies and modify accordingly. They are less interested in winning or being right and more committed to meaningful discourse and making an impact.

I'm so strong, I can carry 170 times my body weight across the ceiling. However, I know that being strong is not the same as having strength. I have learned to cultivate wisdom to assure what I do is correct.

Balance. Rather than struggling between right and wrong, good and bad, black and white, critical thinkers seek a balance between seemingly opposing ideas. They also seek resolution and a means of synthesizing or bringing ideas together in a new way. They recognize that critical thinking is not a race to righteousness, but a way of finding meaning.

When needed, I can live underwater for days at a time, although I'd rather not. I've learned how different environments affect how I live and travel. I make the necessary adjustments so that my needs are met.

Intellectual Maturity. Critical thinkers possess the wisdom that comes with experience. They understand that a problem can have many solutions, some of which may seem to contradict each other. They resist simplistic notions, and avoid drawing conclusions when the evidence is incomplete. They take the time to assure they are thorough.

When spiderlings hatch from eggs, they only look like adults, but they are babies and many die for silly reasons. I had to learn about the complexities of the world to protect and feed myself. There's nothing simple about survival.

Intellectual Autonomy. Critical thinkers learn to think for themselves and take command over their thought processes. They are committed to analyzing and evaluating based on logic and reason. They question when it is rational to question, believe when it is rational to believe, and conform when it is rational to conform. Otherwise, they make their own way and think their own thoughts.

Every now and then, I grow a second exoskeleton and have to burst through the old one. Although I am very vulnerable at that point, I become a newly realized singular me! I love thinkiing for myself.

The characteristics from Table 1 serve as a jumping off point for learners. They get to know the a little about the character of Spyder and the Fly. At this point, they may find they better understand the Fly's point of view but as they learn the Dramafied Web of Critical Thinking, the alliance will shift. Revisiting this information after exploring the Dramafied Web will help learners better identify how their critical thinking skills have evolved.

THE DRAMAFIED WEB OF CRITICAL THINKING

The Dramafied Web of Critical Thinking brings together traditional critical thinking procedures, models of thought and visual learning. Comics are designed to help learners understand and overcome their resistance to expanding and synthesizing the new knowledge that will serve as evidence when making the arguments and drawing conclusions that support a claim. The supporting models are examples of materials that reinforce each step. Interactive games and writing exercises are necessary to the process. The Dramafied Web is best used with the goal of writing an essay because the thinking processes are similar.

THE NONLINEAR WEAVING OF THE DRAMAFIED WEB

The Dramafied Web is presented in a linear format but recognizes that the learners of today often think in a nonlinear fashion. Most learners are comfortable following hyperlinks and move forward in multiple directions rather than in one direction. They use nonlinear thinking to focus on what is of key importance in the material they examine, connecting concepts with prior knowledge (Lambert 2008). The Technical Report 441 of the Center for the Study of Reading suggests that cognitive flexibility is needed to successfully acquire and integrate new knowledge and requires approaches to learning and instruction that:

a) allow an important role for multiple representations
b) view learning as the multidirectional and multiperspectival “criss-crossing” of cases and concepts that make up complex domains’ “landscapes” (with interconnectedness and multiple dimensions)

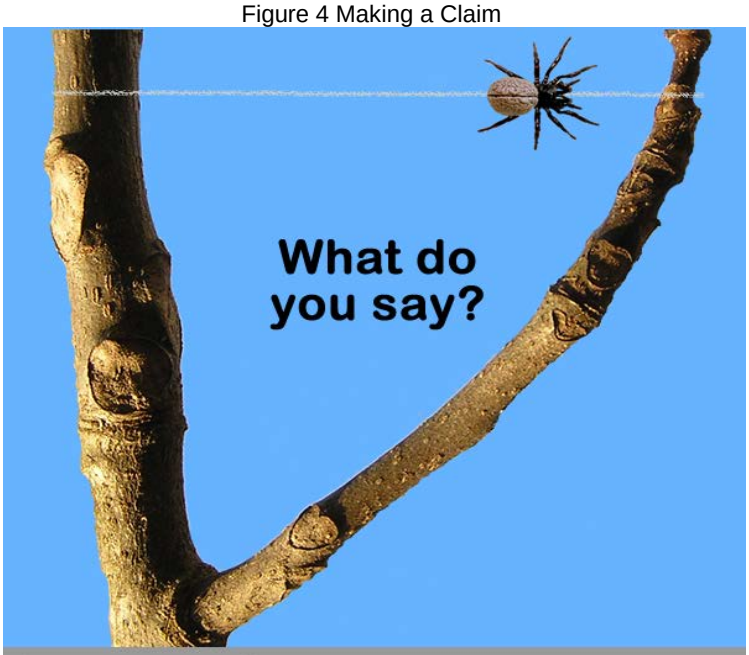
c) foster the ability to assemble diverse knowledge sources to adaptively fit the needs of a particular knowledge application situation (rather than the search for a precompiled schema that fits the situation)

Education has been traditionally been based on linear thinking models and styles due to the influence of the Newtonian cause-effect analysis. The Dramafied Web supports logic and reductionist thinking as well as building knowledge through interconnectedness and the recognition of context. The business environment is strongly nonlinear due to its increasing complexity (Bratianu 2009). Therefore, reinforcing the use of nonlinear thinking supports future success.

In learning the Dramafied Web, learners move forward and back through the steps, modifying and reshaping their arguments, evidence and even their claim. However, they are also required to invest in each step they take. This may require later discarding research and work product that doesn't fit. The willingness and ability to let go of work produced requires practice, training and skills development.

STEP ONE: MAKE A CLAIM

Figure 4 Making a Claim



Spyder takes a leap of faith and builds a bridge between two points to anchor his thinking. His claim is two-dimensional in that he is less concerned with making a point and more interested in the strategic thinking it will take to find his forever home.

The first step in critical thinking is making a claim. The claim is a thesis statement that brings together ideas. The claim will be argued by facts that serve as evidence. However, claims are beliefs or opinions about the ramifications of facts that are arguable and, in some cases, provable. While moving through the process of using the Dramafied Web, learners may find they need to go back to adjust or modify their claim.

Figure 5 Spyder's Claim

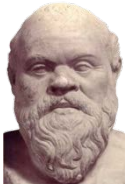
Western and Eastern Thought and Learning

Strategies in thinking differ within and between cultures, and condition how learners make a claim. There is nothing definitive about these differences and they tend to overlap and complement each other. Understanding the historical basis of western and eastern philosophies of thought offers insight into effective strategies for critical thinking.

Socrates and Confucius

Socrates and Confucius were each fundamental to establishing philosophies of thought. Socrates (469–399 BC) was a Greek philosopher and the main source of western thought. He didn't write down his philosophies; they were translated by his students, including Plato. Confucius (551–479) was China’s most famous teacher, philosopher, and political theorist, whose ideas influenced civilizations in East Asia. The popularity of his strategies of thought ebbed and flowed following his death. The approaches of Socrates and Confucius to thinking and learning contrast as follows (Tweed 2002):

Table 2 Socrates and Confucius Regarding Learning

 SOCRATES	 CONFUCIUS
ASKING QUESTIONS demonstrates superior thinking because of a willingness to show ignorance.	USING BEHAVIORAL REFORM ensures individual success and societal harmony through virtuous behavior.
FOCUSING ON ERROR TO EVOKE DOUBT is a basis for further research and the first step in attaining knowledge.	FOCUSING ON EFFORTFUL LEARNING requires practice and single-minded effort which are instrumental to success.
EVALUATION requires asking successively deeper and more probing questions and analyzing the answers.	PRAGMATIC LEARNING relates to higher thinking skills and self-improvement, including becoming more virtuous and more skilled.
SEARCH FOR KNOWLEDGE, NOT TRUE BELIEF assumes knowledge goes beyond accuracy in beliefs; knowledge includes possessing rational justification for those beliefs.	RESPECTUL LEARNING means learning from individuals whom the collective recognizes as exemplars and from the ancients whom the collective recognizes as even greater exemplars.
ESTEEM FOR SELF-GENERATED KNOWLEDGE suggests truth is neither prescribed by authority figures nor socially negotiated; rather, it is found by the self.	THE ACQUISITION OF ESSENTIAL KNOWLEDGE requires acquiring and transferring knowledge rather than expressing personal hypotheses and innovating or criticizing without extensive preparatory knowledge.

