Wicked Problem Group Planning Document

PROBLEM OVERVIEW

PROBLEM	Teaching Complex Thinking
MEMBERS	Laura, Alex, Lupe, & Sarah
PROBLEM SUMMARY	
Complex Thinking (sometimes used interchangeably with computational thinking)**:** Discerning patterns+communication+visualization = **Problem Solving** Problem solving & complex thinking drive innovation, but students aren't being taught how to effectively organize and communicate their ideas in a way that yields productive results.with computational thinking. Guiding question: How are teachers addressing the complex thinking skills necessary for students to become productive and innovative 21st century citizens?	

UNDERSTANDING THE PROBLEM

(1) Brainstorm Questions (asynchronous)

Use the "Question Formulation Technique" (citation) to jumpstart your thinking with regard to your Wicked Problem.You will engage in QFT asynchronously, meaning that each group member should add at least 15 questions, (and shoot for a total of 50) on their own, sometime before your group meeting is scheduled. These will mostly be "WHY" questions at this point.

1. Write down (or record) as many questions as you can about your Wicked Problem, shoot for at least 15 per person. DO NOT ASK ABOUT SOLUTIONS - focus on the problem and what you need to know to truly understand it's wickedness.

2. Don't stop to judge, discuss, or answer any question.

3. If you notice any statements have emerged, change them into questions.

4. Once you have brainstormed, look back through and see if there are any of your own questions you want to revise and improve.

QUESTIONS TO HELP US UNDERSTAND OUR PROBLEM

1. What makes this problem so wicked?
2. **Why should we teach complex thinking? X X**
3. Why is this kind of teaching hard for some people?
4. Why is this kind of thinking hard for some people?
5. Why does complex thinking matter?
6. **What is complex thinking? XXXXX**
7. Why don't our students already know how to think complexly?
8. Do teachers need to know complex thinking to be able to teach it?
9. Can all people learn complex thinking?
10. Where will we find the time to teach complex thinking?
11. Why don't people learn complex thinking without being taught?
12. Can students learn complex thinking from each other?
13. Can teaching complex thinking be fun?
14. What are the steps to teaching complex thinking?
15. Should this be taught in school?
16. **Why don't we already teach complex thinking? XXX**
17. Why is complex thinking complex?
18. Are complex thinkers more successful?
19. What makes complex thinking different than other types of thinking?
20. **What are the parts of complex thinking? X X**
21. Why is complex thinking easy for some people?
22. Why are complex thinking skills developed differently? XXX X
23. **Why does subject matter affect complex thinking? XXX X**
24. What are the "real world" applications of complex thinking? XXX
25. **Why do students need to know complex thinking? XXX XX**
26. How might complex thinking help students in their futures? XXX
27. Do we need to know other levels of thinking to be good at complex thinking?
28. How do we grade complex thinking? (Or do we?)
29. How might our students already be complex thinkers?
30. **Why do some students struggle more with complex thinking than others? XXXXX X**
31. Why don't we already teach complex thinking?
32. Why do we need to teach complex thinking?X XXX
33. Why might some teachers not want to teach complex thinking?
34. Why might some teachers want to teach complex thinking?
35. Why do teachers benefit from complex thinking?
36. Why do adults in general benefit from complex thinking?
37. Why are some people more imaginative or creative than others?
38. Why do some students feel like they can't learn complex thinking? XXX
39. Why are some people better complex thinkers in certain situations but not in others? XXX
40. Why does situation or subject affect complex thinking? XXX
41. Why is complex thinking hard to define?X
42. Why does coding help teach complex thinking? X
43. Why don't other subjects help teach complex thinking? X
44. Why should parents/admin support complex thinking? XXX

45. Can complex thinking be learned on your own or outside of school? XXX
46. How do different content areas support complex thinking? XXXX
47. How do we address higher level thinkers while still supporting struggling thinkers?
48. Why do some people have more success than others with "higher order thinking" skills
49. Why is complex thinking important for 21st century life and success?
50. Why is complex thinking not typically addressed in teacher preparation programs?

Prioritized questions:

51. **What is complex thinking and what are its parts? XXXXX**
52. **Why should students be taught complex thinking? X X**
53. **Why don't we already teach complex thinking? XXX**
54. **Why does subject matter affect complex thinking? XXX X**
55. **Why do some students struggle more with complex thinking than others? XXXXX X**

(2) Group Discussion - Circle of Viewpoints (synchronous)

Host a virtual video meeting using Zoom. Let your instructors know the time/date and we will create a link for you to access. You have two important tasks during this meeting

1. **Prioritize 3-5 questions related to your Wicked Problem from your Brainstormed Questions above.** Where do your questions intersect? Where do they diverge? What are most central/critical to your understanding? *Note these by highlighting or bolding in the brainstorm section above.*

2. **Use the Circle of Viewpoints Visible Thinking Routine to discuss your problem from multiple perspectives.** This protocol may seem overly structured, but is is a helpful tool for considering perspectives, and not jumping towards solutions too soon.

Brainstorm a list of different perspectives *(parent, administrator, policy maker, student, innovative educator, stubborn educator, homeschool parent, etc.)* and then use this script skeleton to explore each one. Go "round robin" and stick to the script until everyone has had a chance to respond, then you can open the discussion.

1. **I am thinking of** ... the topic... **From the point of view of** ... the viewpoint you've chosen
2. **I think** ... describe the topic from your viewpoint. Be an actor - take on the character of your viewpoint
3. **A question I have from this viewpoint is** ... ask a question from this viewpoint

MEMBER NAME	ROLE FOR DISCUSSION ON TEACHING COMPLEX THINKING
Laura	Stubborn educator
Lupe	Administrator
Alex	Parent
Sarah	Student

Wrap up: After each role has shared their perspective, discuss: What new ideas do you have about the topic that you didn't have before? What new questions do you have?

GROUP MEETING REFLECTIONS

Prioritized questions:
What is complex thinking and what are its parts?
Why should students be taught complex thinking?
Why don't we already teach complex thinking?
Why does subject matter affect complex thinking?
Why do some students struggle more with complex thinking than others?

Complex thinking can be used interchangeably with computational thinking:
What is computational thinking?

- "Computational thinking is the thought processes involved in formulating a problem and expressing its solution(s) in such a way that a computer—human or machine—can effectively carry out." (https://en.wikipedia.org/wiki/Computational_thinking)

Notes from Circle of Viewpoints:

Stubborn teacher:
What teaching methods support complex thinking? You can't go from nothing to complex thinking…
Complex thinking is a lot of skills combined. Which skills can we focus on in different lessons to make the wicked problem of complex thinking more manageable?
How might my subject area support teaching complex thinking?

Admin:
How does teaching complex thinking meet the teaching standards of different content areas?
If classrooms are focused on projects or inquiry for entire units, or the entire year, how are CCSS being addressed?
How will teaching complex thinking help students perform well on state assessments?

Parents:
Parents may be concerned if their child's classroom is unconventional--what are the kids

learning?
As a parent, how can I help my child/student develop this skill? At home? In the classroom?

Student:
How do students know they are doing “it right”?
How do I know if I am making my teacher happy?
How do I know if I am going to get an A?
How do I know what I am supposed to do?
What if I don’t like less structured activities/learning?
What if I don’t get it? What if I am the type to struggle?

Reflections:
What does the teaching of complex thinking look like in action? Have we seen it?
How do we provide support knowing we will have a range of learners? How much support is acceptable? At what point am I scaffolding TOO much?
How independently or collaboratively are complex thinking skills learned?
How transparent can this type of instruction be? Considering admin/parents--How explicit??
How do we support more stubborn teachers or those who need help?
What does complex thinking look like in different classes? Not just content, but how do different teachers approach addressing this wicked problem?
Are there different schools of thought around complex thinking in general? What are the generally agreed upon aspects of it?

GATHERING RESEARCH & INFORMATION

Use this section to share and summarize research findings related to your problem.

