Teacher Resource Guide

Science - Grades 6-8

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NewPath Learning®

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Chapter I. Purpose and Overview

NewPath's Teacher Resource Guide: The What, How, and Why

The purpose of NewPath Learning's (NewPath) ***Teacher Resource Guide: Science, Grades 6-8*** is to assist educators in their efforts to **improve student learning**. The ***Guide*** offers support and recommendations in the implementation of NewPath materials within the context of the school's larger standards-based curriculum/instruction/assessment plans. Not only will readers find information about and recommendations on **how** to implement NewPath materials, but they will also find references from research-based studies on **why** the recommended practices will work and with which groups of students. Educators who clearly see the reasons for what they are doing are generally much more effective in improving student learning. At NewPath we believe that the complexity of what teachers must know and be able to do in order to deliver curriculum successfully IS rocket science. We know it is difficult and complex, and it is our fervent desire to make it easier and more effective.

Overview of NewPath Materials

NewPath Learning, founded in 2006, has established as its primary mission the development of innovative, interactive materials for curriculum mastery and assessment preparation that are aligned with the most current academic content standards. NewPath's products are developed by experienced teachers using research-based principles and are classroom tested.

In order to address the needs of the diversity of learners in almost every school, NewPath has assembled, by grade-level, a comprehensive collection of both print and digital materials and tools for teaching English language arts, mathematics, science, and social studies.

NewPath's curriculum resources for science, grades 6-8, are plentiful. Since some schools use an interdisciplinary approach in middle school, teaching some life, physical, and earth science each year, the Science Skills materials will fit their needs. Other schools teach one of the three branches of science each year in middle school. Therefore, there are separate materials for middle school life science, physical science, and earth science.

NewPath's Curriculum Learning Module for science, grades 6-8 includes the following teaching resources:

Teaching Resources Included:	Use
• **3 Science Curriculum Mastery Games** – Life, Earth and Physical Science. Complete standards-based curriculum covering 25 key topics per grade, each in board-game format; 750 questions for each grade level; 12 game boards; game pieces; complete materials for up to 36 students.	Each Curriculum Mastery™ Game provides complete coverage of grade-appropriate science concepts for classroom and assessment success. The Curriculum Mastery™ Games can be used in the classroom to accommodate learners of all different levels. With this versatile tool, teachers can achieve differentiated instruction, assigning a student the content area and knowledge level that suit his/her particular needs and learning pace. The Curriculum Mastery™ Games use a hands-on approach to ensure students become involved in the learning process. Social development is also nurtured as students compete, collaborate, and communicate with one another during structured play.
• **3 Science Flip Chart Sets** – 1 per grade **Each Curriculum Mastery® Flip Chart Set features** • 10 double-sided laminated charts, 18"x12" • 10 fully illustrated colorful charts covering grade-level specific curriculum content • 10 corresponding write-on/wipe-off charts on reverse side for student use or for small-group instruction • Built-in, sturdy, free-standing easel for easy display • Spiral-bound for ease of use • Activity Guide	Curriculum Mastery® Flip Charts provide comprehensive coverage of key standards-based curriculum in an illustrated format that is visually appealing, engaging and easy to use. Curriculum Mastery® Flip Charts can be used with the entire classroom, with small groups, or by students working independently. **Side 1** of each Flip Chart provides graphical representation of key concepts in a concise, grade-appropriate reading level for instructing students. The reverse **Side 2** of each Flip Chart allows teachers or students to fill in the answers and summarize key concepts. Each set includes a guide which provides a graphical activity corresponding to each Flip Chart which students can use to fill in before, during, or after instruction. On the reverse side of each activity are questions corresponding to each Flip Chart topic which can be used as further review or as a means of assessment. The Flip Charts are ideal for learning centers, small-group instruction, independent student use or as a reference/teaching resource.
• **3 Sets of Science Visual Learning Guides** for each grade Provides a hands-on review of grade-specific skill topics. Materials include 3 sets of 10 laminated visual learning guides for each grade for a total of 90 Visual Learning Guides.	Research has shown that visual learning is among the very best methods for teaching students of all ages and is especially appropriate to the attainment and understanding of math and science skills for a wide range of learners. Pictures, diagrams and illustrations help visual learners understand ideas and information better than just written explanations. Visual Learning Guides link verbal and visual information to help students make connections, understand relationships and recall related details. Visual Learning Guides provide comprehensive coverage of key standards-based curriculum in an illustrated format that is visually appealing, engaging and easy to use.

Teaching Resources Included:	**Use**
• **3 Interactive Whiteboard/ Practice CD-ROMs** – 1 per grade Each includes 750 interactive, standards-based review questions, covering the 25 standards-based topics for each grade.	Ideal for use on an Interactive Whiteboard for class-room use or self-guided instruction by students. This product has a site license, allowing its use on any computer (Mac/Win) within a school building. It may be used on individual or networked computers. Students can use the CD-ROM for individual review with digital flashcards. Students are able to review and assess their knowledge of a chosen topic. The questions can also be projected on an interactive whiteboard for a game of practice and review which includes participation from the entire class. Questions from a single topic or multiple topics can be saved as a lesson plan; program provides immedi-ate corrective feedback to student, along with time on task, number of attempts, percent answered correctly, and number of questions remaining.
• **Subscription to NewPath's Online Learning Program** Includes 1 teacher subscription along with a set number of individual student accounts (depending on subscription type) with access to NewPath's curriculum resources and tools.	NewPath's Online Learning Program has been specif-ically developed to meet current national and state standards. It provides comprehensive curriculum coverage accessible by state standard, subject, topic and grade level! Over 30,000 standards-based review questions and other curriculum content is included to create, save, print and assign lesson plans, work-sheets, games, flashcards and assessments. Perfect for mastery of classroom content or preparation for standardized tests!
• **Teacher Resource Guide** (this document)	Provides research-based information on program implementation, along with references for further reading.

