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Teaching and Assessing 21st Century Skills

Presented by Dr. Tammy Heflebower
July 12, 2011



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“The illiterate of the 21st century will not be those who cannot read and write, but those who cannot learn, unlearn, and relearn.”



Alvin Toffler 2001
An American writer and futurist



Explore a few questions together....

- Why 21st Century Skills?
- What are two categories of skills and the research behind them?
- How might we teach and assess such skills?
- How might we begin implementation?



What about Gemma & Eliana?



Fast Company, April 2010. Used with permission.



"GTG," "BRB," "BTW,"
"ROTFLOL"

Why 21st Century Skills?

- ▶ The world is changing and will continue to change dramatically throughout the 21st century.
- ▶ Schools in the United States are not keeping up with many of these changes.
 - Dropout rates
 - Lack of student engagement
 - Achievement gaps
- ▶ In the 21st century, mastery of the basic skills of reading, writing, and math is no longer enough.



Why Consider 21st Century Skills?

- Almost any job that pays more than minimum wage—both blue and white collar—now **calls for employees who know how to solve a range of intellectual and technical problems.**

(p. xxii)

Tony Wagner (2008)



Why 21st Century Skills?

- “On that assessment [PISA] of forty countries, the United States ranked thirty-fifth in mathematics and thirty-first in science.”
- “...in each disciplinary area tested, U.S. students scored lowest on the problem-solving items”

(Darling-Hammond, 2010, p. 35).



Programme for International Student Assessment (2009)⁽¹⁾
(OECD members as of the time of the study in boldface)

Maths		Sciences		Reading	
1. Shanghai, China	600	1. Shanghai, China	575	1. Shanghai, China	556
2. Singapore	562	2. Finland	554	2. South Korea	539
3. Hong Kong, China	555	3. Hong Kong, China	549	3. Finland	536
4. South Korea	546	4. Singapore	542	4. Hong Kong, China	533
5. Taiwan	543	5. Japan	537	5. Singapore	526
6. Finland	541	6. South Korea	538	6. Canada	524
7. Liechtenstein	537	7. New Zealand	532	7. New Zealand	521
8. Switzerland	534	8. Canada	529	8. Japan	520
9. Japan	529	9. Estonia	528	9. Australia	515
10. Canada	527	10. Australia	527	10. Netherlands	508
11. Netherlands	526	11. Netherlands	522	11. Belgium	506
12. Macau, China	525	12. Liechtenstein	520	12. Norway	503
13. New Zealand	519	13. Germany	520	13. Estonia	501
14. Belgium	515	14. Taiwan	520	14. Switzerland	501
15. Australia	514	15. Switzerland	517	15. Poland	500
16. Germany	513	16. United Kingdom	517	16. Iceland	500
17. Estonia	512	17. Slovenia	512	17. United States	500
18. Iceland	507	18. Macau, China	511	18. Liechtenstein	499
19. Denmark	503	19. Poland	508	19. Sweden	497
20. Slovenia	501	20. Ireland	508	20. Germany	497
21. Norway	498	21. Belgium	507	21. Ireland	496
22. France	487	22. Hungary	503	22. France	496

http://en.wikipedia.org/wiki/Programme_for_International_Student_Assessment

**Gemma & Eliana Will
Need Additional
Skills...
21st Century Skills**



Explore a few questions together....

- Why 21st Century Skills?
- What are two categories of skills and the research behind them?
- How might we teach and assess such skills?
- How might we begin implementation?



How do we prepare students?

- Five categories of 21st century skills divided into two sets:

1. Cognitive skills

1. Conative skills



Cognitive Skills

- Teaching of cognitive skills is not unique to the 21st century.
- What is new to the 21st century is the idea that cognitive skills should take a **dominant** role in the curriculum.



Conative Skills

- The process of combining what one knows (cognitive) with how one feels (affective) and deciding what action to take in light of both.



Prepare student with cognitive and conative skills.

Cognitive Skills	Conative Skills
Analyzing and using information	Understanding and controlling oneself
Addressing complex problems and issues	Interacting with others
Creating patterns and mental models	



Please peruse the research and quotes.

- Slides in handout.

★ The phrase or paragraph that stood out.

- Please underline a powerful sentence for you.
- ✓ A word that resonates with you.