Lupe

Article 1 Link: http://journals.sagepub.com.proxy1.cl.msu.edu/doi/pdf/10.2190/ET.43.2.g
Article info:
Pub. Info: J. EDUCATIONAL TECHNOLOGY SYSTEMS, Vol. 43(2) 199-226, 2014-2015

Title: SCAFFOLDING COMPLEX LEARNING: INTEGRATING 21st CENTURY THINKING, EMERGING TECHNOLOGIES, AND DYNAMIC DESIGN AND ASSESSMENT TO EXPAND LEARNING AND COMMUNICATION OPPORTUNITIES
Authors: EILEEN O’CONNOR & FRANK MCDONALD

Empire State College, SUNY, Saratoga Springs

Summary of info presented: In Figure 1, you see the basic outline of what the authors assert are the three components necessary to create enriched learned & productive learning environments. Teachers/Instructors should develop the classroom environment and course program, but students are expected to create elements of their own learning.

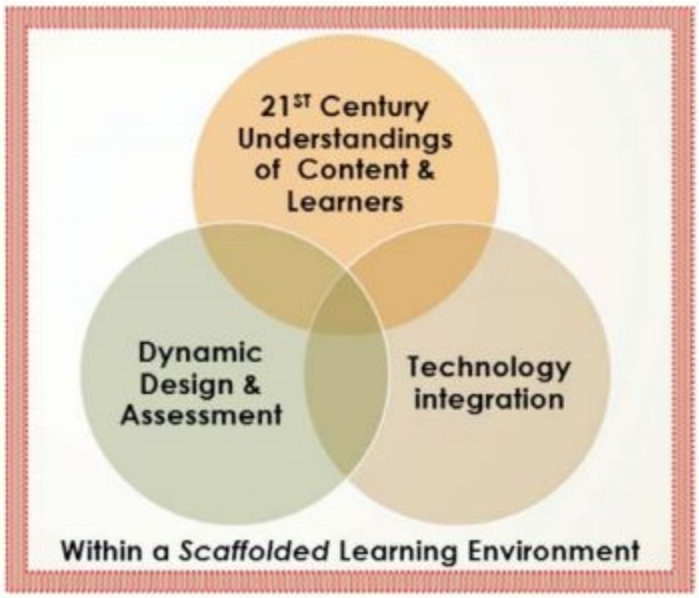


Figure 1. Overarching design framework.

Instructors should consider how the content is relevant in the real world and use technology to enrich this learning process for students: "Emerging and existing technologies can facilitate a rich, complex learning environment, the instructor should envision the possibility of enhanced learning in the content area or learning environment that could result from new ways of thinking not only about content, but also about the communities that develop and use this content, about the cross-cultural interactions now possible, about environments built on trust, and about the learners and the background that they may bring."

Instructors should frame learning with a real world, productive lens: "They should ask: Why is knowing this content important—for government and infrastructure, for science and health, for cultural awareness and peace, for communication and dissemination, for education? And, to whom is it important—government, health care professionals, scholars, businesses, teachers . . . people?"

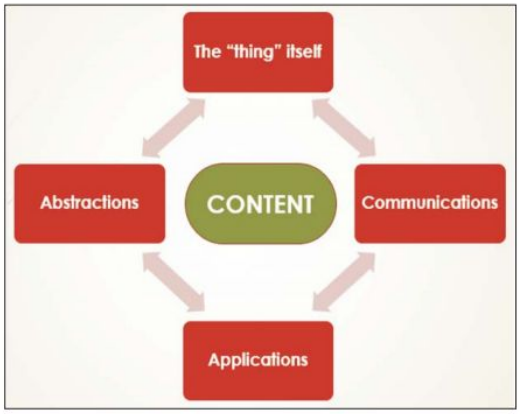


Figure 2. Possible areas to address when studying content.

Creating authenticity in the learning process while addressing content area knowledge is assisted with the use of new tech: "instructors can find innovative ways to include practitioners. Readily available today are online discussions, webinars, live chats, and immersive, virtual locations, all of which can serve as points for presentations, interactions, and discussions."

Use inquiry to address complex thinking and complex problems: "Instructors should also think beyond overly structured approaches and sequencing, valuing also the problem-solving challenges that can be inherent in well-chosen, complex scenarios… Inquiry can raise the

questions that “facts” can later answer.”
Teachers can develop storylines/narratives around complex scenarios to increase student investment in complex thinking: “Creating a reason for knowing and applying knowledge, from problem solving to competing interests can provide greater motivation for learning.”

The use of APPROPRIATE visual/multimedia aids can improve complex learning objectives and experiences: “... integrate media, video, visual, and schematics with questions, challenges, and explanations… the instructor should value and explore the numerous ways that visuals, schematics, and videos can enhance the learning within these complex systems.”

Complex projects should have an authentic audience: “Considering if there is value to making the outcome of complex projects be open to the public—easily done through websites and wikis. Work that can have a public face (have instructor and peer voting for what is ready for public display) can solicit more pride and perfectionism in the students and student teams”

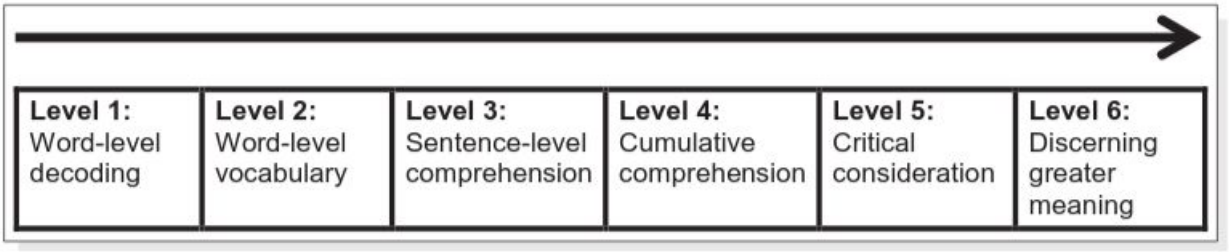
Article 2 Info:

Complex Questions Promote Complex Thinking

Author: Degener, Sophie
Journal: The Reading teacher
ISSN: 0034-0561
Date: 03/01/2017
Volume: 70
Issue: 5
Page: 595-599
DOI: 10.1002/trtr.1535

- Deals primarily with developing complex thought processes in reading & interacting with texts
- Echoes from article 1: Scaffolding is critical.
- Teachers need to ask students more questions that prompt deep thinking.
- Questioning Continuum for grades 4-6:

Figure 1
Continuum of Questioning Complexity



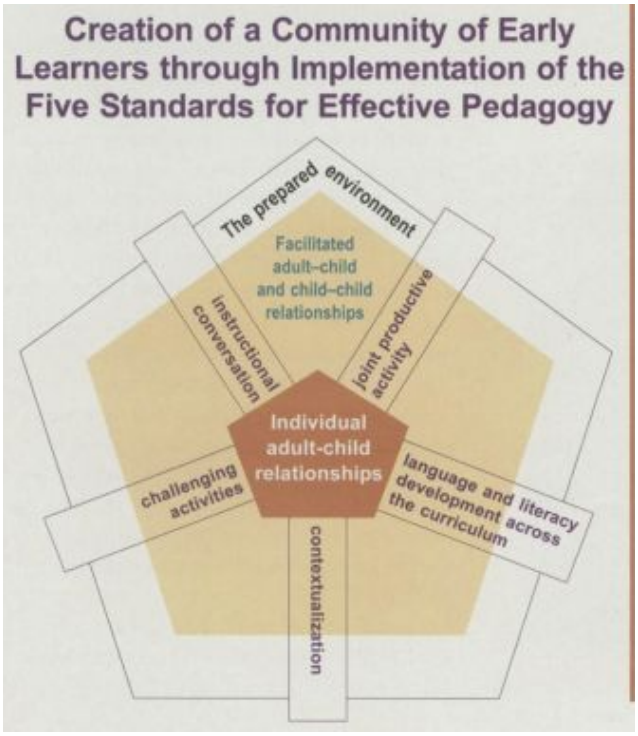
- Example interaction based on figure above:

Table 1
Examples of Teacher Questions Across the Continuum of Questioning Complexity

Level of complexity	Description	Example teacher question
Level 1: Word-level decoding	Focus on accuracy of oral reading	"I heard you pronounce this word [*perseverance*] as 'persiance.' Is that a word you recognize? No, I didn't think so. Let's try chunking this word to figure out what it really says."
Level 2: Word-level vocabulary	Focus on the meaning of a word or words in context	"Do you know what this word [*embedded*] means? What vocabulary strategy that we have learned might help you figure out the meaning of that word?"
Level 3: Sentence-level comprehension	Focus on recall of literal details	"How many nations have better high school graduation rates than America?"
Level 4: Cumulative comprehension	Focus on comprehension across multiple portions of text	"Can you tell me what this writer thinks are the pros and cons of sports in schools?"
Level 5: Critical understanding	Focus on understanding a concept and critically examining it	"Based on what you've read, what do you think would be the downside of removing sports from American schools?"
Level 6: Discerning greater meaning	Focus on relating this text to the world in which it resides, including other texts or concepts not present in the text	"How do you think this discussion of sports in American schools may be different from the discussion of high school sports in other countries? What is it about Americans that makes that discussion different?"