NewPath's Quick Implementation Guide

This "Quick Implementation Guide" is provided for the teacher who needs to start using the new NewPath materials immediately and needs only to know the basics of what they are, how they fit into a typical grades 3-5 science curriculum, and which ones are recommended for which purpose. Chapters II—VI provide more detailed explanations, research summaries, recommendations, and sources for more information on the various phases of science curriculum implementation for general education, as well as programs for struggling learners.

Scope, Sequence, and Pacing Guide

Scope/Sequence. NewPath groups all grade-level standards into 25 standards-based topics. Those 25 topical areas constitute the **scope** of the curriculum. The **sequence** (order) in which they are listed reflects the best thinking of the many sources consulted, including several state departments of education and textbook publishers. When a new topic (concept) is introduced, the teacher usually begins with a review of concepts that are prerequisite to the one to be taught. They then typically teach the new topic and ensure that students develop at least beginning-level mastery. They cycle back periodically to reinforce concepts and provide more practice. The topics weave in and out, as they should.

Pacing. Districts increasingly publish pacing guides that teachers are expected to adhere to in order to ensure that priority objectives are taught and mastered before the summative assessments (end-of-unit, end-of grading period, and state tests, especially). Students will, of course, learn at different rates and to varying degrees of mastery, so some topics will require more time and more review opportunities than others. This recommended pacing guide is a place to start in the event required documents are not available. Assuming 36 weeks of instruction, the pacing suggestions would require about 33 weeks, leaving the equivalent of three weeks for assessments and other activities. If one assumes that each topic is equally challenging, another way to pace would be to allot approximately one and one-half weeks or so for each topic.

The actual time available for instruction has to be factored into the over-all year's plan. To construct a usable pacing guide specific to a school or district, NewPath recommends the following:

- Acquire a copy of the district/school calendar.
- Count the number of days available for instruction.
- Cross out the days required for grading period assessments, benchmark assessments, and state tests.
- Cross out the days when students will be on field trips, in assemblies, etc.
- Allow for some slow-down if the teacher is out and a substitute is required.
- Then count again the number of days actually available for instruction.
- Make a determination of which topics will require the most time for mastery, how much time that is required by topic, and set aside those days first. Then assign other topics to remaining days.
- Schedule the priority topics to be taught BEFORE the summative (district/state) assessments, leaving other topics to teach afterwards.
- Create a day-by-day plan by topic. Make it a living document in digital format, subject to amendment if students move faster than expected—or slower than expected, or if days are lost for bad weather, etc.

Grade 6

Scope/Sequence	Pacing
Life Science • Diversity of Life • Cells: The Basic Units of Life • Genetics: Study of Heredity • Plant Processes • Plant Reproduction • Introduction to Animals • Sponges, Cnidarians, and Worms • Mollusks, Arthropods, and Echinoderms • Fishes, Amphibians, and Reptiles • Birds and Mammals • Ecosystems, Food Chains, and Food Webs	16 weeks
Earth Science/Ecology • Introduction to Earth Science • Maps as Models of the Earth/Contour Models • Earth's Energy Resources • Earth's Fresh Water • Groundwater Resources • Earth's Atmosphere • Our Solar System • Studying and Exploring Space	11 weeks
Physical Science • Introduction to Matter • Solids, Liquids, and Gases • Electricity • Magnetism • Electromagnetism	6 weeks

Grade 7

Scope/Sequence	Pacing
Life Science • The World of Life Science • Cell Processes • Cell Reproduction • Introduction to Animals • Bacteria and Viruses • Protists and Fungi • Introduction to Plants • Ecosystems, Food Chains, and Food Webs	10 weeks
Earth Science/Ecology • Earthquakes • Volcanoes • Weathering of Rocks and Soil Formation • Erosion and Deposition • Exploring the Oceans • Climate • Sun-Earth-Moon System • Our Solar System	10 weeks
Physical Science • Chemistry in Our World • Technology in Our World • Work and Machines • Motion • Forces • Energy and Energy Resources • Mixtures, Solutions, and Compounds • Elements of the Periodic Table • Acids, Bases, and Salts	13 weeks

Grade 8

Scope/Sequence	Pacing
Life Science • Modern Genetics • The Evolution and Interaction of Living Things • Bones, Muscles, and Skin • Digestive System and Nutrition • Circulation and Immunity • Respiration and Excretion • The Nervous System • Endocrine System	11 weeks
Earth Science/Ecology • Minerals • Fossils • Geologic Time • Plate Tectonics • Movement of the Ocean Water • Understanding Weather • Stars, Galaxies, and Universe • Our Impact on Earth	11 weeks
Physical Science • Elements and Periodic Table • Properties of Atoms • Chemical Reactions • Mixtures and Compounds • Forces in Fluids • The Energy of Waves • Sound • Light • Heat and Heat Technology	11 weeks

Schools that focus on either life, physical, or earth science for each of the three years of middle school will find that the topics in the middle school Curriculum Mastery Games to be a suggested sequence of topics. Again, assuming 33 weeks to be available for instruction, there is time for approximately 1½ weeks per topic.

Use of NewPath Materials in Each Stage of the Lesson Design

With so many different products available in the NewPath bundle, teachers have requested recommendations from NewPath on which specific resources are appropriate for each stage of the lesson delivery. In addition to this information, Chapter IV, which focuses on Instructional Strategies, delineates the NewPath materials that can be used with each of the research-based instructional strategies recommended.

