Just the Facts, Ma’am: Why Some Kids Think Like Joe Friday

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What is the path?
How do we Support Growth from a Gifted Adolescent to a Creative, Wise, Expert?
How do Experts Think?

• Ability
• Content
• Conceptual
• Critical Thinking
• Forward Problem-Solving
• Metacognition
• Personality
• Passion
Our great struggle in medicine these days is not just with ignorance and uncertainty. It's also with complexity: how much you have to make sure you have in your head and think about. There are a thousand ways things can go wrong.

Atul Gawande

Scientific views end in awe and mystery, lost at the edge in uncertainty...

Richard P. Feynman

The quest for certainty blocks the search for meaning. Uncertainty is the very condition to impel man to unfold his powers.

Erich Fromm

I have been interested in phenomena involving complexity, diversity and evolution since I was a young boy.

Murray Gell-Mann
So we build or select learning activities
How do Experts Think?

Belief about
What it means to
KNOW Something
If we are to be successful cultivating meaningful, deep thinking students have to believe what we believe about what it means to be wise educated.
‘Mature’ Beliefs about Epistemology and the Meaning of KNOWING

- An ESSENTIAL Component of Expertise
- A Predictor of Middle and High School Achievement
- A Factor in Student Motivation
- A Developmental Sequence Influenced by Education
- Another Source of Qualitative Difference between Gifted and Typically Developing Students
- A Potential Scope and Sequence for Critical Thinking and Foundation for Differentiation in Middle and High School
- Source of Understanding and **PATIENCE**
William Perry
Forms of Intellectual and Ethical Development
Central Lesson:
The road to sophisticated thinking is comprised of a

*predictable,*

*sequential,*

*invariant,*

*developmental,*

series of shifts that restructure one’s view of knowledge and wisdom.
At Each Stage

students hold

**QUALITATIVELY DIFFERENT**

views of what constitutes

‘important, legitimate, valid’

Education
Four Students

Jaspar
Amy
Daniel
Susan
Jasper worked late into the night to finish his history essay. His father asked why he was so frantic. Even though Jasper had made all his important points, he still had two pages to write to meet the length requirement for his assignment. When his father suggested he focus on important ideas and forget about the length, Jasper was aghast. “But I really like Mr. Everest!” he said. “I want to do well for him!” Jasper was completely in earnest... he thought the best way to please his teacher was by providing the right number of facts, missing completely the idea that he had already presented enough valuable ideas.
DUALISM

Naïve Epistemology

See knowledge/wisdom as remembering answers and using the right tools to find right answers
## Dualism

<table>
<thead>
<tr>
<th>Belief about Knowledge</th>
<th>Teacher Role</th>
<th>Valued Critical Thinking</th>
<th>Success in Learning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Everything is known; all legitimate questions can be answered</td>
<td>To dispense known information</td>
<td>Memorization, information retrieval</td>
<td>Absorbing and reciting as much as possible</td>
</tr>
</tbody>
</table>
Voices of Dualism

My best class was history last year. It was a class in world history. The teacher's lectures were clear and well-organized. He knew his stuff, and he would go over things till no questions remained. You knew what was expected and exactly how you would be graded. He was not vague and wandering all over the place like my English teacher."
Given an assignment on Genetically Modified Organisms, a student in Dualism is likely to say...

Genetically Modified Organisms are GOOD

...because I read it in a book
...because my teacher told me
...because my parents told me

it’s as SIMPLE as that.
The Transition Out of Dualism

Exposure to

*Multiple Opinions*

About a Subject or Issue
Ms. Jenkins sighed. She had just gone another round with Amy, who had come storming into her office, waving her paper angrily. “You can’t grade my interpretation of The Tempest!” Amy charged. “No one can really know what it means. Neither of us was alive when it was written, so my opinion is as good as yours!” Amy seemed blind to the idea that some interpretations of the play were more valid than others, for good literary reasons. Instead, she left the room muttering in barely audible tones about the arbitrary grades students received in this class.
MULTIPLICITY

Personal Truth

Two Realities

• one where authority provides correct answers
• and a second where, absent such answers, each person’s answer is fully valid for him/her.

...from “Ignorant Certainty” to “Intelligent Confusion”
## Multiplicity

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<tr>
<td>Most questions are answered, although some important questions are not answered.</td>
<td>Knows the right answer or the ‘right’ opinion</td>
<td>Unbridled speculation, hypothesis posing, debate Form without substance Some use of evidence/one sided</td>
<td>Best: Having own opinion validated. Second Best: Figuring out and repeating the teacher’s position (even if you don’t agree with it).</td>
</tr>
</tbody>
</table>
Lots of Flavors!!!!!!!