Laura

From High Chair to High School: Research-Based Principles for Teaching Complex Thinking
Info: Roland Tharp and Susan Entz, YC Young Children., Vol. 58, No. 5 (September 2003), pp. 38-44, Published by: National Association for the Education of Young Children (NAEYC)
Link: http://www.jstor.org/stable/42728979



Notes: Research conducted among diverse types of schools, populations, ages (K-8), etc. has led to discovering core principles for teaching complex thinking and developing "Five Standards for Effective Pedagogy" for teachers to use.

Researchers found five elements present in programs that were effective for at-risk populations:

- joint productive activity
- language and literacy development across the curriculum
- contextualization
- challenging activities
- instructional conversations

These five elements led to Five Standards for

Effective Pedagogy:

1. **Joint productive activity: Students and teachers producing together.** Teachers should be a part of the activities alongside the students to encourage collaboration, to develop a growing language in the content, and to assist students in their individual strengths and weaknesses.
2. **Language and literacy development: Developing language and literacy across the curriculum.** Language and literacy are underlying goals of every activity and lesson.
3. **Contextualization/making meaning: Connecting school to students' lives.** Knowledge is best learned/remembered when it it is connected to students' previous knowledge, experiences, interests, and values.
4. **Challenging activities: Teaching complex thinking.** "Compelling cognitive challenges," when consistently presented to students, help develop students' brains to be more adaptive to that type of thinking. The more they do it, the more long-term and ingrained it will become.
5. **Instructional conversation: Teaching through conversation.** While there are times that a teacher should talk to the whole group for giving directions and instruction, the most meaningful learning takes place through dialogue in individual or small group settings to tailor learning to students' particular needs.

Specific to complex thinking: A teacher lets students' work through the problem of bullying from the lens of a children's story. The teachers asks students to write an advice column to one of the characters, but first they brainstorm possible ways for making friends, carefully listening to each student's suggestion. This list of possibilities reminds me more of what we're doing with the questioning method from *A More Beautiful Question*. They break into small groups to act out ways to address bullies, so each group proposes different solutions, exposing students to complex thinking even in at a young age.

Sarah

I found this really challenging, because the articles I kept finding talk a lot about how they want to solve the problem, but they don't do a great job of defining or outlining the actual problem.

Validity of High-Stakes Assessment: Are Students Engaged in Complex Thinking?
http://za2uf4ps7f.search.serialssolutions.com/?ctx_ver=Z39.88-2004&ctx_enc=info%3Aofi%2Fenc%3AUTF-8&rfr_id=info%3Asid%2Fsummon.serialssolutions.com&rft_val_fmt=info%3Aofi%2Ffmt%3Akev%3Amtx%3Ajournal&rft.genre=article&rft.atitle=Validity+of+High-Stakes+Assessment%3A+Are+Students+Engaged+in+Complex+Thinking%3F&rft.jtitle=Educational+Measurement%2C+Issues+and+Practice&rft.au=Suzanne+Lane&rft.date=2004-10-01&rft.pub=Wiley+Subscription+Services%2C+Inc&rft.issn=0731-1745&rft.eissn=1745-3992&rft.volume=23&rft.issue=3&rft.spage=6&rft.externalDocID=731115071&paramdict=en-US

In standardized testing, complex thinking isn't assessed. Four criteria for examining

the alignment of assessments to standards: depth-of-knowledge consistency, categorical concurrence, range of knowledge, balance of representation. (p. 7)

Study indicated that a high percentage of state math assessments they researched used items at a complexity level below that of the corresponding objectives. (p. 8)

Relationship between large-scale assessment & instruction (p. 10) "A major goal of the standards-based accountability system is to ensure that all students learn challenging content, leading to improved student learning through improved instruction." When standards-based reform was initiated… performance assessments were considered to be an integral part of the reform.

BUT: few studies have examined the relationship between changes in instructional practice (to performance-based) and improved performance on assessments that are entirely performance-based or include performance tasks (p. 11)

NEWS BRIEFS

Anonymous. Gifted Child Today; Thousand Oaks36.3 (Jul 2013): 159-163.

https://search-proquest-com.proxy1.cl.msu.edu/docview/1419020298?pq-origsite=summon

With routine skills becoming less important and expert thinking and complex communication more important, "deeper learning" has become essential for success in college and the workplace. Employers and university professors want students who can think critically solve problems, and communicate effectively. Employers and university professors want students who can think critically solve problems, and communicate effectively. The National Research Council reported that abilities such as critical thinking and problem solving are associated with positive adult outcomes in the labor market, health, and civic engagement (Pellegrino & Hilton, 2012).

Article: Gifted Child Today ~~This article~~ has lots of suggestions, but I left them out for now - to focus on the problem aspect.

PREVIEW OF NMC HORIZON REPORT: 2017 K-12

http://www.nmc.org/publication/nmccosn-horizon-report-2017-k-12-edition/

Teaching Complex Thinking It is essential for learners both to understand the networked world in which they are growing up and also — through complex thinking — to learn **how to use abstraction and decomposition when tackling complex tasks** and to deploy heuristic reasoning to complex problems. Mastering modes of complex thinking **does not make an impact in isolation**; communication skills must also be mastered for complex thinking to be applied meaningfully. Indeed, the most effective leaders are outstanding communicators with a high level of social intelligence; their capacity to connect people with other people, using technologies to collaborate and leveraging data to support their ideas, requires an ability to

understand the bigger picture and to make appeals that are based on logic, data, and instinct. While some aspects of this topic could be framed as **similar to or overlapping "design thinking,**" for the purposes of this report the two are considered as distinct concepts. The term "complex thinking" refers to the ability to understand complexity, a skill that is needed to comprehend how systems work in order to solve problems, and **can be used interchangeably with "computational thinking.**" Teaching coding is increasingly being viewed as a way to instill this kind of thinking in students as it combines deep computer science knowledge with creativity and problem solving.

- Learn how to use abstraction & decomposition when tackling complex tasks
- Deploy heuristic reasoning to complex problems
- Communication skills a must
- The ability to understand complexity, to understand how systems work in order to solve problems
- Term can be used interchangeably with computational thinking

Lopez, Luz & Sanchez, Adolfo
A Model for Integrating Thinking Skills in the Curriculum
Aug 1992
http://files.eric.ed.gov/fulltext/ED352321.pdf

This article relates to teacher candidates in their teacher prep program, but seems to apply across age groups

Model for curriculum planning - basis is built on four different curriculum planning approaches: (p. 1)

1. Competency-based
2. Ability-based
3. Concept-based
4. Thinking Skills Model

"The foremost aspiration of such a system is to develop an integral human being, capable of adequately interacting with his/her world." (p. 3)

Basic assumptions:
#3 - The teaching experience must provide for activating mental processes
#8 - The relevance of the learning experience depends on the academic context and depth across the curriculum
#9 - A teacher should be a facilitator of the learning experience

Columns 8 & 9 - student is an active agent, has a natural desire to improve his/her skills and visualize the relevance to his/her own interests, needs, experiences (p. 7)
Educator is in a less directive role (p. 7)

Authentic assessment

Pedagogy Matters: Standards for Effective Teaching Practice. Research Report 4.
Dalton, Stephanie Stoll
1998
http://files.eric.ed.gov/fulltext/ED424769.pdf

5 pedagogy standards - one of which is complex thinking (CT)

Intro - Standards "remain focused more on developing statements of what students should know and be able to do and less on articulating how teachers are to accomplish such student outcomes." (p. 1)
Increasing effective teaching has emerged as a means to improve schools, meet ed goals, and ensure that all students experience learning success.
"Current" (1998) reform movement focuses on what students need to learn but ignores teachers' struggle with how to help them learn it (p. 1)

Standard IV
Teaching Complex Thinking (CT) (p. 21)
Challenge students towards cognitive complexity

The teacher:

1. Students see whole picture, not just parts
2. Presents challenging standards for student performance
3. Designs student tasks that advance student understanding to more complex levels
4. Assists students to accomplish more complex understanding by relating to their real-life experience
5. Gives clear, direct feedback about how student performance compares with challenging standards

"Contemporary school reform is likely to emphasize complex thinking as an instructional goal, but for many, at-risk students are considered to be exceptions." (p. 22)

"The complex thinking standard describes pedagogy to assist complex cognitive change for all students. Such pedagogy draws on classroom contexts and social practices, such as peer and teacher interactions and social organization, to help students build their understanding." (p. 23)

Students are motivated to learn skills that will help them see through and into their world. (p. 23)
Encourage them to review and question their own and others' beliefs and rationales
The object of problem solving is not to conclude with a correct answer, but to expand discussion and promote complex thinking on a topic (p. 23)
Students need to receive high standards, guidance, and corrective feedback (p. 23)

Students need to be challenged to stretch, to learn language and context, and to think in complex ways beyond their own capacities (p. 25)

Systemic Education Reform
http://files.eric.ed.gov/fulltext/ED370178.pdf
Assumptions:

1. A thorough understanding of academic content, complex thinking, and problem-solving is necessary for students to become responsible citizens
2. All students are capable of learning challenging content and complex problem-solving skills

Children's complex thinking skills begin forming before they go to school
Harms, William
1/23/13
https://news.uchicago.edu/article/2013/01/23/children-s-complex-thinking-skills-begin-forming-they-go-school

This is related to the article:
Early Executive Function Predicts Reasoning Development (peer reviewed!)
Lindsey E. Richland1 and Margaret R. Burchinal
http://journals.sagepub.com.proxy1.cl.msu.edu/doi/pdf/10.1177/0956797612450883

U Chicago & U North Carolina research:

- children begin to show signs of higher-level thinking skills as young as age 4 ½.
- High early executive function skills at school entry are related to higher than average reasoning skills in adolescence
- may be trainable through pathways, including preschool curriculum, exercise and impulse control training
- may be able to help encourage development of executive function by having youngsters help plan activities, learn to stop, think, and then take action, or engage in pretend play
- Developing complex reasoning ability is particularly fundamental to the innovation and adaptive thinking skills necessary for a modern workforce,

Bransford, J. D., Brown, A. L., & Cocking, R. R. (Eds.). (2000). How People Learn: Brain, Mind, Experience, and School (Expanded ed.). Washington DC: National Academy Press]
This was the book we got the link to before class started...
"Schemata are particularly important guides to complex thinking, including analogical reasoning" (p. 66)

Alex

http://www.facesoflearning.net/complex-thinking/

Focuses on what complex thinking is. How successful complex thinkers look different from unsuccessful complex thinkers. Complex thinkers are "good at deeply understanding ideas and concepts, seeing connections among information from different sources, demonstrating imagination, constructing and defending arguments based on facts or evidence, taking risks with new ideas, and/or drawing inferences from limited information."

"People with challenges in this area may struggle to understand new ideas and concepts without considerable support, have trouble "reading between the lines" or making inferences, approach problems in a haphazard way, or tend to rely on existing ideas rather than coming up with original ones."

Also provides some strategies for managing complex thinking.

http://possibilitiesforlearning.com/?page_id=406

Similar to Lupe's article. Discuss a spectrum of complex thinking, references bloom's taxonomy. Figures don't load but they reference similar ideas to Laura's article.

Complex Thinking, Complex Practice

https://search-proquest-com.proxy2.cl.msu.edu/docview/231441645/fulltext/64484709596340B2PQ/3?accountid=12598

Tsoukas, Haridimos, and Mary Jo Hatch. "Complex Thinking, Complex Practice: The Case for a Narrative Approach to Organizational Complexity." *Human Relations* 54.8 (2001): 979-1013. *ProQuest.* Web. 7 Aug. 2017.

Summary

Discusses the difference between Logico-scientific and narrative approaches to complexity and complex theory. Logico-scientific approach is much more mathematical and from my understanding more so black and white. Where the narrative approach focuses more on storytelling and is more abstract. Also compares organization. One being "sociological-historical-anthropological in orientation; it seeks to produce accounts explaining the specific features of organizations…" (p. 980). The second being cybernetic-systemic. "Here organization is conceived much more broadly: it is thought to be a feature of the cosmos at large, not just social collectivities." (p. 980) Using the narrative approach and organization allows to reach second-order thinking.

From what I gathered the article discuss complexity and complex theory with the idea of using the narrative approach to help make complex theory more manageable. My understanding of

narrative theory is using all parts to put together a story. Wanting to move away from the logico-scientific method which seems more black and white. The article argues this model creates results with scientific methods which control the variables and produce results which are generalized and do not work in specific situations. Uses the vocabulary “nonlinearity, scale dependence, recursiveness, sensitivity to initial conditions and emergence of properties of the system” (p. 989) to discuss complexity.

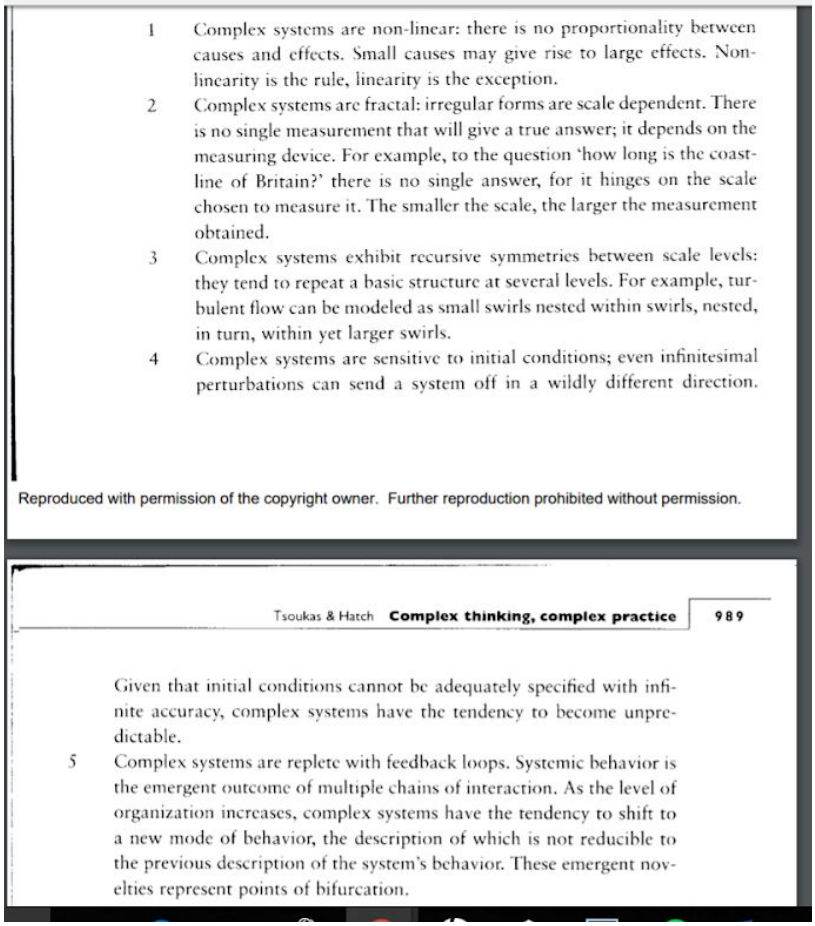
Analyzes the problems with complexity.

“There is apparently no consensus around when a system should be regarded as complex.” (p. 985)

“The complexity of a system, as seen by an observer, is directly proportional to the number of inequivalent descriptions of the system that the observer can generate. The more inequivalent descriptions an observer can produce, the more complex the system will be taken to be.” (p. 986)

“A stone, says Casti (1994), is a very simple object to most of us...but to a geologist it is rather more complicated.” (p.985)

5 properties proposed to be held in common by natural, biological, and social systems



1 Complex systems are non-linear: there is no proportionality between causes and effects. Small causes may give rise to large effects. Non-linearity is the rule, linearity is the exception.

2 Complex systems are fractal: irregular forms are scale dependent. There is no single measurement that will give a true answer; it depends on the measuring device. For example, to the question 'how long is the coast-line of Britain?' there is no single answer, for it hinges on the scale chosen to measure it. The smaller the scale, the larger the measurement obtained.