Lesson Step	Suggested Materials
Pre-testing or diagnostic assessment	**Online Learning**—administer to whole class to identify, by student, strengths and weaknesses so that instruction can be appropriate.
Lesson Planning	**Online Learning**
Sponge Activity (before class begins or for early finishers)	**Flip Chart** displayed on an easel or a Whiteboard if available —for use in introduction of new topic; students can individually begin to access background knowledge or formulate questions about today's topic. At times the **Flip Chart** provides a good advance organizer for the lesson. The teacher can pose a question or two for them to start thinking about. A **Flip Chart** can also be used to review yesterday's lesson. As a review exercise, students could use the backside of the chart to solve problems individually. The **Flip Chart** might also be used to suggest an entry in a science learning log or blog. If there is sufficient time, early finishers may be able to play the **Curriculum Mastery Game**.
Lesson Introduction	For concept introduction, the teacher may wish to use the appropriate **Flip Chart**—either placed so that all the children can see it or projected on the Whiteboard. The appropriate **Visual Learning Guide** can be projected so that critical vocabulary for the concept development can be taught. (ELLs and other struggling learners will need more repetition and practice.) NewPath's **Bulletin Board Charts** are also helpful in introducing a lesson, reviewing concepts from prior lessons, teaching critical vocabulary, helping students access background knowledge, or to refer to as the teacher explains.
Instructional Strategies	See Chapter IV for delineation of which materials can be used with each of the recommended research-based instructional strategies: • Time-on-Task • Multi-sensory Processing Strategies • Practice and Repetition • Corrective Feedback • Worked Examples • Differentiated/Individualized Instruction • Cooperative Learning • Instructional Technology • Student Motivation and Games • Avoiding De-motivation

Lesson Step	Suggested Materials
Modeling of Procedural Learning	The teacher can use **Online Learning** and the **Interactive CD-ROM** resources to display “worked examples” and to verbally walk students through the steps. Repetition is required. Once the teacher has modeled a procedure several times, she may wish to use a few questions from **Online Learning** or the **Interactive CD-ROM** to work through additional problems with the students.
Guided Practice	The teacher may choose a premade lesson or create one of her own for guided practice using **Online Learning**. Students can access the lesson on computers, or the teacher can print the activities. Students can be divided into small groups for guided practice with the teacher floating among the groups to check for understanding and to give immediate corrective feedback. The **Visual Learning Guides** will be useful for another review of the concept, for some problems to solve in the group, and for vocabulary review. Using the results of the pre-tests, the teacher can place at least one student who is already strong in the topic area in each group to serve as a peer tutor and to help provide feedback to the other students. The **question cards** from the **Curriculum Mastery Games** are self-correcting and can be used as flash cards in groups or with the whole class in the guided practice phase. The teacher may instead wish to print some problems from **Online Learning** or the **Interactive CD-ROM** for students to solve in groups, again with strong students in each group. The students can also access these on computers. Another strategy for guided practice would be the teacher’s close observation of students playing the **Curriculum Mastery Game**—perhaps projected on to the **Whiteboard** so that she can give immediate corrective feedback. Students may use the **Visual Learning Guide** when playing the **Curriculum Mastery Game**. For continuous progress monitoring, the teacher can check for understanding to determine who is ready for independent practice and who needs more review and guided practice. **Interactive Whiteboard CD-ROM** and **Online Learning** resources can be used to design a quick assessment and print scores for analysis. The results of this formative assessment will provide further information (in addition to the pre-testing or diagnostic testing done earlier) for the teacher on how to differentiate instruction in subsequent lessons. Whether or not a school is implementing RTI, this is the first point when the teacher needs to provide an intervention for any child or a group of children falling behind. See **Chapter V** for more information.

Lesson Step	Suggested Materials
Differentiated Lessons	**Online Learning** allows the teacher to design lessons and activities for individual students, small groups, or the class as a whole. Some students will require to be taught again from the beginning, some will need more time for review and practice, and others will be ready for independent practice. Grouping at this point, therefore, will be more homogeneous. Learning center activities can be another strategy for differentiating instruction. The teacher can design separate lessons using **Online Learning**, for each student's needs. At times she will want each student to work individually. At other times she may wish to use **Flash Cards**, the **Flip Chart**, or the **Visual Learning Guide** to work with a small group in direct instruction while other students work individually or in a self-directed small group. Various groups could play a **Curriculum Mastery Game**, using a skill set of their choice with little supervision or need for feedback. A group needing more opportunities for teacher input could play the game with the teacher. NewPath's products are labeled as levels, not as grade levels, so that there is reduced stigma for using the materials at a lower grade level for students who are significantly behind and lack prerequisite knowledge and skills to move forward. In-class or before/after school tutorials or interventions can make use of the appropriate level of materials, including **Curriculum Mastery Games**, **Flip Charts**, **Visual Learning Guides**, and all the activities and resources available on the **Interactive Whiteboard CD-ROM** and **Online Learning**.
Continuous Progress Monitoring of Students Needing Intervention	Once the interventions are provided for the students falling behind, the teacher can use her observations as well as another assessment to check on progress. The **Interactive Whiteboard CD-ROM** and/or **Online Learning** will allow her to design another worksheet, activity, flash cards, or quiz on the same topic with different questions to see if there has been improvement. Students can be encouraged to use a computer at school or at home to conduct **self-assessment**. Self-assessment can also be made available through printed quizzes or activities.
Lesson Review	A teacher may wish to review the lesson's concepts and procedures by using the **Bulletin Board Chart**, **Flip Chart**, or the **Visual Learning Guide**.

Lesson Step	Suggested Materials
Independent Practice	Independent practice may be done in the classroom or assigned as homework. At this point the teacher needs to know how children are performing individually—especially those who were found to be falling behind in the guided practice phase. **Online Learning** has multitudes of resources for independent practice. The teacher can design an activity, worksheet, or quiz as appropriate. In some cases the **Curriculum Mastery Game** (board or online) itself is a good independent practice activity. Some teachers will save the **Visual Learning Guides** as support for students playing the **Curriculum Mastery Game** during guided practice, but they could also (or instead) be used in Independent Practice. If there are students who continue to fall behind, the teacher can find ways to extend learning time. One possibility is to use the **Take-Home Edition** (offered separately) of the **Curriculum Mastery Game** (offered separately) and the **activities from the online program** so that parents can help students review and practice. Another strategy would be to use the supplemental materi**als, such as the Flip Charts, Study Cards, Visual Learning Guide**, or **Curriculum Mastery Game** in a before-school, after-school, or in-school tutoring session. The object in independent practice is to provide the student with opportunities to perfect his/her learning, to move toward fluency and mastery, and to demonstrate success in moving learning to long-term memory. Based upon student performance on the independent practice activities, the teacher can decide whether more instruction is needed or if the students are ready for a summative assessment of the topic. In some cases the independent practice activity itself might serve as the summative assessment.
Summative Assessment for Unit	If a summative assessment is needed, once again the teacher can use the tools in the **Interactive Whiteboard CD-ROM** and/or **Online Learning** to design and administer the assessment. She might choose at the same time to add a set of diagnostic items to provide her with information on students' strengths and weaknesses on the next topic.