Research Excerpts About Critical Thinking and Graphic Organizers (Cognitive Skills)



Table: Results from Abrami et al. (2008) Meta-Analysis

Type of intervention	Number of effect sizes	Effect size	Percentile gain
General critical thinking skills: "CT skills and dispositions are learning objectives, without specific subject matter content" (p. 1105)	39	.38	15
Infusion: "deep, thoughtful, and well-understood subject matter instruction in which students are encouraged to think critically in the subject ... general principles of CT skills and dispositions are made explicit" (p. 1106)	52	.54	21
Immersion: "subject matter instruction is thought provoking, and students do get immersed in the subject. However ... general CT principles are not made explicit" (p. 1106)	48	.09	4
Mixed: "students are involved in subject-specific CT instruction, but there is also a separate thread or course aimed at teaching general principals of CT" (p. 1106)	22	.94	33

Table: Meta-Analyses on Graphic Organizers

	Number of Studies	Number of Effect Sizes	Effect Size	Percentile Gain
Hayward & Marzano (2009)	65	65	0.29	11
Nesbit & Adesope (2006)	55	67	0.60	23
Moore & Resndence (1984)*	161	161	0.22	9
Vasquez & Camballo (1993)*	17	19	0.57	23
Horton, McConney, Galle Woods, Sims, & Hamilton (1993)*	19	19	0.45	17
Kang (2002)*	14	14	0.79	29
Kim, Vaughn, Wanzel, & Wei (2004)*	21	52	0.81	29

*As reported in Hattie (2009)

Research Excerpts About Conative Skills



Understanding and Controlling Oneself

Cultivating Self-Efficacy

- ▶ Self-efficacy plays a major role in performance. Schunk & Pajares (2005) reported a 1995 study which found that “despite the influence of mental ability, self-efficacy beliefs made a powerful and independent contribution to the prediction of performance” (p. 93).
- ▶ Pajares (1996) noted that “students who believe they are capable of performing academic tasks use more cognitive and metacognitive strategies and persist longer than those who do not” (pp. 552–553).



Understanding and Controlling Oneself

Resiliency

- ▶ Rubin (1996) noticed that resilient people’s ability to hold onto a self, even in the face of the assaults they suffered, made it possible to stand back and observe the fray without getting bogged down in it.
- ▶ Researchers with the Penn Resiliency Program, developed at the University of Pennsylvania by Martin Seligman and his colleagues, found that they could “make kids more resilient by teaching better thinking skills” and by teaching “the basic skills of problem solving” (Andrews, 2000).



Understanding and Interacting With Others

Responsible Communication

According to Rogers & Farson (1957/2007), *active listening* is listening that will help people “gain a clearer understanding of their situations, take responsibility, and cooperate with each other” (p. 279).



Understanding and Interacting With Others

Addressing Conflict and Controversy

In 1989, Johnson & Johnson conducted a meta-analysis of 378 studies to investigate the effects of interdependence and cooperation on performance. They found that “cooperation promoted greater productivity and achievement than did interpersonal competition or individualistic efforts” (p. 54).

In their most recent meta-analysis examining the effects of *constructive controversy*, a technique designed to help students discuss conflicting ideas and perspectives in productive ways, Johnson & Johnson (2009) found that “[constructive] controversy tended to result in greater mastery and retention of the material and of the skills being learned than did concurrence seeking.”



Explore a few questions together....

- Why 21st Century Skills?
- What are two categories of skills and the research behind them?
- How might we teach and assess such skills?
- How might we begin implementation?



21st Century Skills Include:

Cognitive Skills



- **Analyzing and using information**
- Addressing complex problems and issues
- Creating patterns and mental models

Conative Skills

- Understanding and controlling yourself
- Interacting with others



Important Components of Cognitive Skills

Analyzing and using information

- ▶ Navigating digital sources
 - Focus on what is important.
 - Find information that is relevant and credible.
- ▶ Identifying common logical errors
 - Identify and dismiss arguments that contain errors in thinking.
- ▶ Generating conclusions
- ▶ Presenting and supporting claims
 - Present claims and provide adequate support for those claims.



21st Century Skills Include:

Cognitive Skills



- Analyzing and using information
- **Addressing complex problems and issues**
- Creating patterns and mental models

Conative Skills

- Understanding and controlling yourself
- Interacting with others



Important Components of Cognitive Skills

Addressing complex problems and issues

- ▶ Focus
- ▶ Divergent and convergent thinking
- ▶ A strategy for addressing problems in life



Problem-Solving Invention Convention

- Students read about famous inventors and how they got ideas...including how patents were obtained.
- Considered a problem they would like to solve—used scientific method.
- Researched if there was a market.
- If a market, began creating a prototype.
- Create the real thing and test it out.
- Showcase the invention.



