Meeting the Needs of Advanced Learners

Leadership and Differentiation
ASCD
Houston, TX
February, 2011

Consider These Yardsticks for a Differentiated Curriculum for Gifted Learners

Passow Test
- Could
- Should
- Would

Rich
coherent
relevant
powerful
transferable
authentic
meaningful

Rigorous
S-t-r-e-t-c-h-e-s gifted learners beyond their comfort zone in:
- Insight
- Knowledge
- Thought (cognition & metacognition)
- Production/presentation
- Skill
- Affective awareness
Establishing Deep Roots

1. Using skills of the field with accuracy & ease
2. Understanding & using the vital concepts and principles of the field
3. Understanding & using the thinking skills of the field
4. Developing & applying the production skills of the field
Moving Toward Expertise

1. Working like a professional
2. Addressing real problems
3. Assessment according to expert-level rubrics or guidelines for success
4. Honing skills of independent learning & production

Developing Passion

1. The romance of the real
2. An action orientation
3. High relevance
4. Student choice
5. Digging holes, making tunnels, building bridges
Experiencing, Accepting, & Embracing Challenge

1. Advanced materials
2. Appropriate pace of study
3. Content, production, & product at high degree of difficulty

Balancing the Pull of Early Adolescence with the Pull of Accomplishment

Balancing risk & support
Coaching in Response to individual profile
Curriculum & Instruction for Academically Advanced Learners
Balancing rigor & joy
The Cirque du Soleil & Development Of Advanced Talent

An Important Metaphor for Teachers of High Ability Learners

Differentiation & Cirque du Soleil

An early stage of talent development

Fun & Fundamentals
Differentiation & Cirque du Soleil

An Intermediate Stage of Talent Development

Precision & Polish

Boundary Breaking & Bridging

A Late Stage of Talent Development
Ratcheting:
Planning to Challenge Advanced Learners

Some Underlying Assumptions about Challenging Highly Able Learners

1. All students must work consistently with tasks slightly too difficult for them and have a support system to help them succeed at the new level if they are to learn.

2. There is no such thing as “the gifted learner,” and different learners will need different sorts of challenge at different points in their academic lives. (In other words, “challenge” is highly person- and context-specific.)

3. It is very difficult to make insipid curriculum appropriately challenging. (In other words, a precursor for challenge is quality curriculum.)

4. Even good quality curriculum may be under-challenging for very highly able learners some or much of the time.
In regard to challenge for students with high potential or high achievement, we’re aiming (as with all other students) for work that is a little too hard—work that stretches the student in knowledge, understanding, skill, habits of mind, and affect. We’re also aiming for a support system to help the student over the challenge hump.

The goal is NOT to raise the ceiling and watch the student fail. It’s to raise the ceiling and support the student in succeeding at new heights.

“Hard” and “Rigorous” are Not Synonyms

- **Hard**
  - More
  - More Remote
  - Taxes the Learner

- **Rigorous**
  - Intellectually Challenging
  - Extends the Learner
Ratcheting for Challenge:
Five Approaches

General Guidelines for Challenge
The Equalizer
Kaplan’s Depth & Complexity
Advanced PCM Questions
PCM/AID

Student Needs
Content Requirements
Plan for Curriculum and Instruction
Getting Started

1. Decide whether to work alone or with 1-2 colleagues.
2. Select a children’s book that can serve as a basis for a student activity.
3. Read the book to become familiar with its contents & ideas.
4. Select a grade level for your lesson & activity.
5. Develop a concept and principle to be the focus of the lesson.
6. Select essential knowledge & skill for the lesson.
7. Sketch out the lesson—including an activity that centers on the book & uses the concept/principle/knowledge/skill.
8. Holler when you need help or when you’re ready for us to take a look at your work.

One Route to Designing Challenge:

General Strategies for Ratcheting

In the context of rich curriculum,

In response to student assessment data,

Involving the student in decision-making,

Attending to student interest and learning preferences,

With support for success at a new level.
To Ratchet...