These differences are also conditioned by logistics, media exposure and other factors. However, tendencies and strategies based on the work of Roger Nisbett (2003) include:

Table 3 The Differences and Ramifications Western and Eastern Thinking Strategies When Making a Claim

	WESTERN THINKING SPYDER	EASTERN THINKING SPYDER	DIFFERENCES AND RAMIFICATIONS
ATTENTION			Eastern thinkers are comfortable making a claim before collecting evidence because they are trained to initially look at the big picture. Western thinkers prefer to collect evidence before committing to a claim

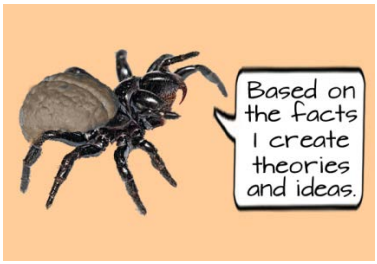
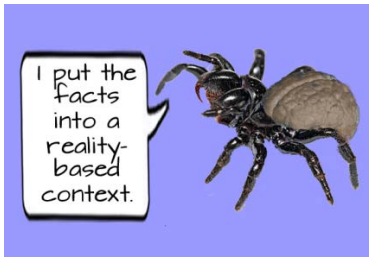
CONTROL			Western thinkers are more willing to make innovative claims because they believe they can control the outcome. The claims of eastern thinkers tend to build on what has been successful in the past.
EXPLANATION			The claims of western thinkers take a dualistic approach that looks at the cause and effect on events. Those of eastern thinkers more likely recognize the mitigating factors that condition the claim.
ORGANIZING STRATEGIES			Western thinkers tend to make claims with a look towards facts and data. Claims of eastern thinkers tend to focus on the interconnectedness and relationships between the facts, data and ideas.
REASONING			Western thinkers are inclined to use abstract thinking and their claims are not necessarily practical. Eastern thinkers will make claims based on plausibility and will include experiential data.
ARGUMENT			Western thinkers tend to make claims that are true or false with a focus on contradiction. Eastern thinkers tend to look to reconciling opposing points of view with the goal of understanding connection.

Table 3 shows broad generalizations that vary with each individual learner regardless of cultural background. Neither is better than the other as noted by Nisbett (2003):

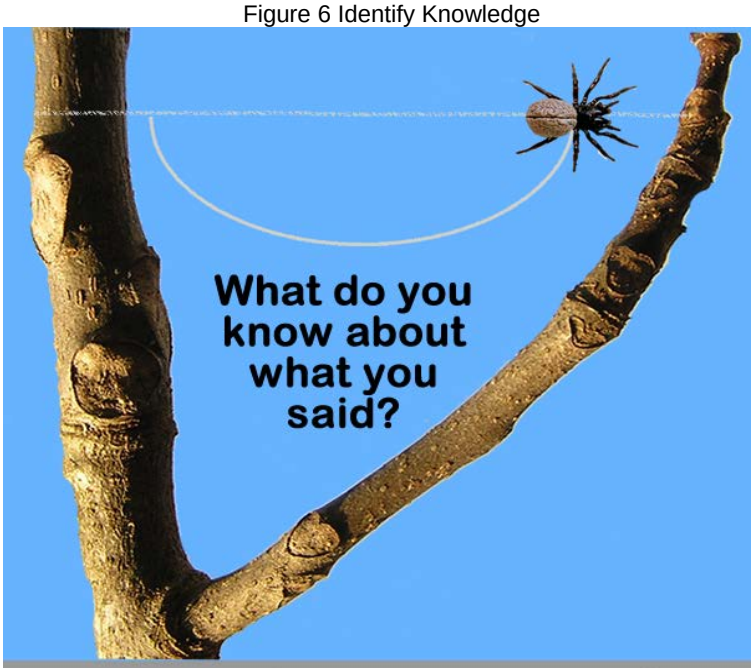
> A Western thinker has said that “if the universe is pretzel-shaped, then we must have pretzel-shaped hypotheses.” True enough, but if we start with a pretzel-shaped hypothesis, the universe had better be pretzel-shaped or there’s no chance we’ll find out just what shape it *is*. For any shape other than a pretzel, you’re better off starting with a straight line and modifying it as it becomes clear that the linear hypothesis is too simple. Asians are surely right in their belief that the world is a complicated place and it may be right to approach everyday life with this stance. In science, though, you get closer to the truth more quickly by riding roughshod over complexity than by welcoming onboard every conceivably relevant factor.

For some learners, making a claim is overwhelming because they don't know what they don't know. The Dramafied Web encourages learners to move forward and back through the steps and gives them permission to adjust or modify their claim until it is clear and can be supported by the evidence and arguments made. Regardless, initially committing to a claim is vital to starting the process of critical thinking.

Spyder's initial claim is: There is a perfect tree for building my web. Given the mitigating circumstances of life span and environmental conditions, the claim itself may not be workable. As he moves forward and back through the steps of the Dramafied Web he will better understand the claim he really wants to make and support it effectively. However, his commitment to this claim is a way of initiating the critical thinking process.

STEP TWO: IDENTIFY KNOWLEDGE

Figure 6 Identify Knowledge



The loose thread carries Spyder's current knowledge and beliefs. The thread is loose because he is still unsure which knowledge and beliefs will support his claim. He thinks about what he knows, how he feels about what he knows and what he thinks he needs to learn.

Having committed to a claim, the next step is for learners to determine what they know and what additional knowledge they need to support their claim. Knowledge includes facts, data and the research of others, as well as personal experience. Recognizing opinions, biases and emotional baggage related to the claim is valuable but isn't always easily accessible. With practice, learners find ways of thinking about how they feel. Some will be comfortable using thinking models to understand emotional triggers; others will need to move forward through the Dramafied Web until their emotions surface in a way they can better identify and understand them.

The Model of the Six Thinking Hats

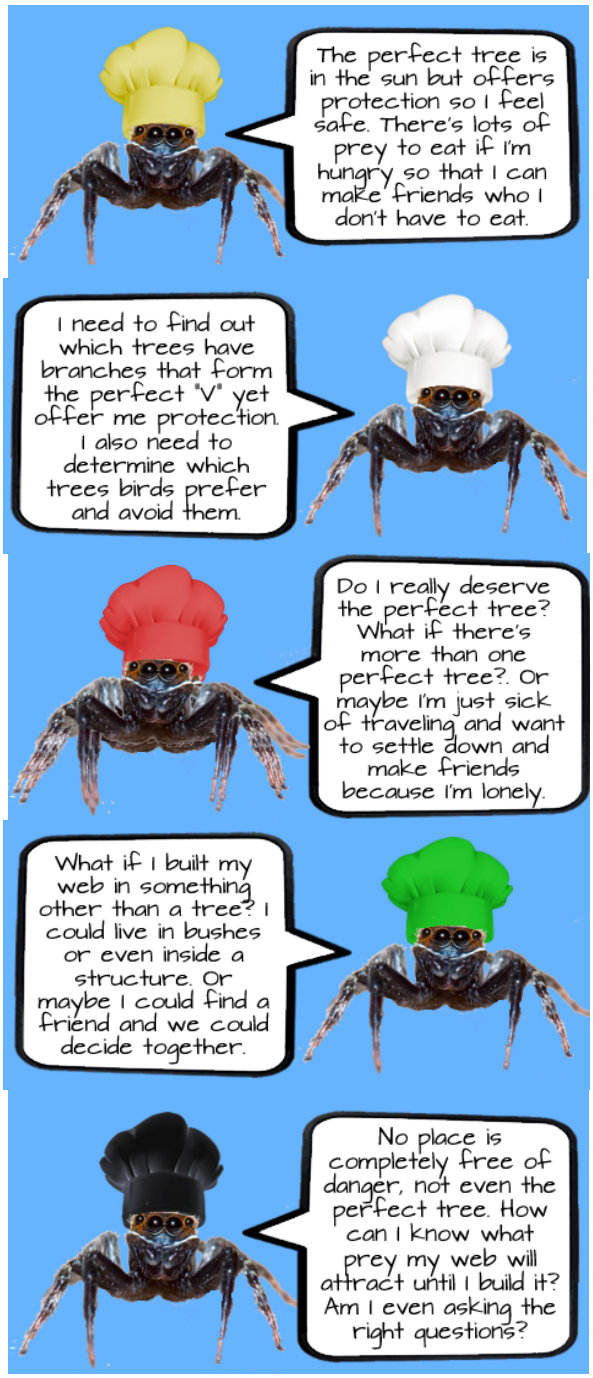
The model of the Six Thinking Hats (de Bono 1999) has proven effective for both teams and individuals for managing the confusion that comes from the mental and emotional challenges of thinking. Learners delineate how they think and feel by wearing different hats. They discern what they know, the tools they possess and

begin to identify what additional research they will need to perform to build effective arguments that support their claim.

Table 4 The Six Thinking Hats

FOCUS	THINKING STRATEGY
VALUE	The yellow hat reinforces an attitude of hope and positivity during the thinking process. Some ideas may not be logical, but the concept behind those ideas can be valuable and can be developed in a different way. Wearing this hat embraces the joy of thinking.
FACTS	When wearing the white hat, learners focus on the facts, data and information that is known or needed. They seek sources that will fill in knowledge gaps. They wear this hat when performing research and integrating new information.
EMOTION	The red hat is less a choice and more an acknowledgment of gut reactions, intuition and emotion. Learners think about how they feel without justification or explanation. Wearing this hat offers insight into the learner's commitment to thinking.
CREATIVITY	When wearing the green hat learners generate new ideas or they alter their perceptions as a way of escaping old paradigms. This can start by looking at alternative points of view or trying on different belief systems to inspire creative thinking and innovation.
CAUTION	The black hat focuses on the weaknesses and errors in thinking. This means considering problems that need to be resolved and obstacles that need to be overcome. Learners contemplate the worst possible scenarios and question the questions they are asking.