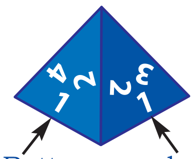
Student Records Management

NewPath has created several tools to assist teachers in keeping track of student performance. They are as follows:

NewPath Product	Student Performance Report
Online Learning See NewPath's *Online Learning User's Guide* and/or access the tutorials located under the *Help-Tutorials* menu.	Online Learning includes an online student records system to track student activity and performance • Each student is assigned a user name and password when he/she is added to a class by the teacher. • Teachers, students, and parents (for their child only) can view the student's online activity—which specific lessons or activities or quizzes that he or she has worked on. • Teachers, students, and parents (again, for their child only) can view the student's grades on each completed activity. • After a class takes a quiz, a score will be displayed for each topic along with an overall percent score. • If a quiz was a part of a lesson plan assigned to a class, individual scores are recorded in the Student Progress Reports. • Student Progress Reports include: All class averages by subject. Class averages by subject and topic. Class averages by student, subject, and topic. Student averages by subject and topic.
Interactive Whiteboard CD-ROM	This product is ready for students to use for individual review on any computer or with any interactive whiteboard or projection system for entire class participation. The teacher can choose to display questions from a single or multiple topics and save selections as a lesson plan for later use. Student responses receive immediate corrective feedback, along with the time-on-task, number of attempts, percent answered correctly, and number of questions remaining. The Interactive Whiteboard for Life Science lessons includes an assessment component that the computer will grade or not grade, depending on the teacher's choice. It will also track the scores of competing teams.
Curriculum Mastery Games	Games can be used as a review, for practice, or for a quiz. See the *Class Assessment Chart*, a tracking tool for the teacher. Each set of game cards is listed, and each student's score noted for that set. The teacher then has a snapshot of how individual students and the whole class are doing in retaining the knowledge and skills. The Student Score Sheet may be used as a form of assessment of the student's achievement within the skill reviewed. The score sheet will indicate the name of the skill covered as well as the number of questions answered correctly. A percentage can be easily determined and then documented in the Assessment Chart.
Flip Charts	The **Flip Chart** *Activity Guide* includes black-line masters of the charts for students to complete, key vocabulary terms, and corresponding review/quiz questions for each chart, along with answers.
Visual Learning Guides	The **Visual Learning Guides** can be used for review, self-assessment, and continuous progress monitoring. Vocabulary attainment can be assessed, as well as the topic's concept(s) and skills.

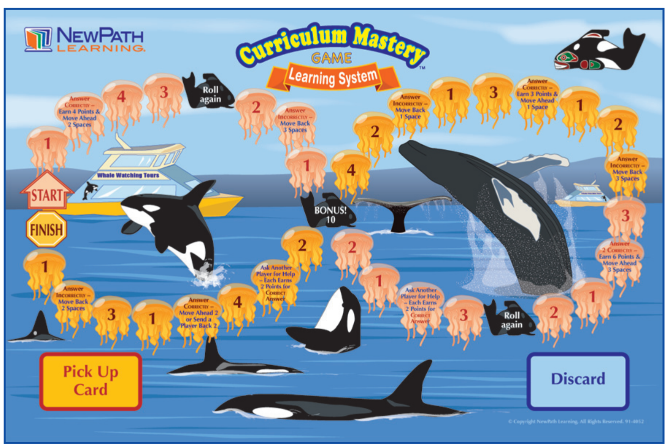
Curriculum Mastery Games

- **Materials needed for a game:** 1 game board, 1 die, 1 set of game cards, 1 player piece and 1 score sheet for each player.
- **Game Boards:** The players may select any game board. The game boards have two sides to allow for different lengths of play. The side with the figure eight path may be used for a time length of 20 to 30 or more minutes. The reverse side with the oval path may be used for a shorter time length of 5 to 15 minutes.
- **Game Cards:** The game board can be matched with any set of game cards preferred. Game card skill sets may be used individually or card sets may be combined for review. The game cards include the question on the front and the answer choice located on the back. The back side of the card also has the topic name and grade level as well as a topic symbol. Each set of cards has its own unique symbol. This allows the students to help keep the sets organized easily.
- **Game Dice:** The dice included in this game are each four sided. On each side, there are three numbers. When the die is rolled, the number rolled will be on the bottom and is the only number that is facing the right way. This number will be the same on all sides.

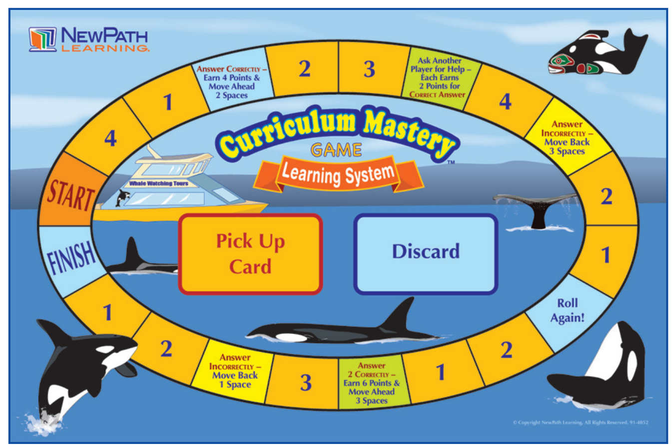


Bottom number

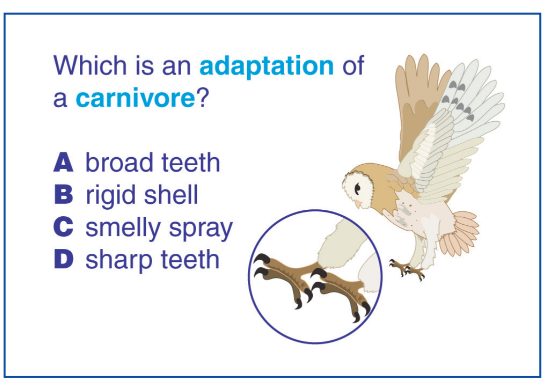
- **Scoring Sheet:** The score sheet master located in this guide can be copied and cut as needed for students to keep track of their points as they play. Note that the score sheets are designed so that the teacher can identify how many questions the player missed in the game.