The “green” refrigerator

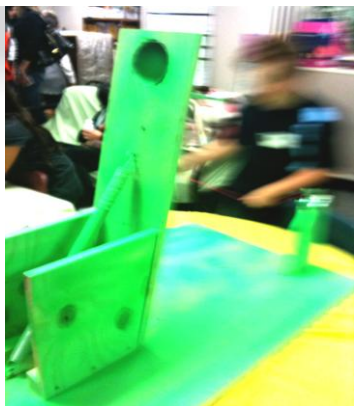


The rotating tree for ease in applying holiday lights



Merrano Research Laboratory

Dog toy thrower



Merrano Research Laboratory

Students earned patents



Merrano Research Laboratory



Parent Reflections...

"The Senior Project was **one of the most memorable experiences** of my son's high school education. I truly believe that lessons learned from the Senior Project will remain with him long after most of what he learned in he classroom. In spite of all his whining at the time, I think he would agree with me now."



Parent Reflections...

"Our daughter was interested in the medical field. She followed a neo-natal nurse at Children's Hospital, and it totally **reinforced her desire to pursue the sciences** as an undergraduate college student."



Parent Reflections...

"For my daughter's senior project she gave a cake decorating class to a group of girls at a home for unwed mothers. **She not only honed her baking skills but gained public speaking skills** from presenting to the class and gained **satisfaction from reaching out to others in need.**"



Parent Reflection cont.

▪ "[My son], never the best student, really had an **opportunity to follow a topic of his own choosing and interest.** When he teamed up with his mentor and learned what the 'real-world' expectations were for tackling a task, he realized **he had to step up his level of effort** on all fronts - the paper, the presentation, and the portfolio..."



Parent Reflections...

• I firmly believe that ThunderRidge's Senior Project fulfilled its Mission Statement and made a great impact on my student. Honestly, **it kept him focused and on track throughout his Senior year.** As stated earlier, he was not a great student. The Senior Project is one of the only things he still talks about, and to me that is a measure of its value. **I'm not sure he would have graduated without it.**"



Student Reflections...

- "I loved the senior project it made me think if I really wanted to do what my project was as a profession!!! :)"
- "I'm in my 4th year in college and I cannot tell you how many projects I've had to do that require extensive research, reporting, and a formal presentation. So I'm happy to have had the experience in completing such an elaborate project early on. It has definitely made my college career a little easier."
- "I shadowed the Arapahoe County coroner's office and I am still studying biology as a major."
- "...it wasn't very fun at times, but it was useful and I am still showing off my portfolio and my hard work today"



Student Reflection cont.

- "The project helped me grow a lot as a person and as a member of society."
- "It helped prepare for college interviews, presentations and job interviews."
- "I feel that doing the Senior project helped me overcome things and face the real world no matter how much I denied it."
- "This was a hands on project which is different from learning from the text."
- I feel that it pushes the students to do something unexpected of themselves and in the end it made me proud of what I had done."



So what?

- Please share ways (or think about ways) in which you or others are connecting students to real world issues.
- How might you use one of these ideas to jump-start or enhance this type of learning at your site?



21st Century Skills Include:

Cognitive Skills

- Analyzing and using information
- Addressing complex problems and issues
- **Creating patterns and mental models**



Conative Skills

- Understanding and controlling yourself
- Interacting with others



Important Components of Cognitive Skills

Mental models

- ▶ Identifying basic relationships between ideas
- ▶ Creating graphic representations
- ▶ Drawing and sketching
- ▶ Mental images
- ▶ Thought experiments
- ▶ Mental rehearsal



Cognitive Skill— Creating Patterns and Mental Models

- **Graphic organizers,**
- Visual models, and
- **Visualization/mental rehearsal**



Graphic Organizers

- **Patterning** is the process whereby the brain perceives and generates patterns by relating new with previously learned material or by chunking material into pattern systems it has used before.



Non-Example

Color the ball inside the toy box.



Color the bucket under the faucet.



Color the bird in the sky.



Color the book on the table.



“When people visualize or imagine using various senses, the parts of their brains involved with those senses become active. What this means is that the body and the brain don’t know the difference between imagined events and real events. The body and the mind are integrally connected.”

(Kirwan Rockefeller, 2007, pg. 28.)



Mirror Neurons

Discovered in 1992 by Giacomo Rizzolatti



21st Century Skills Include:

Cognitive Skills

- Analyzing and using information
- Addressing complex problems and issues
- Creating patterns and mental models



Conative Skills

- **Understanding and controlling yourself**
- Interacting with others



Conative Skill—Understanding and Controlling Oneself

- Interpretations
- Ways of thinking
 - Self-Efficacy
 - Growth Mindset
 - Resiliency
 - Positive Possible Selves
 - Optimism
- Avoidance of Negative Thinking
 - Emotional Thinking
 - Worry



Cultivating Self-Efficacy

- “Self-efficacy has an effect size of .82 relative to students’ academic performance.
- **This translates to an expected 29 percentile point gain.**

Marzano, 2010



Cultivating Self-Efficacy

- At its core, *self-efficacy* is the disposition that an individual has control over his or her life.
 - Self-efficacy plays a major role in performance.
 - **“The average weighted correlation between self-efficacy and work-related performance= impressive 28% gain in task performance.”**

Dale Schunk and Frank Pajares (2005)



Think about...