- Use advanced resources
- Move from facts to meaning
- Probe multiple meanings
- Involve multiple concepts
- Use multiple unknowns
- Call on multiple skills
- Cause reflection
- Require study in depth
- Ask for seemingly unrelated connections
- Require study in breadth
- Use advanced criteria
- Require looking across
- Vary the pacing
- Have the student look at issues/controversies related to the topic
- Call on the student to make and support contrary arguments/viewpoints
- Have the student work like a professional
- Have the student make more choices about more facets of the task

#1: General Strategies for Providing Challenge

A Second Route to Challenge:

“The Equalizer”

In the context of rich curriculum,

In response to student assessment data,

Involving the student in decision-making,

Attending to student interest and learning preferences,

With support for success at a new level.
What Zone Am I In?

**Too Easy**
- I get it right away...
- I already know how...
- This is a cinch...
- I’m sure to make an A...
- I’m coasting...
- I feel relaxed...
- I’m bored...
- No big effort necessary...

**On Target**
- I know some things...
- I have to think...
- I have to work...
- I have to persist...
- I hit some walls...
- I’m on my toes...
- I have to re-group...
- I feel challenged...
- Effort leads to success...

**Too Hard**
- I don’t know where to start...
- I can’t figure it out...
- I’m spinning my wheels...
- I’m missing key skills...
- I feel frustrated...
- I feel angry
- This makes no sense...
- Effort doesn’t pay off...

THIS is the place to be... THIS is the achievement zone...

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New World Explorers

**KNOW**
- Names of New World Explorers
- Key events of contribution

**UNDERSTAND**
- Exploration involves
  - risk
  - costs and benefits
  - success and failure

**Do**
- Use resource materials to illustrate & support ideas
### New World Explorers

Using a teacher-provided list of resources and list of product options, show how 2 key explorers took chances, experienced success and failure, and brought about both positive and negative change. Provide proof/evidence.

Using reliable and defensible research, develop a way to show how New World Explorers were paradoxes. Include and go beyond the unit principles.

<table>
<thead>
<tr>
<th>The Equalizer</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Foundational</td>
</tr>
<tr>
<td>Information, Ideas, Materials, Applications</td>
</tr>
<tr>
<td>2. Concrete</td>
</tr>
<tr>
<td>Representations, Ideas, Applications, Materials</td>
</tr>
<tr>
<td>3. Simple</td>
</tr>
<tr>
<td>Resources, Research, Issues, Problems, Skills, Goals</td>
</tr>
<tr>
<td>4. Single Facet</td>
</tr>
<tr>
<td>Directions, Problems, Application, Solutions, Approaches, Disciplinary Connections</td>
</tr>
<tr>
<td>5. Small Leap</td>
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<tr>
<td>Application, Insight, Transfer</td>
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<tr>
<td>6. More Structured</td>
</tr>
<tr>
<td>Solutions, Decisions, Approaches</td>
</tr>
<tr>
<td>7. Less Independence</td>
</tr>
<tr>
<td>Planning, Designing, Monitoring</td>
</tr>
<tr>
<td>8. Slow</td>
</tr>
<tr>
<td>Pace of Study, Pace of Thought</td>
</tr>
</tbody>
</table>
VARIED WRITING PROMPTS

A. Why did Max go to visit the wild things? Do you think it was a good idea or a bad idea? Why do you say so?

B. If you were Max’s mom or dad, write about what you would think when he went to his room, when he went to where the wild things are, and when he decided to come home.

C. Max sometimes talks to himself. Tell us what he says when he goes to his room, as he goes through his visit with the wild things, when he decides to come home, and when he returns to his room. What do he and his parents say the next morning?

D. What does it really mean to go where the wild things are? Write a story about a time when that happened to you or to someone you know. Tell enough so we can see how the stories are alike and different.

Primary Reading Comprehension
Varied Writing Prompts

A. Write a step by step set of directions, including diagrams and computations, to show someone who has been absent how to do the kind of problem we’ve worked with this week.

Select a key or critical element in the experiment today. Change it in some way. What will happen in the experiment? Infer? Be sure you go for something useful, insightful, and intellectually or scientifically meaningful at your choice.

Upper Elementary Math

Varied Journal Prompts

A. A classmate had to leave the room today just as the lab experiment was beginning to come to a conclusion. Please write that student a note explaining what happened in the lab, why it happened, and what practical use there is in the real world for what the experiment shows us. You’re his/her only hope for clarity! Be as much help as possible.

Middle School Science
A. Create a fortune-line visual (with an explanation, of course) that shows the emotional state of the Little Prince at what you think are the 8-10 most important points in the book. Also explain why you selected these events as most important.