Personal Preference Determines what is BEST
Intellectual Oobleck
My favorite class taken in college was English 261. I ...like the class because the teacher encouraged the students to participate and state their own ideas. I like a class where the teacher does not just tell you everything but lets you state your opinion. Whether he agreed or not never mattered because different meanings could be read into the stories.
Given an assignment on Genetically Modified Organisms, a student in Multiplicity is likely to say…

I believe they are (good/bad)
but you can disagree if you want,
because all opinions are equally valid
just don’t try to grade my opinions!
I still don’t have all the answers, but I’m beginning to ask the right questions.
In Order to Transition Out of Multiplicity

Exposure to *Multiple Theories* About a Subject or Issue

Different Methods for Analyzing Arguments
Daniel

He got it! Dr. Jones has had a good day. She gave her physics class an assignment to develop an experiment testing principles of force and resistance. Rather than have the students conduct the experiment, she had them discuss the different experimental designs to identify the ones that had the most merit. In the course of the discussion, Daniel actually evoked scientific criteria used to judge experiments and chose three he thought were best. Opinions and right-answer dependency finally seemed to take a back seat to solid reasoning.
CONTEXTUAL RELATIVISM
Decisions within disciplines

Students understand
The *evidence*
And the *criteria*
used within a field to select
preferable theories.
**Contextual Relativism**

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</thead>
<tbody>
<tr>
<td>Knowledge is contextual and subjective as it is filtered through perception and judgment. Only interpretations of evidence, events, etc. are known.</td>
<td>To show how different disciplines approach uncertain questions: The structure of the discipline.</td>
<td>Tools of the discipline: Logical consistency, error analysis, agreement with data Advanced comparisons.</td>
<td>Building defensible arguments using the tools of the discipline.</td>
</tr>
</tbody>
</table>
Stage 3: Contextual Relativism

Toolbox
The Fundamental Task of Sophisticated Thinking:

The Comparison of Human Generated Ideas
Voice of Contextual Relativism

My best class was Genetics 3-002. Genetics is a relatively new discipline and those working in the field had proposed a lot of hypotheses to account for certain things but the teacher didn't even pretend that he had the answers. The course offered you a real chance to push yourself to think and try out new ideas.
Tasks for Contextual Relativism

• Teach students structure of the discipline, tools of analysis, process skills, rules for interpreting information

• Ask students how they come to understand instead of what they believe—model considering different approaches to achieve understanding

• Help students realize that what works in one discipline doesn’t always work in another
Given an assignment on Genetically Modified Organisms, a student in Dualism is likely to say...

...I use the rules of science to demonstrate that they are safe to eat.

...but sometimes the facts rules of science make me question what I know, as with the evidence on wheat and gluten intolerance.
In Order to Transition Out of Relativism

Exposure to *Multiple Paradigms* Of Thought
‘Oh this is so cool...’ Susan is reading the Science section of the Tuesday New York Times. She is reading about how the scientists who decoded the DNA sequence realized the best people to help break the DNA code were linguists studying ancient languages, since the operations of deciphering language and DNA were essentially the same. She has always known there were people out there who knew one way of thinking was not enough, that real invention happens when you break boundaries and apply something from one area in another. She just doesn’t find many who think like this at school.
Here’s what you study: *molecular structures of DNA*

What’s your discipline?

Molecular biology
Genetics
Biochemistry
Quantum Mechanics
What are legitimate ways to measure happiness?
DIALECTIC or
COMMITMENT WITHIN
RELATIVISM
Responsible knowing
Students know that problems can be approached from 
*diverse frameworks* and can describe the 
*advantages* of different frameworks, 
*address tradeoffs*, 
and explain *why they support (believe in)* a 
particular approach
## Dialectic

<table>
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</tr>
</thead>
<tbody>
<tr>
<td>Complexity is preferable (although not easier) than simplistic answers.</td>
<td>Models of the personal search for values associated with paradigms of thought.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
“I mean it revolves and you see it revolve and you know it revolves. Then the lighting changes and the window doesn’t revolve, it oscillates…. And then the light goes back to normal, and there it is, revolving.”

She then reported how the teacher, unlike those who present such items as one more quirk of perception, stopped and asked as if of the air: “what do you make of that?” All of a sudden, she reported, it came to her how much we bring with us to our perception of reality, how much we create of all we know. It all “opened out” to her how much we build our worlds. If this could be true of windows, how about people? How about oneself? How about…?

“I mean, I really learned how different things can look in a different light, so to speak. It was terrific.”
Stage 4: “Commitment within Relativism”
Or “Dialectic”

..recognizes the existence of an examined point of view within which exhibits integration of evidence, opinions of experts, and ... experience. [Students] exhibit complex understanding of issues and an awareness that in future they may need to reformulate their point of view on the basis of new evidence. (King, 1977)
A Belief in
and
Commitment to
Unraveling
Complexity

Simplicity does not precede complexity,
but follows it.
Alan Perlis
Given an assignment on Genetically Modified Organisms, a student in Dialectic is likely to say…

I want to do something to end global hunger. GMOs offer one avenue of doing this. I have read the scientific, political, and sociological data and find support for my ideas. I acknowledge there is a legitimate down side, but I believe, based on my data and experience, that the benefits outweigh the risks.