- Identify students for whom you have low expectations.
- Identify similarities in students.
- Identify differential treatment of low-expectancy students.
- Treat low-expectancy and high expectancy students the same.



Intangibles Include:

Cognitive Skills

- Analyzing and using information
- Addressing complex problems and issues
- Creating patterns and mental models



Conative Skills

- Understanding and controlling yourself
- **Interacting with others**



Conative Skill--Interacting with Others

- **Perspective taking,**
- Responsible communication, and
- Addressing conflict and controversy.



Perspective Taking

- *Perspective taking* involves understanding how a situation appears to another person and the reasons for their cognitive and emotional reactions.



Circle of Viewpoints

Topic: Grading practices

Consider traditional grading practices, and that your district is moving toward standards-referenced or standards-based reporting.



From your perspective....

1. With a few (3 others) people near you, assume the following perspectives:

- Parent
- Teacher
- Student
- Influential business member in your community



Circle of Viewpoints

Take one minute to collect your thoughts on the following two statements or questions.

Take four minutes to share your assumed perspective.

1. When I think about grading, my greatest hope or concern is....

1. A question I have from this viewpoint is ...



Personal Wrap Up...

If we were making the assumption that you were wanting to move toward standards-referenced or standards-based grading (or another topic):

1. What new insights do you have about the topic that you didn't have before?
2. How will these insights guide your implementation plan?
3. What is one thing you will do to deepen this understanding within those audiences?



Explore a few questions together....

- **Why 21st Century Skills?**
- **What are two categories of skills and the research behind them?**
- **How might we teach and assess such skills?**
- **How might we bring implementation?**



Sometimes 21st Century Skills are Difficult to Measure.

- Typically they are vague and atypical in how we measure them.
 - How do we measure things like love, thoughtfulness, kindness, fear, concern?
 - We know them when we see or experience them.
 - We need to re-think our teaching and assessing to consider skills that are atypical for us.



Types of Assessments

Obtrusive

Unobtrusive

Student Generated



Assessing 21st Century Skills

- ▶ Create a proficiency scale.
- ▶ Use the scales to monitor progress over time.
- ▶ Traditional assessment types might be very useful in 2.0 content.
- ▶ Teacher observations:
 - Select a small set of skills that fit well with the content.
 - Students track those skills.
 - Teacher records observed skills on weekly or semimonthly basis.



Proficiency Scale

4	In addition to exhibiting level 3 performance, in-depth inferences and applications that go BEYOND what was taught in class
3	No major errors or omissions regarding any of the information and/or processes (SIMPLE OR COMPLEX) that were explicitly taught
2	No major errors or omissions regarding the SIMPLER details and processes BUT major errors or omissions regarding the more complex ideas and processes
1	With HELP, a partial knowledge of some of the simpler and complex details and processes
0	Even with help, no understanding or skill demonstrated

Please review some samples on the next few slides ...



Analyzing and Utilizing Information Navigating Digital Sources

Score 4.0	The student: <ul style="list-style-type: none"> Applies the strategy in unusual situations and/or employs elements that were not explicitly taught. No major errors or omissions regarding the score 4.0 content
Score 3.5	In addition to score 3.0 performance, partial success at score 4.0 content
Score 3.0	The student: <ul style="list-style-type: none"> Analyzes and evaluates websites for the validity of their content. No major errors or omissions regarding the score 3.0 content
Score 2.5	No major errors or omissions regarding score 2.0 content and partial success at score 3.0 content
Score 2.0	The student: <ul style="list-style-type: none"> Can describe important considerations to keep in mind when examining websites. Can describe situations in which checking for the validity of information found on the Internet would be important. Can describe or recognize examples of legitimate and illegitimate websites. No major errors or omissions regarding the score 2.0 content
Score 1.5	Partial success at score 2.0 content, and major errors or omissions at score 3.0 content
Score 1.0	With help, partial success at score 2.0 content and score 3.0 content
Score 0.5	With help, partial success at score 2.0 content, but not at score 3.0 content
Score 0.0	Even with help, no success