B. Create a fortune-line visual (with an explanation, of course) that shows the emotional state of the Little Prince at what you think are the 8-10 most important points in the book. Be sure to arrange them in the order in which they happened rather than the order they are written about in the book. Defend your selection of events and your chronology.
A Third Route to Challenge:

Kaplan’s Depth & Complexity Model

In the context of rich curriculum,

In response to student assessment data,

Involving the student in decision-making,

Attending to student interest and learning preferences,

With support for success at a new level.
Strategies for Differentiation to Promote Academic Rigor

- Accelerating the rate of mastery
- Exploring detail, patterns, rules, ethics, generalizations, and unanswered questions about a topic or concept (Kaplan, 1994)
- Seeing relationships, making connections over time, and seeing from perspectives among, between, and within disciplines (Kaplan, 1994)
- Seeking original interpretations, reinterpretations or challenging existing ideas, and/or developing new, different, non-traditional techniques, materials, or forms (Gallagher, Kaplan, Passow, Renzulli, Sato, Sisk, Wickless, 1979, p. 5; California Department of Education, 1994, pp. 15-16)
- Fostering self-direction, pursuing study of interest(s), conducting self-assessment (Treffinger, 1986, pp. 449-451)

Moving Toward Interdisciplinary Curriculum
Texas Education Agency
### Designing Curriculum That is More In-Depth and Complex

**Subject**

**Topic/Area**

**Grade**

#### COMPLEXITY

<table>
<thead>
<tr>
<th>Unit</th>
<th>Concrete</th>
<th>Abstract</th>
</tr>
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<tbody>
<tr>
<td>DESCRIBE</td>
<td>Overviews</td>
<td>Approaches</td>
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<tr>
<td>OVERSIGHT</td>
<td>Different</td>
<td>Perspectives</td>
</tr>
<tr>
<td>DECODE</td>
<td>Within</td>
<td>Disciplines</td>
</tr>
<tr>
<td>DIRECT</td>
<td>Issues</td>
<td>Among</td>
</tr>
</tbody>
</table>

#### DEPTH

1. Thematic
2. Patterns
3. Trends
4. Counterpoints
5. Ethical Considerations

### DELINEATING CONTENT

Use these key words to delineate the content and highlight the information to be studied:

- Kinds, Characteristics, Factors, Features, Types, Attributes of...
- Function of...
- History/Development of...
- Sequence to/Steps to...
- Conditions for...
- Laws of...
- Purpose of...
- Relationship of...
- Origins of...
- Traditions of...
- Style of...
- Patterns of...
- Importance of...
- Influences of...
- Trends of...
- Interconnectedness of...
- Interdependence of...
- Value of...
- Significance of...
- Problems relating to...
- Concepts/Theories of...
- Issues relating to...
- Future of...
Language Arts 8th Grade
Unit: Poetry
Topic/Concept: Poetry/Culture
Timeframe: 90 minute block

**Essential Questions:**
• What influences our opinion about poetry?
• How do we define poetry?

**Knowledge:**
• Uses of sensory imagery, tone, allusion, figurative language, and sound carried in blank verse poetry

**Enduring Understandings:**
• Poetry demands a response from the reader.

**Skills:**
• Response to poetry
• Interpretation

**Task:**
In *Bronx Masquerade* by Nikki Grimes, we see how Wesley uses his artistic and musical background to influence the structure and meaning of his poem about Langston Hughes. What response do you have to the poem? What influenced your opinion?

Choose one of the poems from your own portfolio so far in class and tell us how your background has influenced the structure and meaning of your poem. What response do you wish to elicit from your reader?

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Physical Education 10th Grade
Unit: Football
Topic/Concept: Offense/Defense
Timeframe: 50 minute block

**Essential Questions:**
• How does a team’s offense impact their defense?
• What can players do to best prepare offensively?

**Knowledge:**
• Pass patterns (5 yard curl, 8 yard post, 5 yard smash, etc.), quarterback, center, receiver

**Enduring Understandings:**
• The best defense is a good offense.
• Mastery of movement is the result of thoughtful practice and leads to lifelong enjoyment and better health.

**Skills:**
• Pass a ball
• Receive a pass/hike
• Hike a ball
• Complete a pass pattern
Task:
The best defense in football is a good offense, and in the lesson today students will be working on offense, specifically 3 position pass patterns.