3 Complex systems exhibit recursive symmetries between scale levels: they tend to repeat a basic structure at several levels. For example, turbulent flow can be modeled as small swirls nested within swirls, nested, in turn, within yet larger swirls.

4 Complex systems are sensitive to initial conditions; even infinitesimal perturbations can send a system off in a wildly different direction.

Given that initial conditions cannot be adequately specified with infinite accuracy, complex systems have the tendency to become unpredictable.

5 Complex systems are replete with feedback loops. Systemic behavior is the emergent outcome of multiple chains of interaction. As the level of organization increases, complex systems have the tendency to shift to a new mode of behavior, the description of which is not reducible to the previous description of the system's behavior. These emergent novelties represent points of bifurcation.

Potential Survey Questions
https://docs.google.com/a/owosso.k12.mi.us/forms/d/1a5-tJ3WhjT7k0kJxMSi4Mkb32Im5-t5Be4mDB44O_OA/edit?usp=sharing
haganla1@msu.edu
gortonal@msu.edu
vanloosa@msu.edu

Begin survey with a definition of the wicked problem for context
Ask about problem solving, discerning patterns, communication, visualization, innovation, etc.
What extent are these being taught in the classroom?
Ask about role? Admin, educators, tech, etc.
Optional: Grade level and content area

By collecting this data, you will have a better understanding of how this problem impacts your community of practice, which will help guide your research on how to address this problem in your WPP.

On a scale of 1 through 7 where 1 means not at all confident and 7 means extremely confident, how confident do you feel when integrating digital technologies in your classroom? 1 2 3 4 5 6 7

Complex Thinking: Discerning patterns+communication+visualization = **Problem Solving**
Problem solving & complex thinking drive innovation, but students aren't being taught how to effectively organize and communicate their ideas in a way that yields productive results. Synonymous with computational thinking.

The questions we are trying answer in our survey:
How confident are the people in our community of practice with teaching aspects of complex thinking?
How often do the people in our community of practice take steps to teach complex thinking?

The NMC Horizon Report: 2015 K-12 Edition lists nine Wicked Problems. One of them is *teaching complex thinking*. Complex thinking, which is synonymous with computational thinking, involves skills with discerning patterns, communication, and visualization skills. Problem solving and complex thinking skills drive innovation, but in general students are not being taught how to effectively organize and communicate their ideas in a way that yields productive results.

How confident do you feel teaching…?

How confident do you feel teaching complex thinking?
How confident do you feel teaching problem solving skills?
How confident do you feel teaching communication skills?
How confident do you feel teaching visualization skills (i.e. creating charts, diagrams, and infographics that represent their learning)?
How confident do you feel providing opportunities for innovation?
How confident do you feel teaching with technology?
How confident do you feel teaching inference (i.e. discerning patterns, making predictions, etc.)?
How confident do you feel teaching computational thinking skills?

How often do you feel you teach --- skills?

How often do you provide opportunities for students to create meaning visualizations of their learning and understanding?
How often do you provide opportunities for students to connect to their previous knowledge, experiences, interests, and values?
How often do you integrate other content areas into your content?
How often do you incorporate inquiry based instruction in your classroom or setting?
How often do you allow for meaningful project based learning?

How effective is your content area in teaching complex thinking?
How effective is your school in teaching complex thinking?

How comfortable do you feel teaching organization?

Agree or disagree…

Organization varies from K-12
All students need organization
Organization is vital to success in school, college, career
Flexibility is necessary for organization
Do different types of organization conflict with each other?
As a school uniformity is needed for organization

From Sarah 8/10/17
In response to this question from Mary: What are you trying to prove with this data that you'll collect? I think you can come up with some questions that have to do with teachers "opinions" on how hard it is to teach complex thinking or at what age they think it should be taught, etc. The questions you have here are all basically getting at the same thing-- do you do this? You can dive deeper than that.

I wonder if we should eliminate many of the "How confident do you feel teaching…" questions. We already asked if teachers do those things. Instead, should we get some opinions?

Q"How early do you think teaching ____ should be incorporated in the classroom?"
A Preschool - Elementary School - Middle School - High School - College - Never & etc.

Also, I made quite a few changes on the form - all documented on the right. I'm all for collaboration, but I definitely feel like I think better after I'm alone again. :)

I Feel like the what approaches do you use in your classroom check box is somewhat overwhelming. I also feel like we get to a similar point with our other questions about communication, visualization, etc. But it does give a nice overview of what strategies teachers are using. My biggest thing was, I took the survey and when I got to that questions my thoughts were "Ugh, I don't want to read and check all these boxes." Whatever you guys want to do I'm good with.

Questions to add/edit/change/etc.:
Open ended questions @ end of survey???? Fewer Q's overall? :
Q"How early do you think teaching ____ should be incorporated in the classroom?"
A Preschool - Elementary School - Middle School - High School - College - Never & etc.

How challenging do you think it is to teach complex thinking?
Scale: 1 to 5

What about questions to address which characteristics of complex thinking do teachers find most valuable?:
Which aspects of complex thinking do you believe hold the most value for students to learn/practice? (Creativity, innovation, problem solving, collaboration, communication, etc.)
--Could be open ended to save space and they can type out answers?

Proposed Scale: 1 = K-1, 2 = Grades 2-3, 3 = Grades 4-5, 4 = Grades 6-8, 5 = 9-12
Are you familiar with the term complex thinking (not to be confused with critical thinking)? (1-5)

Questions to draw out deeper info from the later questions--
At what age should students work in groups? Practice creativity?
How hard is it to teach complex thinking? (1-5)
How often should students get to practice their higher order thinking skills, like complex thinking? (1-5?)
What do you believe are meaningful ways to get students to develop their complex thinking skills? (checklist?)
Do you feel like in your own teacher preparation program, or in professional development/continued education since, that you have been adequately familiarized with the wicked problem of teaching complex thinking? (1-5 scale?)
As an educator, do you think you need additional support or training in order to address the wicked problem of teaching complex thinking? (1-5)

PROPOSING POTENTIAL SOLUTIONS

ONLY NOW SHOULD YOU START THINKING ABOUT SOLUTIONS.

Begin adding “WHAT IF?” questions to your planning document. These are possibilities, but still not solutions. Then, prioritize. Are there any that help move your thinking forward? Help you answer your central "Why" questions? Which ones lead you towards the “best bad solution?”

QUESTIONS TO HELP US UNDERSTAND POTENTIAL SOLUTIONS
1. What if we…? 2. What if we used narratives to help students learn complex thinking? 3. What if we assessed complex thinking? 4. What if we gave students more choice? x 5. What if we didn’t emphasize grades/deadlines as much? XX 6. What if we reached out to admin and other teachers about teaching complex thinking?

7. What if we scaffolded complex thinking by breaking it down into multiple skills?
8. What if we were more explicit in teaching of complex thinking?
9. **What if students had more freedom/choice in developing their complex thinking skills?XX x**
10. What if we helped our districts become more cognizant of the wicked problem of complex thinking?X
11. **What if we embraced more student centered learning methods to embrace complex thinking--PBL, Inquiry, Genius Hour, etc.?XXX**
12. What if teachers were more aware of what in their instructional repertoire already attempts to teach complex thinking?
13. What if we gave students more opportunities to develop the skills necessary to become complex thinkers: problem solving, innovation, communication, reading between the lines, etc.? XX -How???
14. What if we really let our students fail? X
15. What if we had classrooms that were centered around multiple students needs?
16. What if we taught across content areas?XX
17. What if we gave students more time when they need it? X
18. What if we taught strategies for metacognition? XX
19. What if we incorporated more opportunities for creativity?XX
20. What if we held up the arts as important to a well-rounded education? XX
21. What if students had more access to mentors?
22. What if students worked with students across grade levels?XX
23. What if students got to decide which problems to solve? (I guess this is choice - already addressed)
24. What if students had access to technologies?
25. What if we taught design-thinking strategies in school? XX
26. What if students were allowed to ask questions? XX
27. What if we gave our students access to an authentic audience?X
28. What if we gave time and space for student collaboration?X
29. What if we taught coding in school? X
30. What if we taught coding starting in Kindergarten?
31. **What if we focused on the process instead of the final product? XXX**
32. What if teachers had more access to mentors?
33. What if students used technology to communicate academically outside of school?
34. What if students incorporated multi subjects into their work?
35. **What if we let students teach each other? XXX**

Choose one (or 2) of your what if questions and begin asking How? How would you implement one or more of the possibilities to make it real?