But this is complicated.

I will remain open to the possibility that new evidence may force me to reconsider my position.
Mature Epistemology is a Necessary (but not Sufficient) Condition for EXPERT THINKING
Epistemology and Schooling
Impact on School Outcomes

- Students with more mature beliefs have *higher academic achievement, predicts GPA* (Cano, 2005; Ricco, Pierce, & Medinilla, 2010)

- More likely to believe that math is useful (Schommer-Aikens, Duell & Hutter, 2005)

- Write better-reasoned papers (Schommer, 1990)

- Use ‘deep thinking’ strategies (Rodriguez, 2006, 2007)

- Use metacognition, more motivated and self-directed (Smith et al., 2010)

- *Believe in discovery* (Smith et al., 2010)
Most College Freshmen Bordering between Dualism and Multiplicity

Figure 2.8. Reflective Judgment Interview Scores, by Educational Level

Note: Scores are averaged across all studies that reported RJI scores for students (N = 1,334) at these educational levels.


and Graduate in Multiplicity
Epistemology and Giftedness
Three Years of Gifted High School Seniors

Dualism
- Class of 1989: 6.76
- Class of 1990: 2.4
- Class of 1991: 11.49

Multiplicity
- Class of 1989: 31.09
- Class of 1990: 40.12
- Class of 1991: 26.67

Contextual Relativism
- Class of 1989: 43.92
- Class of 1990: 34.13
- Class of 1991: 31.43

Commitment/Dialectic
- Class of 1989: 18.24
- Class of 1990: 22.16
- Class of 1991: 29.52
Developmental Progression of Gifted High School Students

(Gallagher, np)
Reviving Perry: An Analysis of Epistemological Change by Gender and Ethnicity Among Gifted High School Students

Developmental Progression of 485 gifted high school Students

Significant growth from sophomore to senior year.

(Thomas, 2007)
## Two-way ANOVA: Gifted x Grade Analysis of LCQ Scores and Descriptive Statistics

<table>
<thead>
<tr>
<th>Source</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>F</th>
<th>p</th>
<th>Omega squared</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gifted</td>
<td>8.0</td>
<td>1</td>
<td>8.0</td>
<td>13.7</td>
<td>.00</td>
<td>0.061</td>
</tr>
<tr>
<td>Grade</td>
<td>4.57</td>
<td>2</td>
<td>2.28</td>
<td>3.91</td>
<td>0.02</td>
<td>0.03</td>
</tr>
<tr>
<td>Gifted x Grade Interaction</td>
<td>0.71</td>
<td>2</td>
<td>0.36</td>
<td>0.61</td>
<td>0.55</td>
<td>0.00</td>
</tr>
<tr>
<td>Error (Within Groups)</td>
<td>106.83</td>
<td>183</td>
<td>0.58</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Descriptive Statistics

<table>
<thead>
<tr>
<th>Grade</th>
<th>6th</th>
<th>7th</th>
<th>8th</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>sd</td>
<td>n</td>
<td></td>
</tr>
<tr>
<td>Gifted</td>
<td>3.44</td>
<td>0.84</td>
<td>29</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3.11</td>
<td>0.84</td>
<td>42</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3.43</td>
<td>0.75</td>
<td>44</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3.32</td>
<td>0.81</td>
<td>115</td>
<td></td>
</tr>
<tr>
<td>Typically</td>
<td>3.11</td>
<td>0.93</td>
<td>26</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2.67</td>
<td>0.51</td>
<td>26</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2.83</td>
<td>0.43</td>
<td>22</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2.83</td>
<td>0.71</td>
<td>74</td>
<td></td>
</tr>
</tbody>
</table>

**Note:**
- The effect size for Gifted is small
- The effect size for Grade is medium
Gifted Students and Average students in Problem-Based Learning experienced higher increases in epistemological reasoning

- More sophisticated argumentation
- Better justified positions

(Belland, Gu, Kim, Turner, Weiss, 2014)
This Scheme provides A (Rigorous and Relevant) Path towards Meaningful Ends
Mismatch between Stage and Instructional Approach:

- Frustrating
- Debilitating
- Disillusioning.
How do we Differentiate in Secondary Education?

- Commitment/Dialectic
- Contextual Relativism
- Multiplicity
- Dualism
Transitions

Moving Instruction from Authority Centered to Shared Investigation

Moving Curriculum and Assignments from Well Structured to Ill-Structured

Moving Assessment from Judgment-Based to Criteria-Based
Implications for Secondary School

• Differentiation Secondary School is PIVOTAL for Gifted Students
• Many Gifted Students ready for QUALITATIVELY DIFFERENT forms of instruction
• Differentiation should follow this Scheme
  – Emphasis on moving from opinion to discipline-based reasoning
  – Introducing theories, how they are constructed, compared and defended
There is NO Neutral Stance