SPYDER THINKS ABOUT THE PERFECT TREE FOR BUILDING HIS WEB



PROCESS	When wearing the blue hat, learners take a step back to think about thinking. They recognize that their unique methods of thought may not always serve them and put this hat on when their process of thinking interferes with manifesting results.

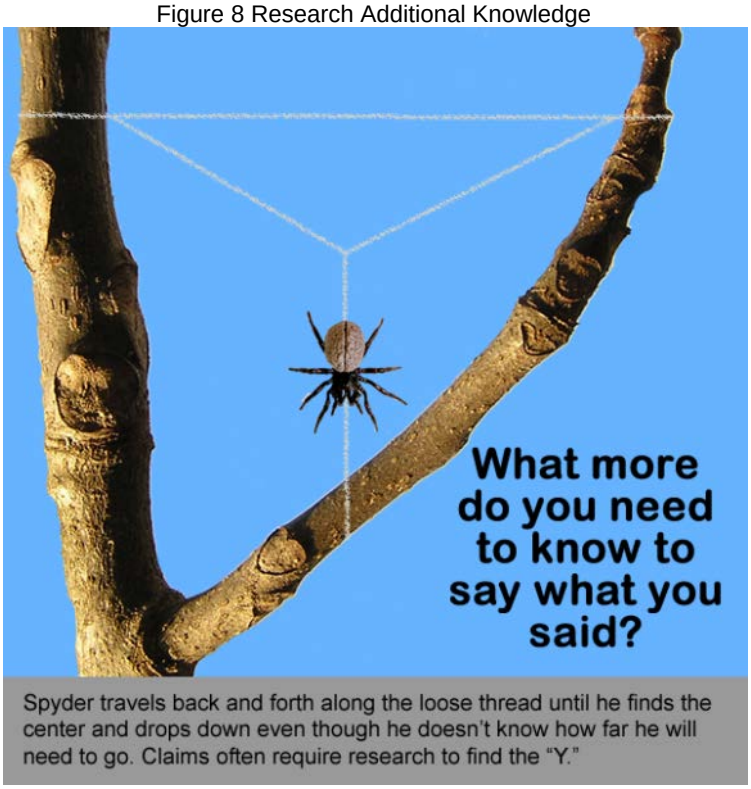
This second step is an opportunity for learners to celebrate what they know and what they have learned through study and experience. It can also offer a daunting view of what they have yet to learn and like Spyder they may need to revisit their claim.

Figure 7 Spyder Revises His Claim

Modifying the claim at this point can clarify so that learners can effectively move forward or it can create a feedback loop of thinking due to the obsessive need to articulate the ideal claim. Some learners get stuck at this stage because they don't know what they don't know and will need to venture into the unknown to collect new knowledge. At this point in using the Dramafied Web, their only option is to take a leap of faith and move forward. Learners discover that critical thinking means periodic states of confusion and learn to trust themselves and the process.

STEP THREE: RESEARCH ADDITIONAL KNOWLEDGE

Figure 8 Research Additional Knowledge



Most learners have grown up with technology that offers easy access to research via computer or mobile devices. They have developed individual organizational systems for social media, photos and searching the internet. They will use these same systems when performing research to support their claim with the added need of citing their sources to assure they are credible.

Given the plethora of research resources does not necessarily make it easier for learners to know what information they need to support their claim, especially when pursuing complex ideas. Part of critical thinking skills development is learning how to synthesize and organize the information in an effective way that may mean altering their pattern and practice from prior experience. The model of Socratic Questioning offers strategies that support focused research.

The Model of Socratic Questioning

The model of Socratic Questioning helps learners manage complex ideas, correct misconceptions and leads to a more reliable construction of knowledge. (Paul 2007) Although primarily a teaching strategy, Socratic questioning can help learners determine how to supplement their knowledge to reinforce their arguments with evidence to support their claim.

Table 5 Socratic Questioning

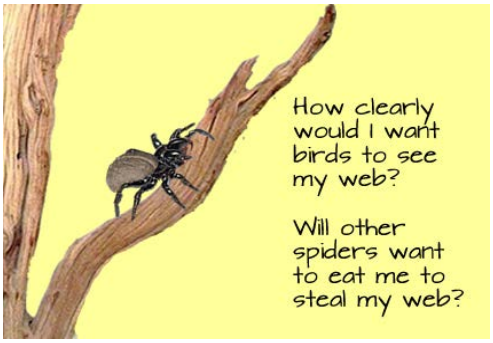
TYPE OF QUESTIONS	STRATEGIC THINKING	SPYDER ASKS HIMSELF QUESTIONS ABOUT HIS CLAIM THAT THERE IS A PERFECT TYPE OF TREE TO WEAVE HIS WEB
QUESTIONS THAT SEEK CLARIFICATION	The first series of questions learners ask helps them assure that their claim is clear and will be understood by themselves and others. They may think they are making one claim when they are really making another. They learn if their claim includes fallacies that may indicate bias. In some cases the research itself may help clarify their claim.	
QUESTIONS THAT PROBE PURPOSE	Learners need to ask themselves what motivated them to make their claim. The reason may be anything from the personal to the existential. Answering these questions helps them focus their research in a way that serves their original purpose. Knowing their intention shapes how they approach collecting new knowledge.	
QUESTIONS THAT PROBE ASSUMPTIONS	These questions ask learners to think about their opinions and beliefs. They think about why they think the way they do and how it compares with the way others think. Certain opinions and beliefs shared with others may be appropriate to use as foundation for reasoning. Seeking to prove or justify them is another way of focusing research.	

QUESTIONS THAT PROBE INFORMATION, REASONS, EVIDENCE AND CAUSES

Learners are asked to not only collect facts and data, but to synthesize and integrate that information to create the evidence and causes for the arguments that support their claim. They may be surprised by how new knowledge shapes their reasoning and discover better ways of expressing why they are making their claim.

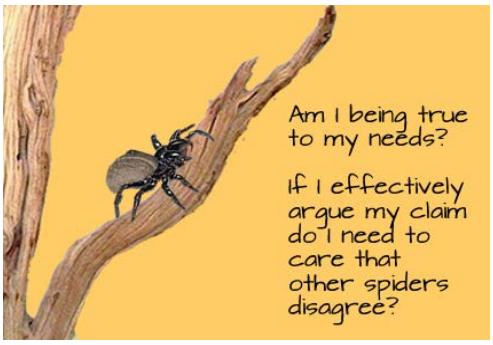
QUESTIONS THAT IDENTIFY VIEWPOINTS AND PERSPECTIVES

Knowledge can be integrated or synthesized in various ways, offering differing viewpoints or perspectives. Understanding different points of view forces learners to deepen their research to assure their evidence and arguments address the differing perspectives when supporting their claim.



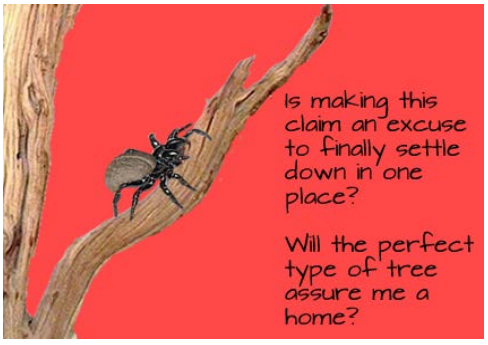
QUESTIONS THAT PROBE IMPLICATIONS AND CONSEQUENCES

Pursuing an understanding of the ramifications of a claim gives learners deeper insight into their assumptions, opinions and beliefs. When the answers to these questions corrupt an argument, learners may need to perform more research to justify their claim. However, provoking disagreement in others can inspire thinking.



QUESTIONS THAT ASK ABOUT THE QUESTION

Based on research and the answers to the prior questions, learners review and possibly modify their claim. They revisit their motivation for making the claim in the first place and think again about the underlying assumptions, opinions and beliefs. They consider the complexities of their claim and strategize their thinking accordingly.

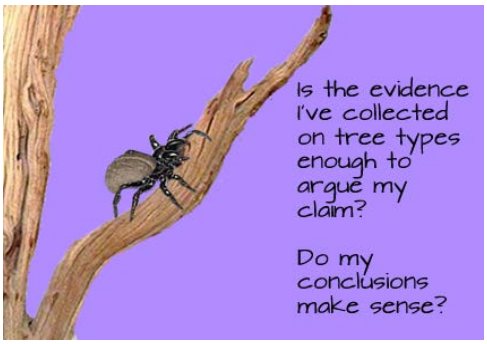


QUESTIONS THAT PROBE CONCEPTS

Learners are asked to step back and consider the big picture behind their claim and use abstract thinking to reinforce their arguments. They look at what constitutes opposition to their claim and how those opposing ideas can be resolved within their arguments supported by reasoning and the evidence they have collected.