Sample - Figure Eight Game Board



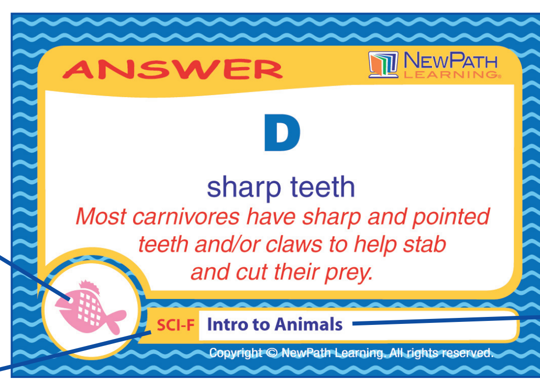
Sample - Oval Path Game Board



Sample - Card Front (Question)

Symbol

Grade Level



Topic

Sample - Card Back (Answer)

Playing the Curriculum Mastery™ Game

Number of players: maximum of 3 per game

Game Time: The amount of time for game play can be anywhere from 5 to 30 or more minutes.

Materials needed for a game: 1 game board, 1 die, 1 set of game cards, and 1 player piece and one score sheet for each player.

Objective of the Game: The players collect points when they answer the curriculum-based questions correctly. The student with the most points at the end of the game is the winner!

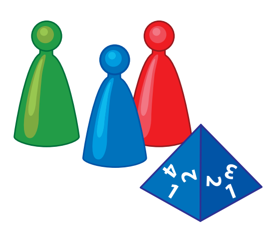
1. Players choose the game board they wish to use, as well as the side of the game board to play on, according to the amount of time they have to play. (See above)
2. Each player chooses the color game piece they wish to use.
3. Players choose a die to use for game play as well.
4. Teacher or players choose the topic of the Game Cards to be used in the game.
5. Players place their game pieces on **START**. Place the Game Cards on the **PICK UP** card section of the board, question side up.
6. Players then roll the die to determine who will go first. The player with the highest roll goes first.
7. The first player rolls the die and moves the game piece that number of spaces on the board. The number in the space is the number of points received for correct answers.
8. The player then picks up the top card from the pile and reads and answers the question on the card.
9. If the question is answered *correctly*, the player receives the points from the space they landed on. These points are written on the *Student Score Sheet* and the card is placed on the **DISCARD** space.

   If the question is answered *incorrectly*, the player simply writes 0 on his/her score sheet and the card is placed underneath the **PICK UP** pile to be answered again.

   Note about points: *The points range from 1-3 for game grades 1 and 2; 1-5 for grades 3-8. For game levels 3-8, there is also a **BONUS** space in the center of the figure eight path. Any player who lands on this space earns an extra ten points!*
10. Play then proceeds to the next player.
11. Play continues until all players have reached **FINISH**. A player may roll a number larger than needed to finish.
12. Players add up all of their points. The winner is determined by the person who has the most points.

    Special spaces: *If a player lands on a **ROLL AGAIN** space, that player is able to roll the die again to move ahead. If a player lands on a **MOVE AHEAD** space, that player is able to move ahead the number of spaces indicated.*

WARNING:
CHOKING HAZARD–Small parts
Not for children under 3 yrs.



Curriculum Mastery™ Game Variations:

No Points –

1. Players place their game pieces on **START**. Place the Game Cards on the PICK UP card section of the board, question side up.
2. The first player draws a card and answers a question.
3. If the question is answered correctly, the player rolls the dice and moves that number of spaces.
4. Play then proceeds to the next player.
5. Once a player has moved or answers a question incorrectly, play moves on to the next player.
6. Repeat with subsequent players.
7. The player who reaches **FINISH** first is the winner.

Timed Game With Points – If there is a limited amount of time to play the game or if you wish to challenge a student, try this option. Players keep track of points and the player with the most points when the time is up wins the game.

Timed Game Without Points – This version frees up players to focus on the questions in the time they have, rather than on keeping score. In this case, the winner would be determined by whoever is closest to **FINISH**.

Curriculum Mastery™ Game/Activity Extensions

Well-designed materials are a rich resource for the creative teacher. Here are some further uses of the Curriculum Mastery™ Games.

- **Class competition:** Students may compete in teams. Two teams can be formed to compete against each other by simply dividing the class in half or multiple teams can compete by forming groups of two, three, four, or however many are desired. The students in each team work together to answer a question or take turns. The teams can compete all at once with the same game or around the room with multiple games being played at the same time. The team with the most points at the end of each game is the winner.
- **Individual play:** Students may play the Curriculum Mastery™ Games individually as well. The student is able to self-check his or her responses with the correct answer on the back of the card. The student keeps track of responses on a copy of the *Student Score Sheet* to be handed in to the teacher.
- **Test/quiz review:** The cards from the Curriculum Mastery™ Games can be used on their own for test/quiz review with partners, small groups, or whole class.
- **Flashcards:** The cards can also be used as flashcards between teacher and student(s) or student and student or to play a game of "Around the World" where students compete with one another to answer the questions. Whoever, among the pair, answers correctly first moves on to compete with another student. The goal for each student is to go up against each student around the classroom. The *Class Assessment Chart* that follows is a tracking tool for the teacher. Each Game Card Set, which is tied to a particular group of curriculum standards, can be listed and each student's score noted for that set. The teacher then has a snapshot of how well the student is doing in retaining content in the subject area. The *Student Score Sheet* for a given game may be used as a form of assessment of the student's achievement within the skill reviewed. The score sheet will indicate the name of the skill covered as well as the number of questions answered correctly. A percentage can be easily determined and then documented in the *Assessment Chart*. If a student and/or teacher sets scoring goals for the students, these assessment tools can give both student and teacher a view of the student's progress in meeting his/her goals.