1. Have the students divide themselves (or the teacher may) into groups of 3. Set one cone in front of them and the other cone about 10-12 yards ahead of that.
2. One student will be the center and will stand at the cone. The receiver will stand about 2-3 feet beside the center. The quarterback should be in ready position about 1-2 feet behind the center.
3. Upon snapping the ball back to the quarterback from the center, the receiver will sprint out to the cone and curl around it and in to receive a pass (5 yard curl).
4. The students should rotate positions within their groups so each student has an opportunity at each position.

Humanities 11th Grade
Unit: Early Civilizations
Topic/Concept: Art Interpretation/Culture
Timeframe: 90 minute block

Essential Questions:
• What or whose values does a culture’s art represent?
• What or whose values does a culture’s art omit?

Knowledge:
• Selected attributes of folk art
• Facets of “culture”

Enduring Understandings:
• Art is a representation of the values, beliefs, and traditions of a culture.

Skills:
• Interpret
• Compare and contrast
• Synthesize
• Apply
• Collaborate
Task:
Share the quote: Art speaks to the soul of its culture.
Abby Willowroot

As a class discuss the artwork that is currently on display around the high school. Does this art represent the “soul” of the high school culture? Why or why not?

Imagine that the high school is getting ready to undergo a major construction project. Part of the project is a new wing that will display a permanent exhibit of new and old artwork created by professional artists, community members, and students. The gallery will be called “The Soul of Our High School.”

You are on a student committee that will decide which parts of “The Soul of Our High School” are already represented in its artwork and which parts are missing, so that the gallery as a whole will be inclusive and comprehensive. Prepare a report that your committee will present to the administrators and interested parties that will state your case as to why some pieces deserve a place in the new gallery and which pieces should be added to fully represent the “soul” of the high school in the new gallery.

Good Stewardship of Advanced Ability
Is NOT About:
• Rote memorization of more information,
• Earning the “right” to “explore” by demonstrating mastery of the basics,
• Recognition for norm-based “excellence,”
• Finishing first – or even finishing,
• Being sure or being right,
• Comfort
• Hunger for reward

Good Stewardship of Advanced Ability
Is About:
• An on-going quest for understanding/making meaning,
• A quest for depth in areas of ability,
• Satisfaction derived from self-testing and idea testing,
• Persistence,
• Continual push for improvement/search for truth and insight; open mindedness,
• Hard work, disciplined work,
• Hunger to be productive, to be useful, to push the boundaries of own possibilities to guide others in “becoming.”
A Fourth Route to Challenge:

**Advanced PCM Questions**

In the context of rich curriculum,

In response to student assessment data,

Involving the student in decision-making,

Attending to student interest and learning preferences,

With support for success at a new level.
Students Show Continuous Intellectual Ascent

For example:
- non-imitative use of knowledge,
- extensive knowledge and skill,
- pattern recognition,
- efficient and meaningful organization of knowledge,
- increased curiosity, reflection and concentration,
- questioning about reasons for and uses of knowledge,
- formulating insights/insightful questions,
- assuming considerable responsibility for own learning,
- reflective, evaluative behavior

As Teachers See Continuous Intellectual Ascent, They Apply Ascending Intellectual Demand

For example, requiring:
- use of heuristic approaches to problem solving,
- transfer of content & skills for use in other novel and unfamiliar contexts,
- higher degree of abstract and critical thinking,
- use of a more complex and extensive knowledge and skill,
  - search for subtle examples,
  - more global applicability,
  - change in nature of the audience.
  - increased self reflection and honing,
  - tolerance of greater risk
Some Paths to Ascending Intellectual Demand in the Core Curriculum

• Call on students to use more advanced reading, resources, & research materials
• Assist students in determining and understanding multiple perspectives on issues and problems
• Adjust the pace of teaching and learning to account for rapid speed of learning or to permit additional depth of inquiry
• Develop tasks and products that call on students to work at greater levels of depth, breadth, complexity or abstractness
• Have students apply what they are learning to contexts that are unfamiliar or are quite dissimilar from applications explored in class
• Design tasks and products that are more open-ended or ambiguous in nature and/or call on students to exercise greater levels of independence in thought and scholarly behavior as learners and producers
• Develop rubrics for tasks and products that delineate levels of quality that include expert-level indicators
• Encourage collaborations between students and adults experts in an area of shared interest
• Design tasks that require continuing student reflection on the significance of ideas and information, causes students to generate new and useful methods and procedures to represent ideas and solutions
• Include directions and procedures that ask students to establish criteria for high quality work, assess their progress in working toward those criteria, seek and use feedback that improves quality of efforts and methods of working
• Ask students to reflect on personal and societal implications of solutions they propose to problems