QUESTIONS THAT PROBE INFERENCES AND INTERPRETATIONS

Learners interpret the evidence and identify the inferences in their arguments so that they draw conclusions that contribute to their claim. They also consider other conclusions that could have been drawn. If dissatisfied, they continue researching until they have enough evidence to make the arguments that support their claim.

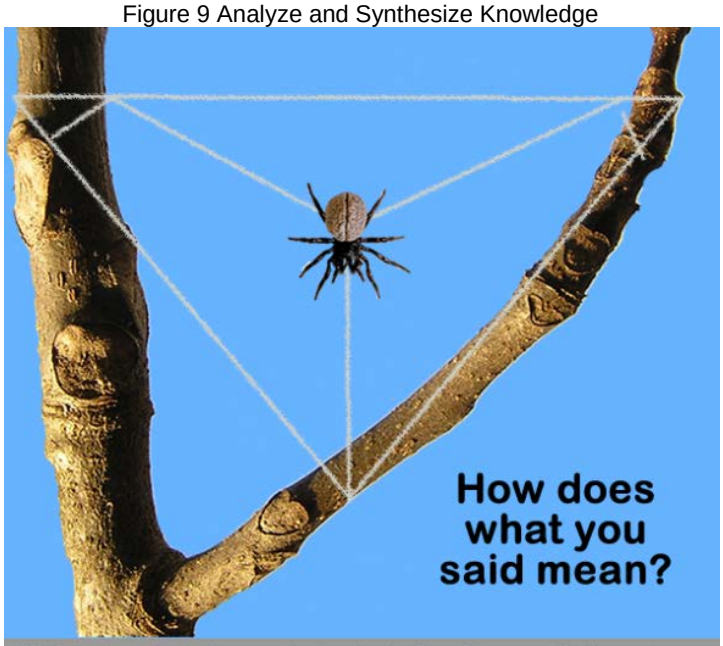


Through Socratic Questioning Spyder can see that his claim is more personal than universal. He has collected data and facts on various trees but that evidence could be compiled and interpreted by other spiders in different ways, according to their needs and desires. In this way, he shows how the Dramafied Web of Critical Thinking can be applied to both quantitative and qualitative claims.

STEP FOUR: ANALYZE AND SYNTHESIZE KNOWLEDGE

Analyzing and synthesizing knowledge is a way of finding meaning. The question of "what does this mean?" is not as important as "how does this mean?" In other words, meaning isn't seen as definitive but as part of a spectrum of understanding. Meaning looks at the elements

Figure 9 Analyze and Synthesize Knowledge



With the knowledge he needs, Spyder builds a framework. He analyzes and synthesizes old and new knowledge to understand how the meaining of the evidence will contribute to the arguments that will support his claim

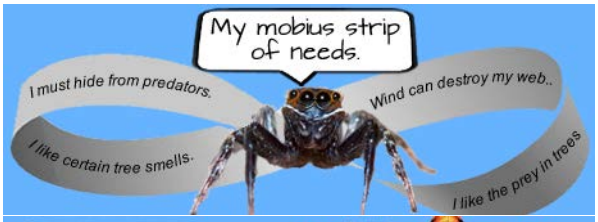
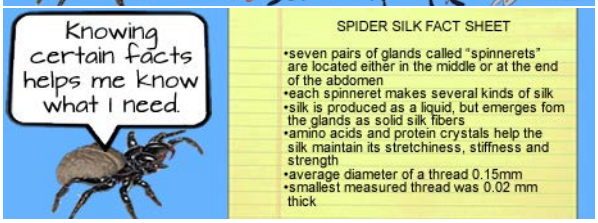
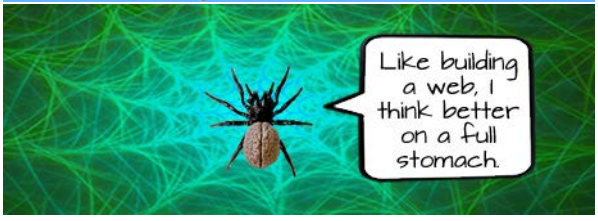
knowledge as well as how that knowledge interrelates. The meaning of the analyzed and synthesized old and new knowledge will contribute to the arguments that support the claim.

The process of analyzing and synthesizing knowledge takes effort, determination and patience. It can easily confound or overwhelm learners, especially if they expect instant results. The fear of failure, chaotic thinking and other forms of resistance can serve as obstacles. Overcoming these obstacles is requires commitment and faith in the process until a spark of insight allows learners to move forward and actively thinking for themselves. Many thinking models and strategies can help learners spark insight individually or in collaboration including Systems Thinking.

The Model of Systems Thinking

After observing three years of world-wide workshops, Barry Richmond created a model of systems thinking to enhance the critical thinking skills of educators, business people and others, especially those working in collaboration. Systems thinking is the art and science of making reliable inferences about behavior by developing an increasingly deeper understanding of the underlying structures. The focus is on the complexities that result from the dynamic interdependencies of the knowledge and information that contributes to problems and issues. (Richmond 1993) He later adapted used this model in STELLA software to offer a visual way of understanding and communicating the complex interdependencies of ideas.

Table 6 Systems Thinking

SPYDER THINKS ABOUT HOW TO THINK ABOUT THE BEST TYPE OF TREE FOR HIS WEB	SYSTEMS THINKING SKILL	SYSTEMS THINKING SKILL STRATEGY
	**DYNAMIC THINKING**	This skill is about deducing behavior patterns rather than focusing on events. They are honed by tracing how those patterns change over time to shape events and outcomes.
	**CLOSED-LOOP THINKING**	These skills monitor focus on a set of ongoing, interdependent processes rather than external factors. The behavior patterns themselves are evaluated rather than the causes of that behavior.
	**GENERIC THINKING**	This skill divorces specific identifiers with larger events so that correlation does not imply causation. This disallows shortcuts based on beliefs or assumptions that can be disproven.
	**STRUCTURAL THINKING**	This skill recognizes physical constraints and uses units of measure, dimensions or other natural laws. The thinking process is infused with discipline and precision to produce measured results.
	**OPERATIONAL THINKING**	This skill means thinking in terms of how things really work rather than how they would theoretically work. The focus is actual process rather than an abstract strategy or list of factors.
	**SCIENTIFIC THINKING**	This skill uses quantification to look at that which cannot be precisely measured. A scale or other format does not specify values but does establish a convention for thinking about what is being quantified.
	**CONTINUUM THINKING**	This skill focuses on seeing connections and interdependencies rather than sharp boundaries and disconnections. This goes beyond dualistic thinking in black and white.

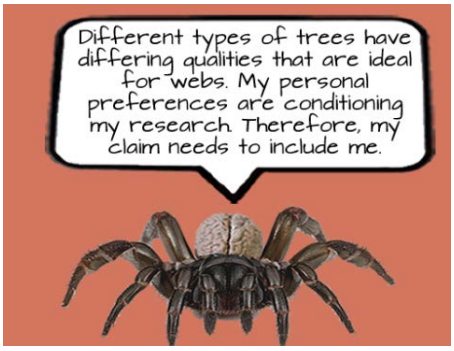
Spyder now sees that his prior claim that there is a perfect tree for a web was too specific and his revised claim that there is a perfect type of tree for building a web is too generic. He knows that the claim he wants to make needs further refining.

Inductive and Deductive Reasoning

Inductive and deductive reasoning are both integral to critical thinking. Deductive reasoning resonates with a more western approach to thinking inductive reasoning resonates with a more eastern approach.

Table 7 Deductive and Inductive Reasoning

DEDUCTIVE	INDUCTIVE
• from the general to the specific • top down reasoning • if the premises are true, the conclusion cannot be false • goal of proving a claim	• from the specific to the general • bottom up reasoning • if the premises are true, the conclusion may be true • goal of innovating a new idea



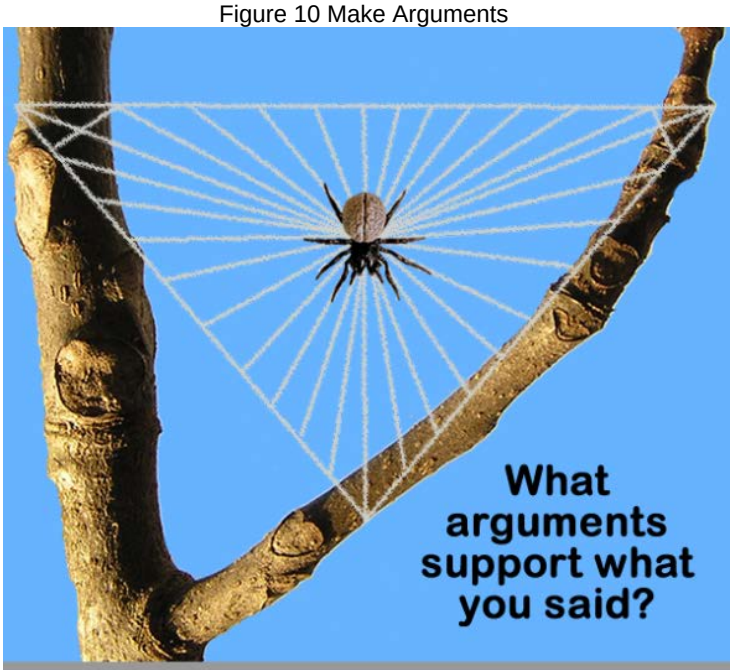
therefore,

Because he has refined his claim, much of the research and analysis Spyder has done on the different types of trees will not be used in his arguments. Learners may feel like they've wasted time gathering, analyzing and synthesizing unusable or irrelevant research. Part of developing critical thinking skills is knowing how to focus only on the evidence that can be argued to support the claim and discarding the rest. Letting go of unworkable work product is part of skills development.