Analyzing and Utilizing Information: Identifying Common Logical Errors

Score 4.0	The student: <ul style="list-style-type: none"> Applies the strategy in unusual situations and/or identifies logical errors that go beyond those that were explicitly taught. No major errors or omissions regarding the score 4.0 content
Score 3.5	In addition to score 3.0 performance, partial success at score 4.0 content
Score 3.0	The student: <ul style="list-style-type: none"> Analyzes appropriate information for common logical errors. No major errors or omissions regarding the score 3.0 content
Score 2.5	No major errors or omissions regarding score 2.0 content and partial success at score 3.0 content
Score 2.0	The student: <ul style="list-style-type: none"> Can describe situations in which it is beneficial to analyze information for common logical errors. Can describe and/or recognize the various common logical errors that have been taught: contradiction, accident, false cause, begging the question, evading the issue, arguing from ignorance, and composition or division. No major errors or omissions regarding the score 2.0 content
Score 1.5	Partial success at score 2.0 content, and major errors or omissions at score 3.0 content
Score 1.0	With help, partial success at score 2.0 content and score 3.0 content
Score 0.5	With help, partial success at score 2.0 content, but not at score 3.0 content
Score 0.0	Even with help, no success

One way to assess...

- A very straightforward way to assign scores to students using the scales.
- The teacher records his or her perceptions of students on a weekly or alternate week basis.



Tracking Intangibles

	Steph	Tammy	Jed	David	Noah	Shawna	Linea	Roger	Andy
Divergent and Convergent Thinking	1.5	2.5	2.5	3.0	0.5	2.0	2.5	1.5	3.0
	2.0	3.0	3.0	3.0	3.0	2.0	2.5	3.5	4.0
	2.0	3.0	3.0	3.0	3.0	2.0	2.5	3.5	4.0
Controversy and Conflict Resolution	2.0	2.5	1.5	3.0	2.5	0.5	2.0	1.5	2.5
	3.0	1.5	3.0	2.5	1.5	1.5	Inc	3.5	2.0
	3.0	3.5	2.0	3.0	2.0	2.0	2.0	4.0	3.0
Perspective Taking	1.5	1.0	1.5	2.5	1.5	1.0	2.5	3.5	1.5
	1.0	2.0	1.5	3.5	1.5	2.5	2.5	2.5	3.0
	2.0	2.5	2.0	4.0	1.0	3.0	2.0	3.0	2.0

Another Option

- Design a specific task that requires students to use a 21st century skill that is the focus of instruction.
- For example, for the general skill of addressing problems in life, a teacher might present students with the following task:



Teacher Designed Task:

- Select a recurring problem you have been having at school or at home and apply the strategy we have been studying for addressing problems in life. That strategy has eight steps:



Teacher Designed Task:

- Over the next two weeks apply these steps to the problem you have selected.
- In writing, describe how you have addressed each step and then evaluate the overall effectiveness of the strategy in helping you solve this problem.



Teacher Designed Task:

- **Step 1:** Determine whether you really have a problem.
- **Step 2:** If you think you really have a problem, take a moment to affirm some positive beliefs.
- **Step 3:** Start talking to yourself about the problem.
- **Step 4:** Start looking for the obstacles in your way. What's missing? What is limiting you?



Teacher Designed Task:

- **Step 5:** For each of the possible solutions you have identified, determine how likely it is to succeed.
- **Step 6:** Try out the solution you believe has the best chance of success and fits your comfort level for risk.
- **Step 7:** If your solution doesn't work, clear your mind, go back to another solution you have identified and try it out.
- **Step 8:** If no solution can be found that works, 'revalue' what you are trying to accomplish.



Yet Another...

- Student self-analysis or student self-assessment
- Students record self-perceptions of their status on a particular 21st century skill.
- Students might score themselves at the same time the teacher scores them.



Student Self-Assessment

- The teacher would assign scores to each student using the Teacher Tracking Sheet.
- At the same time, students would score themselves using the same scale as the teacher and turn in their self-ratings to the teacher.
- The teacher would compare the students' self-ratings with his or her own.



Explore a few questions together....

- Why 21st Century Skills?
- What are two categories of skills and the research behind them?
- How might we teach and assess such skills?
- How might we begin implementation?



Implementation...

- Get clear about what's important.
- **Integrate** 21st Century Skills into academic learning areas and teach **explicitly** across the grades.



Implementation...

- Review current guides to ensure:
 - Global perspectives where applicable
 - Application to real world (personal, local, national, international)
 - Infuse social and emotional components of learning
 - Career exploration
 - Technology and media taught AND used

Jacobs, H. (2010). *Curriculum 21*. Alexandria, VA: ASCD.

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