Frameworks for Student Products

Core Parallel

Explore the concept of nationalism in U.S. & German actions/policies during WWII. (High School History)

§ Using primary documents for key U.S. & German leaders to guide your conclusions, explore the role of nationalism in U.S. & German actions/policies during WWII.
§ Develop supported hypotheses/assertions about the varied shapes of nationalism in the U.S. & Germany during WWII by researching perspectives of varied groups within each country—for example: African Americans, Japanese, and political leaders in the U.S., and resistance leaders, general citizens and military leaders in Germany.
§ Propose an approach to developing and maintaining a “healthy nationalism” based on your research and understanding of nationalism in Germany and the United States during WWII. Illustrate the social implications of your recommendations with illustrations from WWII time period.
§ In your work, give evidence of your evolving thought based on reflection and informed self-critique.
Some Paths to Ascending Intellectual Demand in the Curriculum of Identity

- Looking for and reflecting on “truths,” beliefs, ways of working, styles, etc. that typify the field
- Looking for “roots” of theories, beliefs, and principles in a field and relating those theories, beliefs, and principles to the time when they “took root” in one’s own life
- Looking for and reflecting on the meaning of paradoxes and contradictions in the discipline or field
- Conducting an ethnography of a facet of the discipline and reflecting on both findings and personal revelations
- Engaging in long-term problem-solving on an intractable problem in the discipline that causes the student to encounter and mediate multiple points of view, and reflecting systematically on the experience
- Researching and establishing standards of quality work as defined by the discipline, applying those standards to the student’s own work in the discipline over an extended time period, and reflecting systematically on the experience
- Collaborating with a high level professional or practitioner in the field in shared problem solving and reflection
- Challenging or looking for limitations of the ideas, models, ways of working or belief systems of the discipline
- Looking for parallels (or contrasts) in personal prejudices, blind spots, assumptions, habits, and those evident in the field
- Studying and reflecting on one discipline by using the concepts, principles, and modes of working of another discipline, reflecting on the interactions and insights gained

Frameworks for Student Products

Curriculum of Identity

Researchers try to get closer to truth. Ethnographers work for evidence that is confirmable and dependable. Use these approaches in your contribution to our classroom ethnography of neighborhoods. Tell/show us how your work helped you understand yourself as well as your neighborhood.

(Primary Science, Social Studies, Writing)

§ Be sure you show how your own beliefs can get in the way of good ethnography and how you tried to avoid that problem.
§ What contradictions (or things that don’t seem like they should exist together) did your ethnography show you in neighborhoods and in yourself.
§ What beliefs about neighborhoods did you have before your ethnography? What beliefs do you have now? Explain how and why your beliefs have change or remained the same. Talk about how ethnography worked for you as a way to get close to the truth.
A Fifth Route to Challenge:

Expertise (AID) as a Way to Frame Challenge

In the context of rich curriculum,

In response to student assessment data,

Involving the student in decision-making,

Attending to student interest and learning preferences,

With support for success at a new level.

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**Expertise**

**Degree of Difficulty / Continuous Intellectual Ascent**

*Images from Rafting*

**Floating/Rafting**

- **Easy:** few riffles, small waves, few or no, obstructions,
- **Medium:** fairly frequent, but visible rapids, course is generally obvious, some maneuvering required
- **Difficult:** numerous rapids, narrow passages requiring complex maneuvers
- **Very Difficult:** long rapids with high, irregular waves and boulders, swift current, course not obvious requiring scouting from banks
- **Exceedingly Difficult:** dynamically rocky rapids with irregular broken water that cannot be avoided, fast flow, abrupt bends, strong cross currents
- **Limit of Navigability:** upper limits of skills and equipment, risk taking only for experts

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Expertise

Degree of Difficulty / Continuous Intellectual Ascent

Images From Music

- Increasing levels of musical knowledge,
- High level of mastery and technical ability,
- Strong desire to demonstrate talent,
- Increasing curiosity, reflection and concentration,
- Higher quality of practice-excellent results due to excellent actions,
- Increasing levels of endurance,
- Self assessing strengths and weaknesses,
- Increased focus on maturing the interpretation from within,
- Gates to intellectual but passionate interpretation are open,
- Greater versatility and expressive power,
- Help the audience understand the piece better.