STEP FIVE: MAKE ARGUMENTS

Arguments pursue the complexities of a claim supported by the research and knowledge that now serves as evidence. This process uses logic and reasoning to analyze data, research, quotes and other supporting materials. Differing points of view are presented in a fair but focused debate.

Figure 10 Make Arguments



Spyder makes arguments that use the analyzed and synthesized knowledge that reinforce his claim. He draws on knowledge from a number of sources while staying within the framework he has created.

Unlike the scientific process, the goal of arguments in critical thinking is provability rather than definitive proof. The goal is correct thinking rather than right or wrong.

Fallacies of Thought

Fallacies appear logical but are actually an error in reasoning. Sometimes they are committed intentionally to manipulate or persuade by deception. Other times they are committed unintentionally due to carelessness, ignorance or faulty language use.

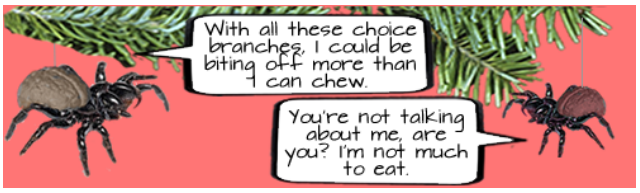
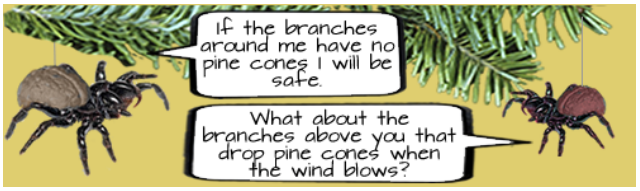
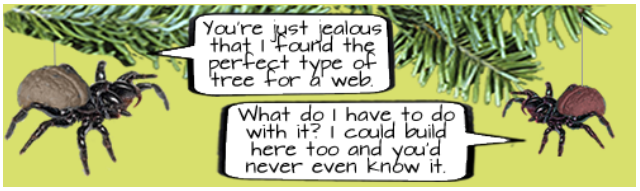
Western and eastern approaches to fallacies are different; however, they share the need for sound reasoning. In western philosophy, Aristotle was the first to systematize fallacies into a list of thirteen errors in what or how an argument is presented. Jain philosophy, an ancient religion in India, identifies seven strategies of logic along with the fallacious thinking that can result. Understanding both approaches to errors in logic help learners avoid incorrect thinking when presenting arguments that support their claim.

Aristotelian Fallacies

Aristotle was the first western philosopher to systematize fallacies. Since his time, the list of identifiable fallacies has grown well beyond 200. However, his original thirteen serve as a foundation of what learners need to avoid.

Table 8 Aristotelian Fallacies

FALLACY DESCRIPTION	ARISTOLIAN FALLACY	SPYDER'S THINKING FALLACIES ABOUT PINE TREES AS THE PERFECT TYPE OF TREE FOR A WEB
This occurs when words or phrases are given two different meanings within an argument.	**AMBIGUITY or EQUIVOCATION**	

This occurs because of a misuse of grammar (or punctuation) that promotes multiple interpretations.	**AMPHIBOLY**	
This occurs when the trueness inferred by the parts is based on the features of the whole.	**COMPOSITION**	
This occurs when the trueness inferred by the whole is based on the features of the parts.	**DIVISION**	
This occurs when the meaning of a set of words changes by the way they are spoken.	**ACCENT**	
This occurs when words or expressions similar in form are understood as similar in meaning.	**FIGURE OF SPEECH**	
This occurs when generalizations are applied that ignore mitigating circumstances or exceptions.	**ACCIDENT**	
This occurs when inferring that by disproving the opposition to an argument, the argument is proven.	**AFFIRMING THE CONSEQUENT**	
This occurs when taking an attribute bound to a certain area and applying it to a wider domain.	**IN A CERTAIN RESPECT AND SIMPLY**	
This occurs when plausible arguments are presented but are irrelevant and diversionary.	**RED HERRING**	

This occurs when the conclusion of an argument is used as a premise of that same argument.

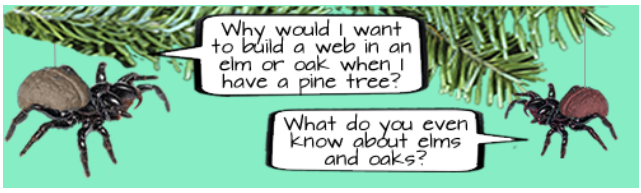
BEGGING THE QUESTION

This occurs when correlation or relationship also assumes cause and effect.

FALSE CAUSE

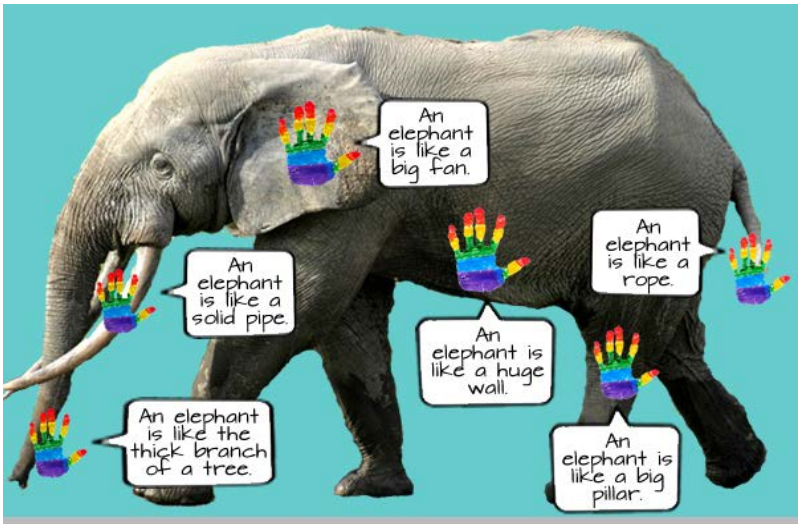
This occurs when a question presupposes something that has not been proven or accepted.

COMPLEX QUESTION



Jain Logic Fallacies

One of the rudimentary beliefs of Jain philosophy is the idea that because reality is multifaceted, it is impossible to view its entirety. No single statement or set of statements can capture the entire truth about anything described. Reality is so complex that any claim about it will fall short of complete accuracy. For example:

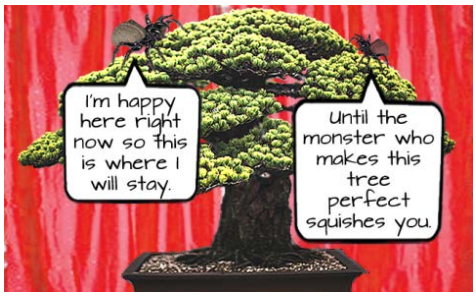
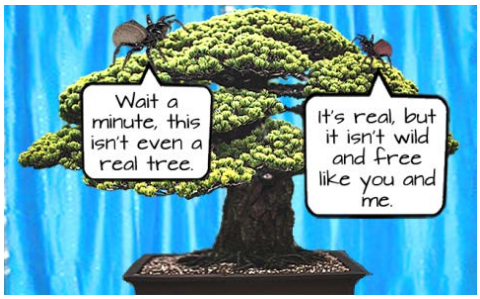


Six blind people argued about the nature of the elephant, each insisting they were right. A sighted person was passing by and asked them why they were arguing. They said, "We cannot agree on what the elephant is like." The sighted person smiled and said, "All of you are right. The reason each of you is telling it differently is because each of you is touching a different part of the elephant. The elephant has each and every one of the attributes each of you claim." They stopped arguing, happy that each of them was correct.