Class Assessment Chart - Life Science

Student Name	The World of Life Science	Diversity of Life	Cells: The Basic Units of Life	Cell Processes	Cell Reproduction	Genetics – Study of Heredity	Modern Genetics	The Evolution & Interaction of Living Things	Bacteria and Viruses	Protists and Fungi	Introduction to Plants	Plant Processes	Plant Reproduction	Introduction to Animals	Sponges, Cnidarians & Worms	Mollusks, Arthropods & Echinoderms	Fishes, Amphibians & Reptiles	Birds and Mammals	Bones, Muscles, and Skin	The Digestive System & Nutrition	Circulation and Immunity	Respiration and Excretion	The Nervous System	The Endocrine System & Reproduction	Ecosystems, Food Chains & Food Webs

Class Assessment Chart - Earth Science

Student Name	Introduction to Earth Science	Maps as Models of the Earth	Minerals	Rocks	Fossils	Earth's Energy Resources	Geologic Time	Plate Tectonics	Earthquakes	Volcanoes	Weathering of Rocks & Soil Formation	Earth's Fresh Water	Groundwater Resources	Agents of Erosion and Deposition	Exploring the Oceans/Oceanography	The Movement of Ocean Water	Earth's Atmosphere	Understanding Weather	Weather Patterns	Climate	Studying and Exploring Space	Stars, Galaxies, and the Universe	The Sun-Earth-Moon System	Our Solar System	Our Impact on Earth

Class Assessment Chart - Physical Science

Student Name	Introduction to Physical Science	Introduction to Matter	Solids, Liquids, and Gases	Mixtures, Solutions, & Compounds	Motion	Forces	Forces in Fluids	Work and Machines	Energy and Energy Resources	Heat and Heat Technology	Properties of Atoms	Elements and the Periodic Table	Chemical Bonding	Chemical Reactions	Acids, Bases, and Salts	Organic Compounds	Electricity	Magnetism	Electromagnetism	The Energy of Waves	Sound	Light	Mirrors and Lenses	Chemistry in Our World	Technology in Our World

Curriculum Mastery™ Games Student Score Sheets

NAME:

Topic Name:

Turn	Points	Total
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		
21		
22		
23		
24		
25		
TOTAL		

NAME:

Topic Name:

Turn	Points	Total
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		
21		
22		
23		
24		
25		
TOTAL		

NAME:

Topic Name:

Turn	Points	Total
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		
21		
22		
23		
24		
25		
TOTAL		

Chapter II. Curriculum Content

Overview of Standards and Curriculum

Any definition of curriculum in 21st century schools begins with curriculum content standards. Since almost all states have adopted the Common Core Standards in English Language Arts and Mathematics, the nation's public schools have moved very quickly to what some define as a "national curriculum," similar to the national curricula of the world's highest performing countries, according to international assessments. The Common Core Standards are strongly influenced by

- the content standards from other high-performing countries;
- the national standards created by professional subject-matter organizations (e.g., National Research Council);
- the standards deemed most appropriate and rigorous that have been adopted by states;
- the standards recommended by discipline scholars; and
- the recommendations of K-12 and university-based practitioners.

The National Research Council recently (2011) published a new study in anticipation of new science standards development: *A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas*. "The time is ripe for a new framework for K-12 science education," they state, "not only because of weaknesses in the current approaches, but also because new knowledge in both the sciences and the teaching and learning of science has accumulated in the past 15 years." Common Core standards have not yet been developed for science, but work is underway by the National Research Council, the National Science Teachers Association, The American Association for the Advancement of Science, and Achieve for new science standards to be ready for adoption by the states by the end of 2012.

The current National Science Education Standards, first published in 1996, include eight categories of content standards. They are as follows:

- Unifying concepts and processes in science
- Science as inquiry
- Physical science
- Life science
- Earth and space science
- Science and technology
- Science in personal and social perspectives
- History and nature of science

For more information on how the curriculum content standards are derived and assigned to grade levels, NewPath recommends the following:

National Research Council (2011). *A framework for K-12 science education: Practices, crosscutting concepts, and core ideas*. Washington, DC: National Academies Press.

National Research Council (1996). *National science education standards.* Washington, DC: National Academies Press.

To access the official position of the National Science Teachers Association on science education standards, go to **http://www.nsta.org/about/positions/standards.aspx**

For a description of the process to develop new science standards, go to the webpage for Achieve at **http://www.nextgenscience.org/**

To access the content standards in current adoption by your state, go to the webpage of your state department of education, and click on **curriculum**.

To access the *Common Core Standards for science*, go to **http://www.corestandards.org**

It is important to keep in mind that a list of curriculum content standards is *not* curriculum. Content standards merely specify what students at a given grade level should know and be able to do—**what to teach**. The curriculum is the umbrella for the whole teaching-learning plan to ensure students' mastery of the content standards. It includes, of course, the standards themselves--plus topic delineations, scope and sequence, pacing guides, unit/module plans, identification of resources and materials, lesson designs, instructional strategies, the range of assessments required, accommodations for special populations, professional development, parent involvement, and program evaluation.