Images from Teaching

Novice
- needs absolute rules to follow,
- needs to learn facts and features,
- lacks confidence in ability,
- does not take full responsibility for action.

Advanced Beginner
- experience melds with verbal knowledge,
- case knowledge is accumulated,
- similarities across cases are recognized,
- knowledge develops on when to bend or break rules,
- still working to determine what’s important,
- develops some insights.

Competent
- high motivation to succeed,
- makes conscious choices about what to do,
- can determine what is/isn’t important,
- assumes responsibility for actions,
- follows rational behavior and strategies,
- still not fast, fluid or flexible in behaviors.
**Proficient**
- intuition of know-how becomes prominent,
- views situation holistically, sees patterns,
- recognizes similarities among events, makes connections,
- brings case knowledge and experience to bear when assessing new situations,
- remains largely analytic and deliberative in deciding appropriate actions.

**Expert**
- chooses to learn from experience,
- exhibits fluid performance,
- intuitively grasps situations, responds automatically,
- heuristic approach to solving problems,
- understands domain at a deep level,
- represents problems in an organized and sophisticated manner,
- can mentally represent a problem and its parameters,
- reflective and evaluative behavior,
- ability to attend to atypical and novel stimuli,
- has fact and accurate pattern recognition, interprets cues.

Based on work of David Berlau.

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**Expertise**

**Degree of Difficulty/Continuous Intellectual Ascent**

**Images from Golf**

A player is assigned a "Handicap Index" that reflects the player's potential based on player's gross score.
- course difficulty
- slope rating of tees played
- handicap index is automatically reduced when golfer records at least 2 tournament scores that are a minimum of 3 strokes better than his/her existing index.
- the better the score, the greater the reduction, thereby increasing the personal challenge level for the individual golfer.
Expertise Requires

- Expertise in particular areas involves more than a set of general, problem-solving skills; it also requires well organized knowledge of concepts and inquiry procedures. Different disciplines are organized differently and have different approaches to inquiry. For example, the evidence needed to support a set of historical claims is different from the evidence needed to prove a mathematical conjecture, and both of these differ from the evidence needed to test a scientific theory.
Curricula Leading to Expertise Would:

1. Be built on the key concepts, principles, skills and information of the discipline
2. Ensure understanding rather than rote memory of the nature of the discipline
3. Emphasize meaningful patterns of knowledge and pattern recognition
4. Help students begin by trying to understand problems rather than searching for canned or algorithmic solutions
5. Emphasize depth of knowledge over breadth of knowledge
6. Help students practice selective retrieval (look for relevant information and processes from large bodies of information or process options)

7. Ensure that students know when, where, and why to use knowledge, not just repeat knowledge
8. Help students practice fluency at least as much as accuracy (relates to effortless retrieval)
9. Help students focus on learning vs. remembering
10. Help students learn to teach themselves
11. Encourage to monitor their approach to problem solving (be metacognitive)
12. Help learners routinely step back from problems and ask whether the knowledge and processes they are using are relevant and effective

Based on
How People Learn: Brain, Mind, Experience and School
National Research Council, 1999
The Parallel Curriculum Model and Ascending Intellectual Demand

Novice
- Experiences content at a concrete level
- Manipulates microconcepts one-at-a-time
- Needs skill instruction and guided practice
- Seeks affirmation of competency in order to complete a task

Apprentice
- Understands the connections among microconcepts within a discipline
- Connects information within a microconcept
- Applies skills with limited supervision
- Seeks confirmation at the end of a task

Practitioner
- Manipulates 2 or more microconcepts simultaneously
- Creates generalizations that explain connections among concepts
- Reflects upon content and skills when prompted

Expert
- Utilizes concepts within and among disciplines in order to derive theories and principles
- Creates innovations within a field
- Practices skill development independently and for the purpose of improvement
- Seeks input from other experts in a field for a specific purpose
- Works to achieve flow and derives pleasure from the experience (high challenge, advanced skill knowledge)
- Independent and self-directed as a learner
- Seeks experiences which cause a return to previous levels in varying degrees

A Continuum of Ascending Intellectual Demand

Kelly A. Hedrick
Teacher Response to Student Development of AID

What does the learner need at each stage?