Jain logic focuses more on meaning than language use, periodically overlapping Aristotelian fallacies. The concepts of Jain logic tend to be more strategic than definitive. In Jain logic, each of the seven nayas are a way of reconciling conflicting ways of understanding reality. A synthesis of nayas is a way of retaining the relative importance of each point of view and may overlap to offer deeper meaning. However each naya can also be gently misinterpreted or misconstrued into the form of a fallacy.

Table 9 Jain Logic Fallacies

NAYA	MEANING	SPYDER'S THINKING FALLACIES ABOUT PINE TREES AS THE PERFECT TYPE OF TREE FOR A WEB	NAYA FALLACY	MEANING
Naigama naya	not distinguishing specific from general qualities		**Naigambhasa**	emphasizing only general or special qualities
Sangraha naya	deliberately focusing on general qualities		**Sangrahabhasa**	considering only the general qualities
Vyavahara naya	asserting the empirical to give importance to the practical		**Vyavaharabhasi**	making distinctions that are absolute, not relative, that can result in inconsistency

Rjusutra naya	understanding qualities based on the here and now and not as a continuum		**Rijusutrabhasa**	understanding qualities that disregard the passage of time
Sabda naya	analyzing the meaning of words due to tense, context and other word forms		**Sabdabhasa**	maintaining the meaning of words regardless of usage or context
Samabhirudha naya	concentrating on the etymological distinction between synonyms		**Sambhirudabhasa**	different etymologies of synonyms mean different denotations
Evambhuta naya	narrowing down the meaning of a word to the present context		**Evambhutabhasa**	negating the relevance of the present function of a word

The use of the word “argument” can trigger high emotion in learners who associate the term with the volatility that can come with conflict. Initially applying the Dramafied Web to claims that are not personal or emotional in nature is a way of turning conflict, opposition and debate into the mental exercise so they can fearlessly pursue arguments. However, even the most objective claims can provoke passion. With

practice and support, learners develop skills in building boundaries between their critical thinking goals and the high emotion the process may provoke.

STEP SIX: CORRELATE AND SYNTHESIZE ARGUMENTS AND EVIDENCE

Figure 11 Correlate and Synthesize

Spyder weaves the arguments and evidence together with a spiral that brings together the spokes of old and new knowledge. He He thinks about why the framework secures his claim.

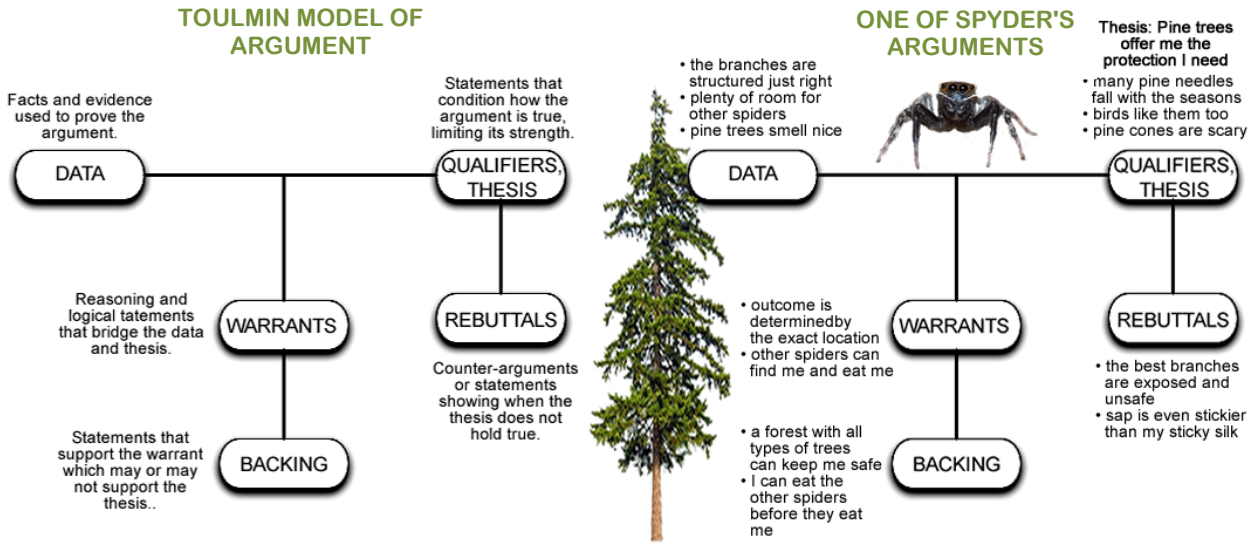
This step brings together the premises of the arguments, the arguments themselves and the evidence that supports This step can overwhelm learners and they are in danger of ineffectively moving through the chaos this step can engender, especially if they are still embroiled in the high emotion of the prior step. The negative results range from shutting down their thinking and relying on the thinking others to making fallacious arguments unsupported by what they have presented. However, with practice and the right tools, they can learn how to apply their unique style of thinking to bringing their work together. Many learners benefit from stepping back and using visual tools for purposes of outlining and mapping.

The Model of Argument and Argument Mapping

In the 1950's, Stephen Toulmin developed a visual model of argument that has since served as the foundation for argument mapping. Visual models of argument force

learners to be concise and offer organizing systems they may not have previously considered. Toulmin‘s model of argument was originally developed to analyze the arguments of others but can also help learners structure their own arguments.

Figure 12 Toulmin's Model of Argument

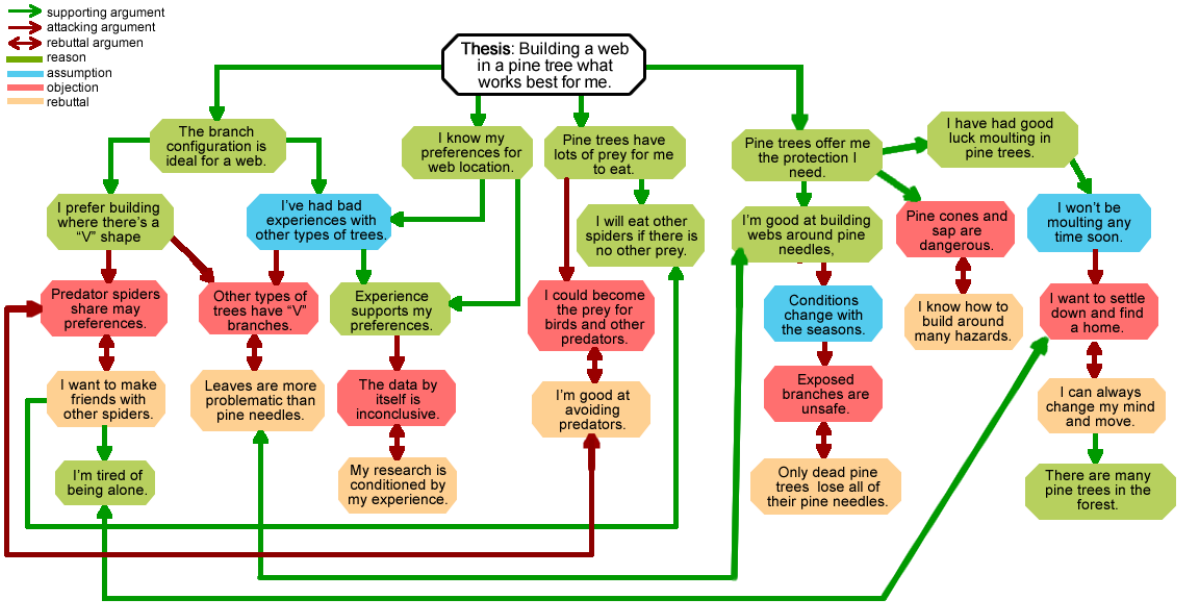


In Toulmin's Model, each argument has a thesis which is conditioned by qualifiers. The thesis is supported by data through at least one warrant. Each warrant is supported by backing. Arguments do not offer absolutes, which is why qualifiers shape the thesis and rebuttals demonstrate contrast rather than opposition.

Argument maps take Toulmin’s Model of Argument a step further, allowing for more complex arguments in which information may overlap. A variety of software is available to learners or they can opt for a non-digital method such as colored stickies, string and pin tacks on a cork board. The result resembles what learners often see in

crime investigations on television or in movies, helping them look objectively at both the big picture and the detail simultaneously.