Educators at the district and school levels typically have an ongoing conversation about standards-based teaching and learning and the implications of that concept for all parts of the teaching/learning experiences. In discussing content standards, the following topics are usually included:

- Curriculum content standards (based on National Science Education Standards and/or state-adopted standards).
- Identification of content standards to be assessed in national/state assessments.
- Identification of priority standards (foundational knowledge and skills; areas which tend to be difficult to teach/learn; and areas where there are significant achievement gaps).
- Delineation of units, modules, or general topics to be taught that will provide every student with the opportunity to master the content standards.

The content standards selected for summative assessment by the state are available on the websites of the state departments of education. The identification of priority standards for the school's emphasis will depend, first, on the teachers' expert observations of student performance in the past and, second, on their analyses of data from prior years' assessments that will reveal where students are weak and the topics or standards that require greater attention.

How NewPath Can Help Make Sense of Content Standards

The grades 6-8 science correlations of the NewPath topics with the science content standards published by the National Research Council provide educators with critical information about how NewPath materials reflect all the content standards and how they fit under the curriculum umbrella. The NewPath materials are designed to provide comprehensive coverage of all the content standards. Further, all five NewPath products are aligned, not only with each other, but also with the content standards.

- **Science Skills Curriculum Mastery Games.** Under each NewPath topic (and each is correlated to one or more content standards), there are 25 standards-based questions for students to use in mastering both concepts (including vocabulary), and procedural knowledge.
- **Science Skills Flip Charts.** Each set of Flip Charts for grades 3-5 includes ten high-priority, standards-based science concepts interwoven with procedural skills, plus practice opportunities (wipe-on, wipe-off) on the flip charts themselves, supplemented by an Activity Guide featuring black-line copy-masters and exercises.

- **Science Skills Visual Learning Guides.** NewPath's laminated Visual Learning Guides feature the same ten high-priority, standards-based science concepts as included in the Flip Charts. The first page focuses on the concept, the second page on procedural knowledge, the third on science vocabulary (enhancing understanding of the concept), and the fourth includes practice items.
- **Interactive Whiteboard CD-ROMs.** This NewPath product features the same standards-based questions as are the basis for the Curriculum Mastery Games. Teachers can choose questions from one topic or multiple topics, save them for a lesson plan or a formative assessment, and students can work independently or in groups wherever there is a computer.
- **Online Learning.** Teachers are provided tools and resources (including everything in the print materials) to create and save standards-based custom games, assessments, and interactive practice activities to assign to the whole class, small groups, or individual students. Students can also make selections of games, activities, and assessments to reinforce their learning and ensure mastery of standards. They can access all resources at school, home, or wherever there is a computer. Parents can review the content standards for their child's grade level, monitor their progress in mastering those standards, use resources to tutor or reinforce learning at home, and communicate with the teacher.

NewPath's materials and resources provide significant support to teachers in delivery of a standards-based curriculum. The organization of learning activities by standards-based topics assists educators in the delineation and organization of units or modules and the creation of standards-based lesson plans and assessments in order to ensure not only coverage, but also to ensure every student's **opportunity to learn**.

For more information on standards-based curriculum, NewPath recommends the following:

Ainsworth, L. (2010). *Rigorous curriculum design: How to create curricular units of study that align standards, instruction, and assessment.* Englewood, CO: Lead+Learn Press.

Jacobs, H. H. (2010). *Curriculum 21: Essential education for a changing world.* Alexandria, VA: Association for Supervision and Curriculum Development.

Marzano, R. J. (1992). *A different kind of classroom: Teaching with dimensions of learning.* Alexandria, VA: Association for Supervision and Curriculum Development.

Wiggins, G. & McTighe, J. (1998). *Understanding by design.* Alexandria, VA: Association for Supervision and Curriculum Development.

For an evaluation of science standards by state, go to **http://www.edexcellence.net**

NCTM Principles, Standards, and Focal Points can be accessed at **http://www.nctm.org/standards**

Curriculum Standards Correlation - Life Science

Curriculum Mastery® GAME Learning System

Middle School LIFE SCIENCE Topics	NSES Standards																						
	A		B			C					D			E		F					G		
	Science as Inquiry		Physical Science			Life Science					Earth & Space Science			Science & Technology		Science in Personal & Social Perspectives					History & Nature of Science		
	Abilities necessary to do scientific inquiry	Understandings about scientific inquiry	Properties & changes of properties in matter	Motion and forces	Transfer of energy	Structure and function in living systems	Reproduction and heredity	Regulation and behavior	Populations and ecosystems	Diversity and adaptations of organisms	Structure of the Earth system	Earth's history	Earth in the solar system	Abilities of technological design	Understandings about science & technology	Personal health	Populations, resources & environments	Natural hazards	Risks and benefits	Science and technology in society	Science as a human endeavor	Nature of science	History of science
1. The World of Life Science	X	X														X					X	X	
2. Diversity of Life	X	X				X			X	X											X	X	
3. Cells: The Basic Units of Life	X	X				X		X												X	X	X	X
4. Cell Processes	X	X				X		X													X		
5. Cell Reproduction	X	X				X	X	X													X	X	X
6. Genetics – Study of Heredity	X	X				X	X			X				X	X						X	X	X
7. Modern Genetics	X	X				X	X			X				X	X				X	X	X	X	
8. Evolution & Interaction of Living Things	X	X					X	X	X	X		X			X		X		X	X	X	X	X
9. Bacteria and Viruses	X	X				X	X	X	X						X	X			X		X		X
10. Protists and Fungi	X	X				X	X		X	X									X		X		
11. Introduction to Plants	X	X				X	X	X	X	X											X	X	
12. Plant Processes	X	X				X		X	X								X	X			X		
13. Plant Reproduction	X	X				X	X														X	X	
14. Introduction to Animals	X	X				X	X	X	X	X											X	X	
15. Sponges, Cnidarians & Worms	X	X				X	X	X													X	X	
16. Mollusks, Arthropods & Echinoderms	X	X					X	X													X	X	
17. Fishes, Amphibians & Reptiles	X	X				X	X	X													X	X	
18. Birds and Mammals	X	X				X	X	X		X											X	X	
19. Bones, Muscles, and Skin	X	X				X		X							X	X				X	X		
20. The Digestive System & Nutrition	X	X				X		X							X	X				X	X		
21. Circulation and Immunity	X	X				X		X							X	X			X	X	X		
22. Respiration and Excretion	X	X	X			X		X							X	X				X	X		
23. The Nervous System	X	X				X		X							X	X				X	X		
24. Endocrine System & Reproduction	X	X				X	X	X							X	X				X	X		
25. Ecosystems, Food Chains & Webs	X	X	X						X		X			X	X		X	X		X	X	X	