Novice
- Analyzes existing theories, principles, and rules
- Sees science as a body of facts and skills
- Seeks algorithmic tasks; ambiguity causes discomfort
- Seeks a definitive hypothesis as a failure
- Anachronism includes and fails to manage multiple variables
- Science is isolated from other disciplines

Apprentice
- Tests and manipulates existing theories, principles, and rules
- Sees science as a body of concepts and recognizes connections among the microdisciplines
- Uses existing scientific questions for research and experimentation
- Sees the ambiguous nature of science
- Manipulates one variable within an experiment with ease
- Identifies, isolates, and analyzes the relationships among the independent and dependent variables, constants, and controls
- Uses mathematics to conduct scientific work

Practitioner
- Challenges existing theories, principles, and rules through research and experimentation
- Assumes and appreciates that scientific knowledge is never declared certain
- Sees new scientific questions
- Uses the broad and varied fields of science
- Effectively manipulates multiple variables within an experiment
- Plans for and observes a wide range of factors, variables, constants, controls, and outcomes
- Uses mathematics as the language of science

Expert
- Makes a contribution to the discipline and/or a field (e.g., new experiments, new observations, new methods and tools, new theories, principles, paradigm)
- Sees original scientific questions at the limits of the existing body of knowledge
- Unifies and analyzes the relationships among the fields of science and other fields across multiple disciplines
-遛A derives satisfaction from the ambiguity inherent in science
- Conducts complex experiments with ease and facility; fluidly manipulates methods, tools, knowledge, and skill to achieve desired results

Reference: Benchmarks for Science Literacy; American Association for the Advancement of Science Literacy: Project 2061

Expertise in Science

Novice
- Analyzes existing theories, principles, and rules
- Sees science as a body of facts and skills
- Seeks algorithmic tasks; ambiguity causes discomfort
- Seeks a definitive hypothesis as a failure
- Anachronism includes and fails to manage multiple variables
- Science is isolated from other disciplines

Apprentice
- Tests and manipulates existing theories, principles, and rules
- Sees science as a body of concepts and recognizes connections among the microdisciplines
- Uses existing scientific questions for research and experimentation
- Sees the ambiguous nature of science
- Manipulates one variable within an experiment with ease
- Identifies, isolates, and analyzes the relationships among the independent and dependent variables, constants, and controls
- Uses mathematics to conduct scientific work

Practitioner
- Challenges existing theories, principles, and rules through research and experimentation
- Assumes and appreciates that scientific knowledge is never declared certain
- Sees new scientific questions
- Uses the broad and varied fields of science
- Effectively manipulates multiple variables within an experiment
- Plans for and observes a wide range of factors, variables, constants, controls, and outcomes
- Uses mathematics as the language of science

Expert
- Makes a contribution to the discipline and/or a field (e.g., new experiments, new observations, new methods and tools, new theories, principles, paradigm)
- Sees original scientific questions at the limits of the existing body of knowledge
- Unifies and analyzes the relationships among the fields of science and other fields across multiple disciplines
- A derives satisfaction from the ambiguity inherent in science
- Conducts complex experiments with ease and facility; fluidly manipulates methods, tools, knowledge, and skill to achieve desired results

Reference: Benchmarks for Science Literacy; American Association for the Advancement of Science Literacy: Project 2061
Expertise in History

Novice
- Defines history as isolated people, places, and events
- Sees the facts and skills, but not the concepts that link them
- Studies history through rote memorization
- Needs experiences with sequencing to establish a sense of chronology
- Identifies causes and effects as isolated events
- Lacks an appreciation for history and its relevance to self and the world in the present and future

Apprentice
- Understands history at the conceptual level
- Seeks connections among microconcepts in order to make sense of historical patterns and trends
- Sees historical research questions
- Has a clearly defined sense of chronology
- Understands the complexity of causes and effects
- Recognizes the importance of perspectives or historical contexts, human perspectives, and consequences