QUESTIONS TO HELP US DEVELOP SOLUTIONS

- **What if students had more freedom/choice in developing their complex thinking skills?**
    a. How could we allow time for choice in the classroom?
    b. How might we integrate freedom/choice into our curriculums?
    c. How might we manage/assist with the freedom/choice for students who might be reluctant?
    d. How do we ensure we are meeting standards?
    e. How could we implement project-based learning / problem-based learning / inquiry-based learning / genius hour?
    f. How do we keep student interest and investment in class work while still allowing choice to play an important role?
    g. How do we ensure that all students are equally invested in their work and completing tasks?
        i. How do we keep all students on track to meet their goals and be successful? (some students moving ahead and others not doing much of anything?)
    h. How do we show that student choice increases achievement?
    i. How do we show that student choice drives student created learning?
    j. How do we show that standards are still being met while allowing for broad student choice (genius hour, PBL, etc.)
    k. How can we convince stakeholders that student centered/ student choice centered learning is best practice?
    l. How does student choice affect the learning of complex thinking skills?
    m. How does complex thinking develop in project based learning/inquiry based learning/genius hour, etc?
    n. How can we scaffold complex thinking skills while still allowing for broad student choice?
    o. How could we teach across disciplines (integration)?
    p. How do we differentiate student learning?
- **What if we focused on the process instead of the final product?**
    a. How do different instructional methods (PBL, DL, Inquiry) support this type of ongoing assessment? Which are best?
    b. How do we increase student investment in the process over the product, despite what they are used to?
    c. How do teachers distance themselves from the standard of grading the final product and become comfortable assessing the process instead?
    d. How do we determine if it makes sense to assess everything?
    e. How do we get past a mindset that EVERYTHING has to be assessed with standards?
    f. How is this mindset supported by current research and best practice?
    g. How might we grade the process (or should we)?
    h. How might we assess the final product while also considering the process?

i. How might we convince others (teachers, admin, teachers) to focus on the process?
j. How might we determine the goals/purpose when focusing on the process?
k. How might we connect the process to meeting standards?
l. How might we decide on the “process” of different content areas?

SHARING OUR SOLUTIONS

Use this section to share ideas and collaboratively plan your Multimodal presentation.

Use thinglink collaboratively: https://youtu.be/di69ALz5jRw

- ❏ Begin developing your a Multimodal presentation (**ThingLink**, video, EdCanvas, etc.) that shares your suggested solution(s). Your recommendation should:
  - ❏ integrate technologies
    - ❏ How can complex thinking be addressed with tech?
  - ❏ be informed by theory (e.g., TPACK and Berger’s ideas about questioning).
    - ❏ Which theories support the teaching of complex thinking / the approaches we suggest?
  - ❏ Be informed by research.
    - ❏ How are our solutions supported by research? Peer reviewed!
  - ❏ Represent by the collaborative thinking that you do with your think tank group and the questions you posed together
    - ❏ How do we want to pose/present the main questions we have developed?

From Eval notebook:

Wicked Problem Project [20%]

Specific Grading Guidelines
Be sure to check the assignment on WordPress. In addition to the General Grading Guidelines...

Critical Evaluation of the Problem and Solution

- Is it clear that you, as a group, have explored the problem's complexities and understand what makes it especially difficult to solve?
- Have you presented multiple ideas/strategies/approaches that, when applied together, could offer a viable solution or multi-pronged approach to dealing with this issue?
- Is/Are your proposed solution(s) well reasoned and justified?
- Have you used research to guide your thinking? Have you referenced this explicitly? Is your thinking informed by theory and is this made explicit in your white paper report?
- Did you use the questioning process - Why? What If? How?

Communication of Ideas

- Is the final product polished? Stated another way, Is it obvious that each contribution to the final product has been thoughtfully curated and produced?
- Is each contribution a part of the larger 'whole'? Is it clear that each contribution connects in some important way to the other contributions?
- Are ideas coherent, and logically organized?
- Is the tone/register professional and persuasive?
- Do multi-modal elements extend and enhance the meaning of the words you've used?
- Is language polished? Do errors interfere with the reader's understanding of your ideas?
- Are APA conventions of style observed?

Theoretical Compass

- Have you used the TPACK theoretical framework to guide your understanding of the wicked problem and the proposed solutions? Have you referenced this explicitly in your final product? For instance, have you analyzed the complexities of introducing a technology into a new context and what that will mean to the overall outcome?

Evidence of feedback from PLNS

- Did you gather feedback, ideas, and input from members of your PLN?
- Did you integrate suggestions from these discussion into your final product?
- Did you provide insightful commentary to another Think Tank on their Wicked Problem Project?
- Is there evidence of this feedback loop and its implementation?

Instructor Feedback

Feedback from survey:

- Which CT skills are hardest to teach?
    - Authentic opportunities for inquiry
    - Coding/computer science
    - Opportunities for student innovation
- Which CT skills are most important?

    - Problem solving
    - Communication
    - Engagement with real world problems
- Which CT skills are most important does NOT necessarily correspond with what the research shows. Even though research shows that choice is really important, only 2 of 128 respondents says choice is not in the top 3 most important aspects of teaching.
    - Maybe correspondents don't realize the intersection of student choice w the CT skills found most difficult to address:
    - Authentic opportunities for inquiry
    - Coding/computer science
    - Opportunities for student innovation
        - Student choice was one of the most selected CT skills as being difficult to teach/incorporate in class-- This is probably connected to why many correspondents didn't select it in their top 3 most valuable skills, because they don't know how to use it???
        - ALso connects the other way: Student choice benefits the skills selected as most important: prob solving, comm skills, real world problems…

- Teachers don't know how to teach inquiry, coding, student innovation - so maybe that's why they don't see choice as one of the top 3 most important skills to teach.

Multimodal presentation format = thinglink:
https://www.thinglink.com/scene/953784434413273091/editor

Solution overall: Student Choice

Multiple ideas/strategies/approaches -- Specific classroom strategies to provide more student choice:

- PBL - Sarah
- Authentic opportunities for inquiry - Alex
- Genius Hour/20 Time - Lupe
- ANother one?? General choice in assessment formats? Papers, video, podcast, visualization (infographics, etc)...) - Laura

Rationale:

- Integrated classroom instruction
- can address multiple content areas demands with well designed delivery/facilitation
- How is this approach research based?
- More specific details??

How does technology fit into all of this?

Logistics of multimodal:

- -Identify the wicked problem of teaching complex thinking: Infographic? Alex
- -Address our why/what if /how process?
    - Intro & Why? = Laura

    - What If & How? = Sarah
- -Survey results how it led to Solution = student choice Lupe
- -Present 4 solutions, 1 for each of us: Address the following:
    - Rationale for each (should connect to research, TPACK, whatever, something)
    - How can technology be incorporated/enhance each of these approaches
    - What does this really look like in the classroom/how do you manage it
- Project-based learning - Sarah
- Authentic opportunities for inquiry Alex
- Genius Hour/20 Time: Lupe
- ANother one?? General choice in assessment formats? Papers, video, podcast, visualization (infographics, etc)...) Laura

What is PROJECT-based learning?
https://www.edutopia.org/blog/pbl-vs-pbl-vs-xbl-john-larmer
According to the Buck Institute for Education, it comes from the phrase "project learning." It's based on the work of John Dewey and the phrase was first used by William Kilpatrick in 1918 (Larmer, 2014).

Project-based learning is sort of a big umbrella that includes many other _____-based learning methods, including problem-based learning. All feature some of the Buck Institute for Education's (BIE's) Essential Elements of PBL (Larmer, 2014).

All fall under the category of inquiry-based learning... (Larmer, 2014)
Such as:
- Case-based learning
- Community-based learning
- Design-based learning
- Place-based learning
- Problem-based learning
- And others...