Figure 13 Spyder's Argument Map



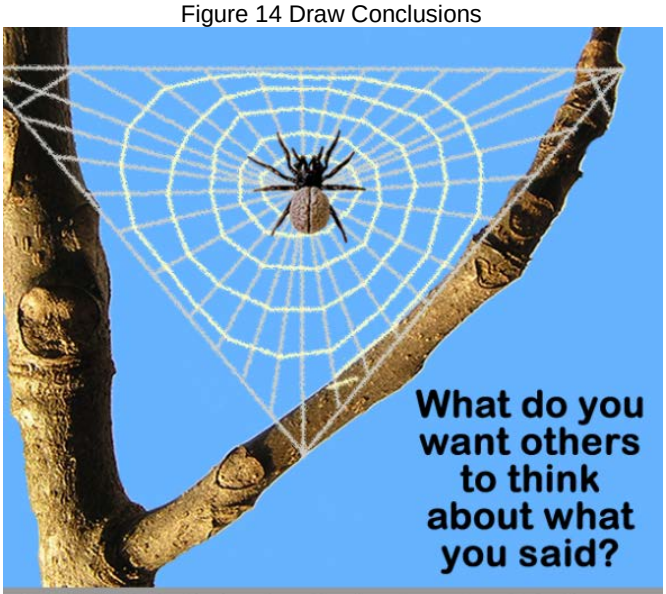
Not all learners will find the visual and/or kinesthetic aspect of argument mapping valuable, but those who do will find it invaluable. An argument map is multi-faceted so they use both deductive and inductive logic. A comprehensive map shows them the interdependencies, inconsistencies and complexities within their arguments. Moving the elements around can produce surprising results and open up pathways to innovative thinking. Learners get an overview of just how much work they have done to this point.

Argument maps help critical thinking; however, the map is not the territory. Learners need to make sense of what they see. The map is another way of looking at gaps in evidence and arguments but does not replace the learners' need to perform the thinking required to bring the information together.

STEP SEVEN: DRAW CONCLUSIONS

In this step, learners bring all of the work together in a form that clearly communicates to others their conclusions about their claim. They summarize the evidence and arguments and restate their claim. More importantly, they share their work for feedback either formally or informally. With this information they may need to revisit previous steps to assure they have argued their claim successfully.

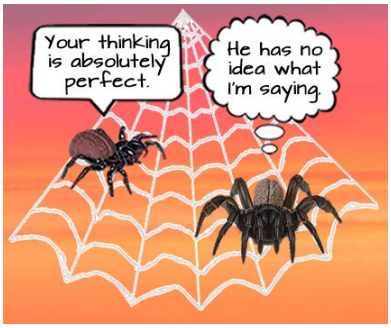
Figure 14 Draw Conclusions

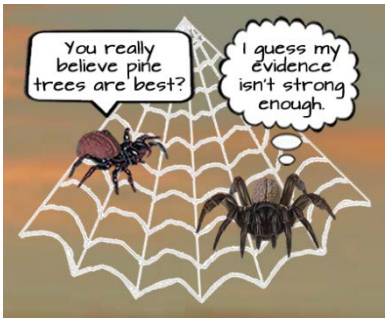


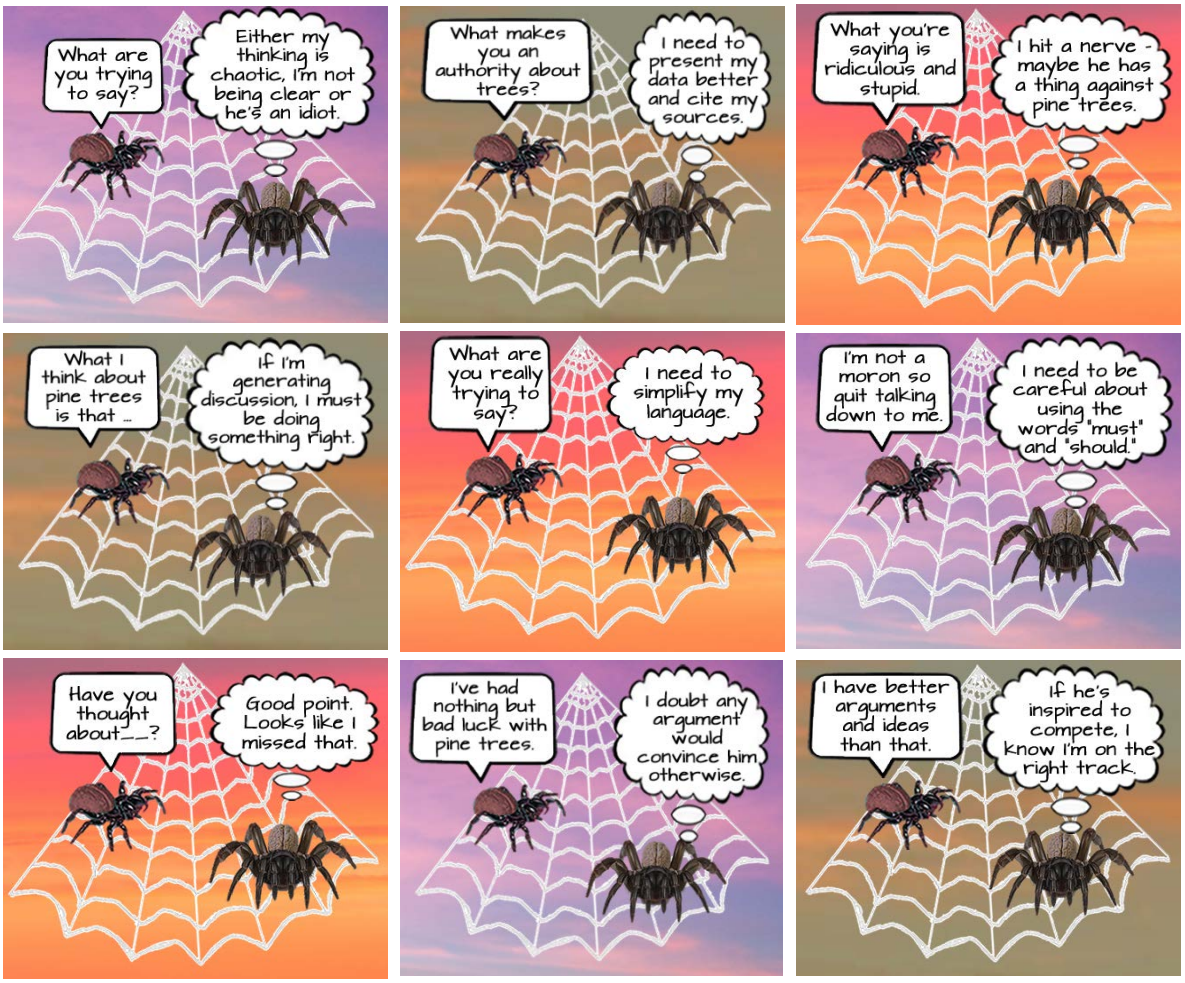
Satisfied with what he has done, Spyder retraces the spiral with a sticky substance to attract those interested in his claim. He knows that once attracted, they will stick with him as he draws conclusions and reinforces his claim.

Sharing their thinking with others can be daunting for learners. To this point, their process has been private. Additionally, learning to give and hear feedback and critique is a skill unto itself because not all of the feedback will be helpful.

Table 10 Translating Feedback and Critique







Some of the feedback and critique will be integral to enhancing the process of critical thinking skills. The content may give learners insight into new avenues of knowledge they hadn't considered. The SECI Model offers a strategy of applying the knowledge and experience of others.

The SECI Model

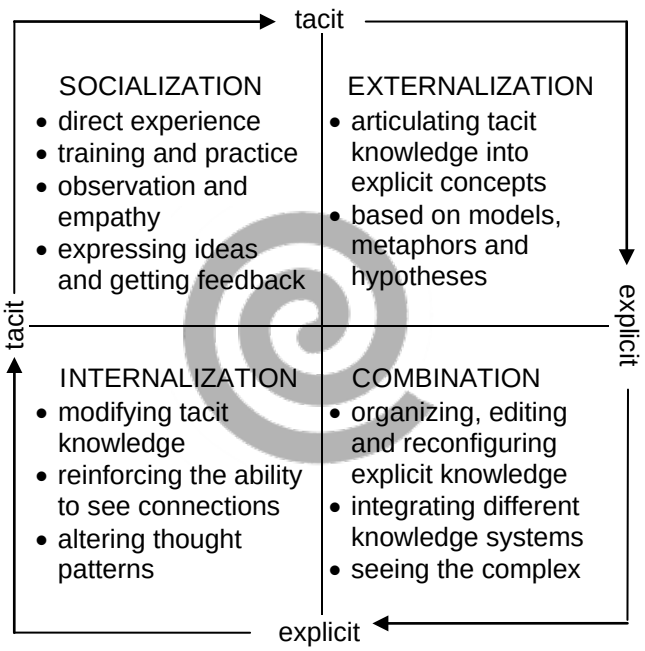
The SECI model proposes four ways that knowledge types can be combined and converted to show how knowledge is created and shared. (Nonaka & Takeuchi 1996) Individual members of a group within an organization go through successive iterations

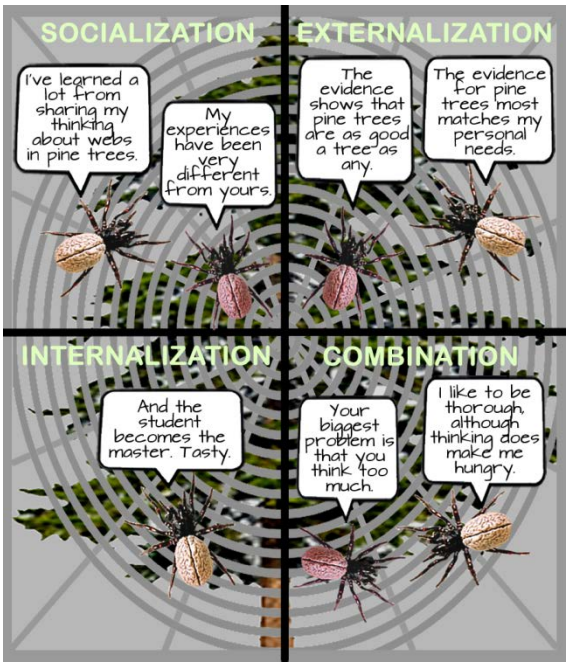
of the process that form a spiral so that each loop amplifies the knowledge. This model can help learners better understand what and how they are communicating as well as what they need to supplement their evidence and arguments. Spyder's use of a sticky silk on the spiral of his web to attract prey parallels this model.