Practitioner
- Analyzes contemporary events through an historical lens with automaticity
- Understands chronology, but has the ability to follow themes across events and time periods regardless of the direction (present to past, past to present)
- Identifies unanswered questions and seeks researchable questions to investigate them
- Understands the social, political, economic, and technological influences on particular issues and trends
- Understands and appreciates the influence of individual experiences, societal values, and traditions on historical perspectives

Expert
- Moves easily from the theoretical to the practical and vice versa in response to a situation
- Challenges accepted bodies of knowledge, methods, and research findings
- Develops themes and connections across historical events, periods, and fields without reliance, but acknowledges of chronology
- Uses the knowledge and skills of the discipline across diverse fields and disciplines
- Displays curiosity and seeks challenge through unanswered questions in the field
- Volunteers at the silhouettes of history and its implications in shaping the present and future
- Synthesizes and makes connections through the historical and future

Reference:
Curriculum Standards for Social Studies
National Council for the Social Studies

Expertise in Mathematics

Novice
- Applies the skills of discrete mathematics, but lacks a conceptual understanding
- Identifies the principles, but cannot apply them in novel situations
- Computes efficiently, but lacks fluency
- Sees limited relationships among numbers and number systems
- Identifies only the most basic patterns
- Seeks frequent feedback and assurance during problem solving
- Sees the "right answer" as the goal

Apprentice
- Connects the relationships among mathematical facts and skills through concepts
- Computes flawlessly and makes reasonable estimations
- Applies skills with confidence and develops greater understanding beyond number operations
- Makes connections across mathematical ideas
- Understands the principles that frame a field (e.g., measurement, algebra, geometry, statistics)
- Develops skills and understanding through complex problem solving
- Sets goals that extend beyond computational accuracy

Practitioner
- Uses the principles of mathematics to make connections among concepts across multiple fields within mathematics
- Makes appropriate selections about which tools and methods to use
- Understands patterns, relations, and functions
- Applies skills with automaticity
- Understands change in a variety of contexts
- Uses a variety of tools and methods with efficiency in the analysis of mathematical situations
- Appreciates the role of mathematics in other disciplines
- Formulates questions for research that can be addressed through one or more fields of mathematics

Expert
- Uses computation as merely a means to an end
- Questions existing mathematical principles
- Moves easily among the fields of mathematics through the use of microconcepts
- Links mathematical principles to other fields through real-world problems
- Seeks the challenge of unsolved problems and the testing of existing theories
- Seeks new through the manipulation of tools and methods in complex problem solving
- Views unanswered questions in other disciplines through the concepts of mathematics
- Uses reflection and practice as tools for self-improvement

Reference:
Principles and Standards for School Mathematics
National Council of Teachers of Mathematics
Expertise in English Language Arts

Novice
• Applies a limited range of skills in an algorithmic manner
• Understands the skills and concepts in isolation, but lacks flexibility in understanding and application
• Practices and applies skills when prompted
• Limits reading selections and resources to a narrow scope
• Written and oral communication is technically correct, but lacks variety and personal relevance
• Sees written and oral communication as limited possibilities
• Views editing and revision as punitive and difficult

Apprentice
• Demonstrates flexibility in the use of skills and the understanding of concepts
• Understands the connections across written and oral communication, reading, and research
• Understands the need for a variety of selections in reading, writing, and research
• Understands the role of effective communication for a variety of purposes
• Adjusts communication modes according to purpose and audience
• Values the input of qualified reviewers in the editing and revision process

Practitioner
• Applies the skills of language arts in other disciplines with relative ease
• Moves fluidly among the various modes and methodologies associated with language arts
• Appreciates the art of communication
• Conducts authentic research applying the skills of questioning, information gathering, data analysis, and synthesis
• Understands the necessity for multiple and varied resources in research
• Seeks the constructive criticism of knowledgeable persons across disciplines in developing a product
• Understands and respects the diversity of language across cultures

Expert
• Demonstrates knowledge, reflection, creativity, and critical analysis of language arts skills and concepts across a wide variety of disciplines
• Applies the full range of skills associated with effective oral and written communication, reading, and research with originality
• Reading, writing, speaking, and researching lead to personal fulfillment beyond the goals of learning and the exchange of information
• Appreciates the power of the written and spoken word
• Questioned the accepted conventions and rules
• Experiments with methods to communicate and develop greater understanding
• Practices in all areas (i.e., written and oral communication, reading, and research)

Reference: NCTE/IRA Standards for English Language Arts

Kelly A. Hedrick