So what is PROBLEM-based learning?
- BIE calls problem-based learning a subset of project-based learning:(Larmer, 2014)
    - *one* of the ways a teacher could frame a project is "to solve a problem(Larmer, 2014)
- problem-BL has its own history and set of typically-followed procedures, which are more formally observed than in other types of projects. (Larmer, 2014)
- an instructional method of hands-on, active learning centered on the investigation and resolution of messy, real-world problems (https://www.learning-theories.com/problem-based-learning-pbl.html)
- Benefits of problem-BL (https://www.learning-theories.com/problem-based-learning-pbl.html)
    - develops critical thinking and creative skills (Lee, Ng, Rabinovich, & Wu, 2014)
    - improves problem-solving skills (Lee et al., 2014)
    - increases motivation (Lee et al., 2014)
    - helps students learn to transfer knowledge to new situations (Lee et al., 2014)
- Important to note re problem-BL: (https://www.learning-theories.com/problem-based-learning-pbl.html#concepts)
    - No one "right" answer (Lee et al., 2014)
    - Problems are context specific (Lee et al., 2014)
    - Students work in small groups (Lee et al., 2014)
    - Key problem is identified and solution is implemented (Lee et al., 2014)
    - Teachers are facilitators (Lee et al., 2014)

- Criticisms of problem-BL:
    - Students can't know what's important for them to learn (Lee et al., 2014)
    - Teacher-facilitators MUST assess & account for prior knowledge (Lee et al., 2014)

Although there are lots of different ways to implement it, there are **5 key components of PROJECT-BL** (Edutopia, 2014) - https://www.edutopia.org/video/5-keys-rigorous-project-based-learning:

1. Real-world connections (an authentic problem that drives the curriculum) (Edutopia, 2014)
2. Core to learning (academic rigor - not at the end of the unit; it IS the unit, the way they learn the unit. The standards are incorporated throughout the unit.) (Edutopia, 2014)
3. Structured collaboration ("Allowing students to work together, but giving them a structure within which to work." It's scaffolded - not just "Here's a task. Get it done in the next hour.") (Edutopia, 2014)
4. Student driven (Teacher as facilitator. Students take an active role. Facilitator needs to be able to ask Qs, redirect, give hints and not answers.) (Edutopia, 2014)
5. Multifaceted assessment (Assessment is integrated throughout the entire unit. Small check-ins (~formative assessments), students are assessing themselves. Students are part of the process; the assessment isn't being done TO them.) (Edutopia, 2014)

Benefits OF project-BL

- Students (Edutopia, 2014)
    - Become more engaged and self-directed (Edutopia, 2014)
    - Learn more deeply & transfer learning to new situations (can connect to How People Learn) (Edutopia, 2014)
    - Improve problem-solving and collaboration skills (Edutopia, 2014)
    - Perform as well or better on high-stakes tests (Edutopia, 2014)
- Teachers may find that it's easier, exciting, less burnout. (Edutopia, 2014)
- Student quotes: "We're basically the teachers in this, so we're going to create a rubric, our group contracts and we're going to launch this project to our class." (Edutopia, 2014)

How Does Project-Based Learning Work? (Edutopia, 2007)
https://www.edutopia.org/project-based-learning-guide-implementation
= how to implement project-based learning

- Start with the Essential Question
    - Real-world topic
    - Edutopia has links to other resources for helping to craft the driving Q
- Design a Plan for the Project
    - Keep content standards in mind
    - Involve students in planning so they feel ownership
    - Integrate as many subjects as possible
- Create a Schedule
    - Design a timeline
    - Be flexible
    - Students do need to know there's a deadline
    - Consider:
        - How much time will be given to the project?
        - Will it happen during a dedicated block or during the whole school day?
        - How many days will be devoted to the project?
    - Enable students by practicing the following tactics:
        - Help students who may not perceive time limits.
        - Set benchmarks.
        - Give students direction for managing their time.
        - Teach them how to schedule their tasks.

        - Remind them of the timeline.
        - Help them set deadlines.
        - Keep the essential question simple and age appropriate.
        - Initiate projects that will let all students meet with success.
    - Allow students to go in new directions but guide them if they digress
    - If students going a different direction, ask them to explain their reasoning
- Monitor the Students and the Progress of the Project
    - Facilitate the process and the love of learning.
    - Teach the students how to work collaboratively.
    - Designate fluid roles for group members.
    - Have students choose their primary roles, but assume responsibility and interactivity for all group roles.
    - Remind them that every part of the process belongs to each individual and needs each student's total involvement.
    - Provide resources and guidance.
    - Assess the process by creating team and project rubrics.
- Assess the Outcome
    - provides diagnostic feedback.
    - helps educators set standards.
    - allows one to evaluate progress and relate that progress to others.
    - gives students feedback on how well they understand the information and on what they need to improve.
    - helps the teacher design instruction to teach more effectively.
- Evaluate the Experience
    - Allow time for reflection
        - Take time to reflect, individually and as a group.
        - Share feelings and experiences.
        - Discuss what worked well.
        - Discuss what needs change.
        - Share ideas that will lead to new questions and new projects.

Comprehensive, research-based model for project-BL by Buck Institute for Education (BIE) (Larmer, Mergendoller, & Boss, 2015)
"gold standard" of project-BL -used to indicate the highest quality process or product
http://www.bie.org/object/document/gold_standard_pbl_essential_project_design_elements

1. Student Learning Goals (p. 1)
    a. Key knowledge & understanding (p. 1)
        i. Teaches students the important and fundamental academic content standards and concepts
        ii. Students learn how to apply those concepts in the real world
    b. Key success skills - can only be taught through acquisition of content knowledge (p. 1)
        i. Think critically / Solve problems
        ii. Work cooperatively
        iii. Manage themselves
2. Essential Project Design Elements (p. 2)
    a. Challenging problem or question (p. 2)
        i. Could be concrete or abstract
        ii. Needs to be meaningful for the students to be engaging
        iii. Should challenge the students without being intimidating
        iv. Could be in the form of an open-ending, student-friendly driving question, like "How can we improve our school's recycling system, so we can reduce waste? (p. 2)
    b. Sustained inquiry (p. 2)
        i. Inquiry takes time; a gold standard project takes more than a few days

c. Authenticity (p. 3)
    i. This is about how "real world" the problem is (p. 3)
    ii. Could be real world processes, tasks and tools, quality standards
d. Student voice and choice (p. 3)
    i. The questions they generate
    ii. The resources they'll use to answer the Qs
    iii. The tasks & roles they'll take on as team members
    iv. The products they'll create
    v. Advanced students may select the topic and nature of the project
    vi. Write their own driving Qs
    vii. Demonstrate what they've learned, make their work public
e. Reflection (p. 3)
    i. Throughout the project, not just at the end: what they're learning, why and how
    ii. Can be informal
    iii. Should also be "an explicit part of project journals, scheduled formative assessment, discussions at project checkpoints, and public presentations of student work" (p. 3)
    iv. Helps students solidify what they've learned and think about how it might apply elsewhere
    v. Helps students internal the value of the skills
    vi. Helps students set goals for further growth
    vii. Helps students think about how to implement their next project
    viii. Helps teachers improve the quality of their PBL practice
f. Critique & revision (p. 4)
    i. Thoughtful critique & revision is the route to high quality work
    ii. Give & receive constructive peer feedback (needs to be taught)
    iii. Guided by rubrics, models, formal feedback/critique protocols
    iv. Outside adults, experts can also give feedback
    v.
g. Public product (p. 4)
    i. Product can be tangible, or can be a presentation of a problem solution or answer to a driving question
    ii. Adds to motivating power and encourages high-quality work
    iii. Find the sweet spot of just enough anxiety (about presenting in public)
    iv. It becomes tangible and discussible
    v. Social dimension of learning becomes more important
    vi. Effective way to communicate with parents, community members, wider world about what PBL is and what it does for students

3. Project Based Teaching Practices (not covered in this article) - see instead: https://www.edutopia.org/project-based-learning-guide-implementation#pbl_question (Edutopia, 2007)

~~Problem framing in project-based learning~~
~~http://msulibraries.summon.serialssolutions.com/#!/search?bookMark=ePnHCXMwTV3NCsMgDJbRw7a-RF_ArUWt9rqxsuMOvYvRWjq20vc_Lalu7KYhET6Q_BG-HFmBdevINn5ErXVzxiDdcIVhhz0ZYkf8pVlQ_J332X22mFGLA2t75zNN9TJVj7RepcJk7k33eSERNSr4BZ19qDIZ6VSyob8N1zvPmwQ4GCO4Em3tgpbQeCwkaVDCgZe1kxBDp4OJeoxjBO2h88Z0WkWFfzkGHca2Mx5EyU7p2W_osmvigrCYQxNISzgs4bAEEg2qZABpnvWnPz9XeG0qHxMiU34~~ ~~(Reeve & Svihla, 2016)~~
~~Reeve, R., & Svihla, V. (2016). Facilitating problem framing in project-based learning.~~*~~Interdisciplinary Journal of Problem-Based Learning, 10~~*~~(2) doi:10.7771/1541-5015.1603~~