Tacit knowledge is knowledge, including personal and cognitive skills, based on experience, values, emotions and other subjective criteria

Explicit knowledge is knowledge that can be articulated in words and numbers, and transmitted systematically

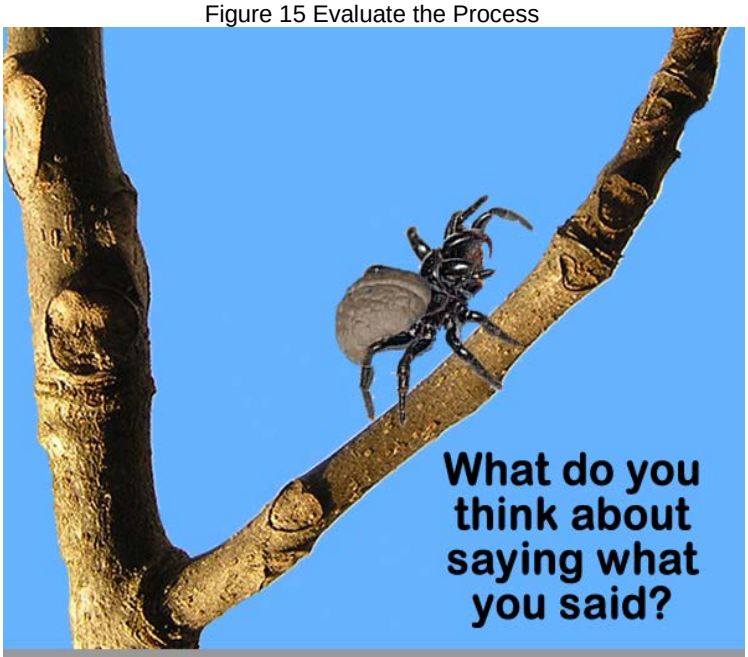
Table 11 The SECI Model





STEP EIGHT: EVALUATE THE PROCESS

Figure 15 Evaluate the Process



Spyder looks one more time at the branches that helped him weave his Dramafied Web of Critical Thinking before moving on to another pine tree. There were times he didn't know if he could complete his task but learned that doubt and discomfort are simply part of the process. The results were worth it. He now knows what he wants and needs and will proceed accordingly.

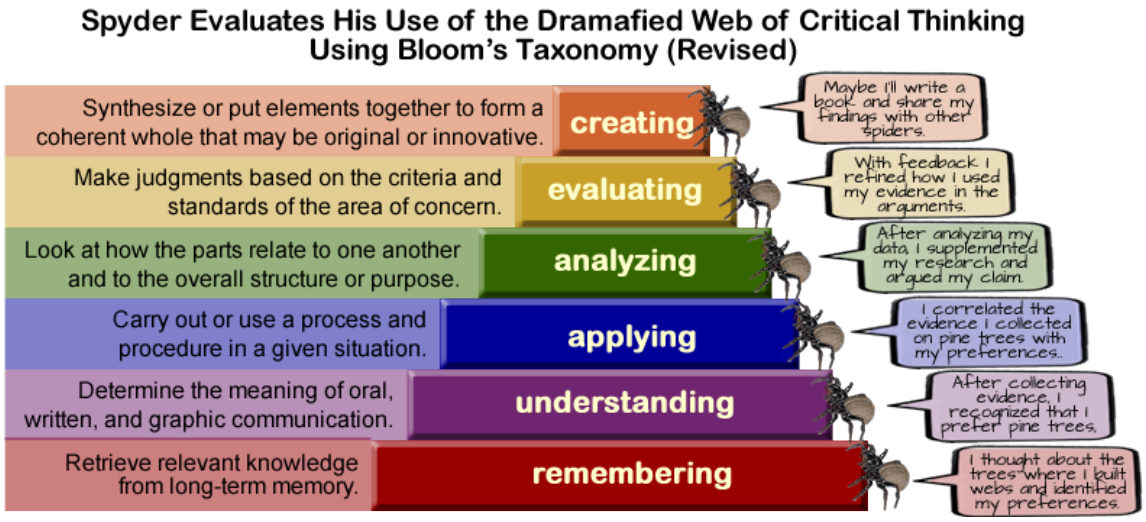
This the final step asks learners to evaluate what they have learned while they built their Dramafied Web of Critical Thinking. They assess the content of their research, arguments and conclusions. More importantly, they evaluate their thinking habits, planning methods, research patterns and other personal strategies. They also look at the obstacles they struggled to overcome, mistakes in thinking and strategy, ineffective styles of communication and other strategies that didn't work.

The Model of Bloom's Taxonomy (Revised)

The model of Bloom's Taxonomy was originally developed to as a framework for educators to categorize educational goals and measure outcomes. The triangle goes from the simplest thinking cognitive function to the most complex, describing degrees of difficulties. (Bloom 1956) One of the enhancements of the Bloom's Taxonomy (Revised) (Krathwohl 2002) is that it uses an active verbs to describe each cognitive

function. These building blocks help learners evaluate their process of collecting evidence and arguing their claim.

Figure 16 Bloom's Taxonomy (Revised)



Adding the dimension of "knowledge" to the model of Bloom's Taxonomy in the revised version brings greater depth to the process self-evaluation. It includes four knowledge dimensions that move from the concrete to the abstract:

Factual Knowledge	essential facts, basic elements and terminology
Conceptual Knowledge	classifications, principles, generalizations, theories, models or structures
Procedural Knowledge	methods of inquiry, specific skills, algorithms, techniques, and methodologies
Metacognitive Knowledge	strategic and reflective knowledge, self-knowledge, awareness of conditional and contextual knowledge

In the following table, Spyder tracks his experience using the Dramafied Web of Critical Thinking layering the building blocks of Bloom's Taxonomy (Revised) with the different dimensions of knowledge.

Table 12 Spyder's Evaluation Using Bloom's Taxonomy (Revised)

	Factual Knowledge	Conceptual Knowledge	Procedural Knowledge	Metacognitive Knowledge
Remembering	I've had experience building webs in trees.	Claiming there's a perfect type of tree uses my research and experience.	Making a claim that pine trees are best for me gives me direction.	I've met amazing spiders in pine trees, some of whom I didn't eat.
Understanding	I can't believe how much there is to know about trees.	I can't help it if personal bias conditions how I research.	Converting experience and research into evidence finally makes sense.	My research is showing me that I'm not alone in my beliefs.
Applying	The perfect tree meets a spider's personal preferences.	I have so much data and research, I don't know what to think.	Given the evidence, I can think of lots of ways to argue my claim.	The evidence supports arguments both for and against my claim.
Analyzing	OMG! My research has nothing to do with the claim I want to make.	When it comes down to it, my preference is pine trees.	I need to correlate my personal preferences with facts about trees.	I had no idea I was so fussy about where I build my web. Mind boggling.
Evaluating	No way I can successfully argue for the perfect tree.	My claim is about pine trees. Time to grieve over discarded research.	Just because my claim is personal doesn't mean I can't argue it without bias.	I hope arguing my claim helps other spiders find a home.
Creating	Forget the perfect tree, I want the perfect type of tree.	Putting myself into my claim makes it less generic and more arguable.	I need a survey of what other spiders think about pine trees.	I want to express the universal through the personal.

Spyder's steepest learning curve was determining his claim. Each learner will struggle with different steps in the Dramafied Web of Critical Thinking.

CONCLUSION

Critical thinking skills are integral to a learner's future success. Today's critical thinkers embrace both logic and interconnectedness by using both linear and nonlinear thinking styles. The Dramafied Web of Critical Thinking uses visual tools to assure skills development in critical thinking, offering a means of understanding complex concepts through comics, humor and the emotional validation. The narrative

of the comics offers a through-line to maintain attention and retention. Learners move forward and back through the steps of the Dramafied Web, modifying arguments, reorganizing evidence and even adjusting their claim. Models of thought help them understand the needs of each step. With training and practice using the Dramafied Web, learners align their thinking habits with those needed for effective critical thinking.

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