- ~~Students need genuine ownership over the problems they're working on~~

- ~~even when students are presented with authentic dilemmas that require decisions about possible solutions, there are few cases in which students actually get to take the necessary time to frame the problem they are solving~~
- ~~"students are sometimes given the semblance of control but only over a limited part of the task" (p1)~~
- ~~the driving question should be based on a real-world problem that motivates students, they find meaningful~~

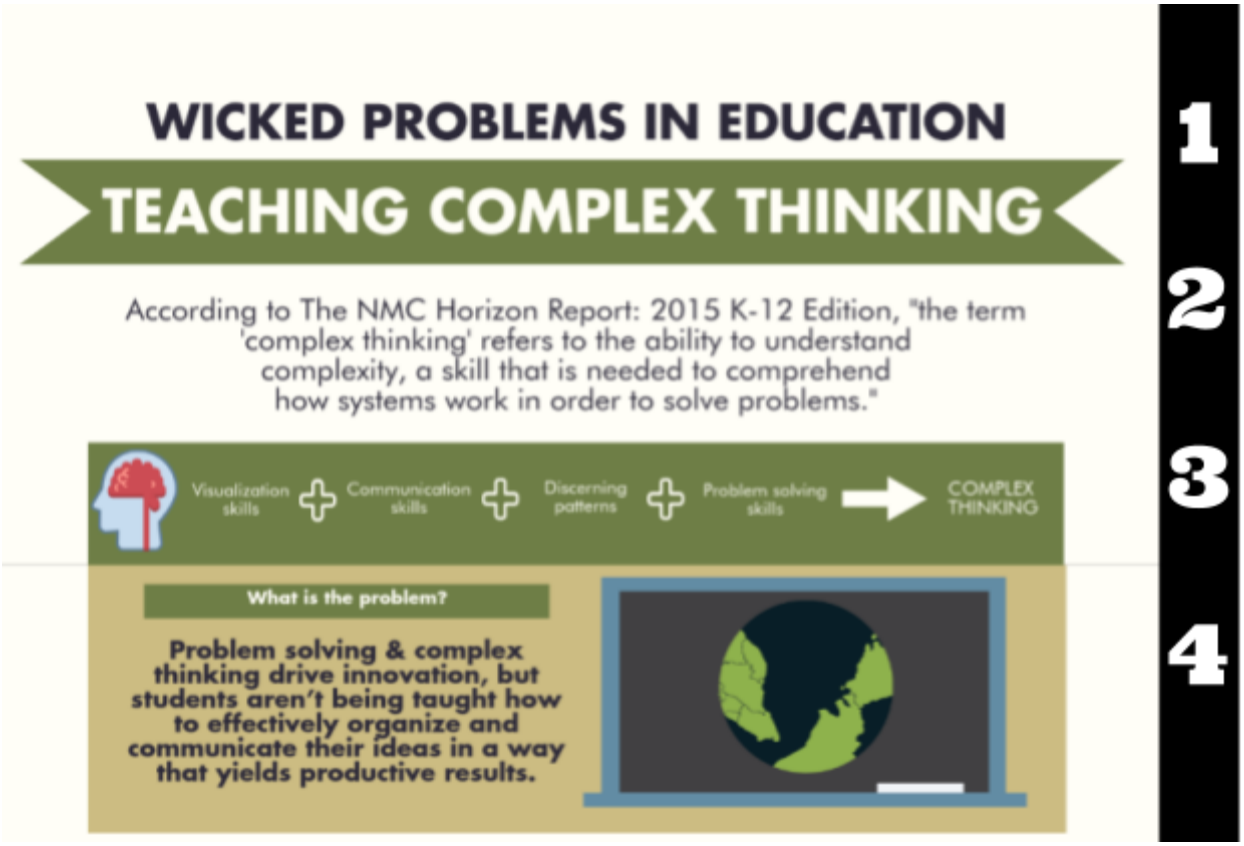
~~Suggestions for getting started with project-BL:~~

- ~~Start small. Consider just running one unit as a project-BL unit.~~

PROJECT-BASED LEARNING
https://www.thinglink.com/scene/953784434413273091/editor

- Make thinglink to this video by Edutopia https://www.youtube.com/watch?v=hnzCGNnU_WM. They give permission as long as we give them credit. Original source (Edutopia, 2014): https://www.edutopia.org/video/5-keys-rigorous-project-based-learning

- Make thinglink to this site by Edutopia **What the heck is it?** (Wolpert-Gawron, 2015): https://www.edutopia.org/blog/what-heck-project-based-learning-heather-wolpert-gawron
- Make thinglink to this site by Edutopia **Guide to getting started** (Edutopia, 2007): https://www.edutopia.org/project-based-learning-guide-implementation#pbl_question
- Make thinglink to this site by BIE **"Gold Standards" for PBL** (Edutopia, 2007): http://www.bie.org/object/document/gold_standard_pbl_essential_project_design_elements



REFERENCES

I found a good resource to use in our blogs:
http://www.tandfonline.com.proxy1.cl.msu.edu/doi/full/10.1080/00098655.2016.1147411

"Researchers suggest that by providing opportunities for higher order thinking, student choice, and creative ways to showcase knowledge, students will find engagement and motivation in the classroom. Many teachers of adolescent students struggle with ways to integrate these approaches while meeting the standards. The purpose of this article is to provide examples of engaging literacy strategies that focus on the Common Core State Standards for middle and high school students."

If link won't work, search **Engaging Minds in the Common Core: Integrating Standards for Student Engagement** by Christy Howard on MSU Lib website to get to the article.

REFERENCES

Authentic Enquiry. (n.d.). Retrieved August 16, 2017, from http://learningemergence.net/about/authentic-enquiry/

Berger, W. (2016). *A more beautiful question: The power of inquiry to spark breakthrough ideas*. New York: Bloomsbury.

Block, J. (2014, October 30). Student Choice Leads to Student Voice. Retrieved from https://www.edutopia.org/blog/student-choice-leads-to-voice-joshua-block

Edutopia. (2007, October 19). How Does Project-Based Learning Work? Retrieved from https://www.edutopia.org/project-based-learning-guide-implementation#pbl_question

Edutopia (2014, June 26). 5 Keys to Rigorous Project-Based Learning. Retrieved from https://www.edutopia.org/video/5-keys-rigorous-project-based-learning

Hosking, J. (2016, May 05). Genius Hour in Your Classroom. Retrieved from https://www.educationtechnologysolutions.com.au/2016/05/genius-hour-in-your-classroom/

Juliani, A. (2013, September). Research Behind Genius Hour & Choice in the Classroom. Retrieved from http://ajjuliani.com/research/

Larmer, J. (2014, January 06). Project-Based Learning vs. Problem-Based Learning vs. X-BL. Retrieved from https://www.edutopia.org/blog/pbl-vs-pbl-vs-xbl-john-larmer

Larmer, J., Mergendoller, J., & Boss, S. (2015). Gold Standard PBL: Essential Project Design Elements (Adapted from Setting the Standard for Project Based Learning: A Proven Approach to Rigorous Classroom Instruction). *Buck Institute for Education 2015*. Retrieved from http://www.bie.org/object/document/gold_standard_pbl_essential_project_design_elements

Lee, J., Ng, J., Rabinovich, A., & Wu, J. (2014, June 23). Problem-Based Learning (PBL). Retrieved from

https://www.learning-theories.com/problem-based-learning-pbl.html#concepts

Leeves, S., & Banerjee, R. (2013). Childhood social anxiety and social support-seeking: distinctive links with perceived support from teachers. European Journal of Psychology of Education, 29(1), 43-62. doi:10.1007/s10212-013-0186-1

Mishra, P., & Koehler, M. (May 2009). Too cool for school? No way! *ISTE (International Society for Technology in Education),* 14-18.

Practice. (n.d.). Retrieved August 16, 2017, from https://www.authenticinquiry.org/page/practice

Wolpert-Gawron, H. (2015, January 26). What the Heck Is Project-Based Learning? Retrieved from https://www.edutopia.org/blog/what-heck-project-based-learning-heather-wolpert-gawron