Curriculum Standards Correlation - Earth Science

Middle School EARTH SCIENCE Topics	NSES Standards																						
	A		B			C					D			E		F					G		
	Science as Inquiry		Physical Science			Life Science					Earth & Space Science			Science & Technology		Science in Personal & Social Perspectives					History & Nature of Science		
	Abilities necessary to do scientific inquiry	Understandings about scientific inquiry	Properties & changes of properties in matter	Motion and forces	Transfer of energy	Structure and function in living systems	Reproduction and heredity	Regulation and behavior	Populations and ecosystems	Diversity and adaptations of organisms	Structure of the Earth system	Earth's history	Earth in the solar system	Abilities of technological design	Understandings about science & technology	Personal health	Populations, resources & environments	Natural hazards	Risks and benefits	Science and technology in society	Science as a human endeavor	Nature of science	History of science
1. Introduction to Earth Science	X	X													X					X	X	X	
2. Maps as Models of the Earth	X	X									X				X						X	X	X
3. Minerals	X	X									X			X	X		X			X	X	X	X
4. Rocks	X	X									X	X									X	X	
5. Fossils	X	X								X	X	X		X	X						X	X	X
6. Earth's Energy Resources	X	X									X	X	X	X	X		X		X	X	X	X	X
7. Geologic Time	X	X								X	X	X	X		X					X	X	X	X
8. Plate Tectonics	X	X									X	X		X	X					X	X	X	X
9. Earthquakes	X	X									X	X		X	X	X		X	X	X	X	X	X
10. Volcanoes	X	X									X	X		X	X	X		X	X	X	X	X	X
11. Weathering of Rocks, Soil Formation	X	X									X			X	X		X			X	X	X	
12. Earth's Fresh Water	X	X									X			X	X		X	X	X	X	X	X	
13. Groundwater Resources	X	X									X			X	X					X	X	X	
14. Agents of Erosion & Deposition	X	X									X									X	X	X	
15. Exploring Oceans/Oceanography	X	X							X		X			X	X		X		X	X	X	X	X
16. The Movement of Ocean Water	X	X									X		X					X		X	X	X	
17. Earth's Atmosphere	X	X									X		X				X		X	X	X	X	
18. Understanding Weather	X	X									X		X		X						X	X	
19. Weather Patterns	X	X									X		X	X	X			X	X	X	X	X	
20. Climate	X	X									X	X	X	X	X		X				X	X	X
21. Studying and Exploring Space	X	X											X	X	X					X	X	X	X
22. Stars, Galaxies & the Universe	X	X											X		X					X	X	X	X
23. The Sun-Earth-Moon System	X	X											X	X	X					X	X	X	X
24. Our Solar System	X	X											X		X					X	X	X	X
25. Our Impact on Earth	X	X									X			X	X	X	X	X	X	X	X	X	

Curriculum Standards Correlation - Physical Science

Curriculum Mastery GAME Learning System®

Middle School PHYSICAL SCIENCE Topics / NSES Standards

Middle School PHYSICAL SCIENCE Topics	A: Science as Inquiry		B: Physical Science			C: Life Science					D: Earth & Space Science			E: Science & Technology		F: Science in Personal & Social Perspectives					G: History & Nature of Science		
	Abilities necessary to do scientific inquiry	Understandings about scientific inquiry	Properties & changes of properties in matter	Motion and forces	Transfer of energy	Structure and function in living systems	Reproduction and heredity	Regulation and behavior	Populations and ecosystems	Diversity and adaptations of organisms	Structure of the Earth system	Earth's history	Earth in the solar system	Abilities of technological design	Understandings about science & technology	Personal health	Populations, resources & environments	Natural hazards	Risks and benefits	Science and technology in society	Science as a human endeavor	Nature of science	History of science
1. Introduction to Physical Science	X	X	X	X	X									X	X					X	X	X	
2. Introduction to Matter	X	X	X		X																X	X	
3. Solids, Liquids, and Gases	X	X	X		X						X			X	X					X	X	X	X
4. Mixtures, Solutions & Compounds	X	X	X											X	X		X		X	X	X	X	
5. Motion	X	X		X	X									X	X					X	X	X	
6. Forces	X	X		X	X									X	X						X	X	X
7. Forces in Fluids	X	X		X										X	X						X	X	
8. Work and Machines	X	X		X	X									X	X				X	X	X	X	
9. Energy and Energy Resources	X	X	X	X	X									X	X		X	X	X	X	X	X	X
10. Heat and Heat Technology	X	X		X	X									X	X					X	X	X	
11. Properties of Atoms	X	X	X												X					X	X	X	
12. Elements and Periodic Table	X	X	X												X					X	X	X	
13. Chemical Bonding	X	X	X																	X			
14. Chemical Reactions	X	X	X											X	X	X			X		X	X	
15. Acids, Bases, and Salts	X	X	X													X		X	X	X	X	X	
16. Organic Compounds	X	X	X			X			X											X	X	X	
17. Electricity	X	X		X	X									X	X	X		X	X	X	X		
18. Magnetism	X	X		X											X					X	X	X	X
19. Electromagnetism	X	X		X	X									X	X					X	X		
20. The Energy of Waves	X	X		X	X						X			X	X	X		X		X	X	X	
21. Sound	X	X	X	X	X	X								X		X				X	X	X	
22. Light	X	X	X	X	X									X						X	X	X	
23. Mirrors and Lenses	X	X			X									X						X	X	X	
24. Chemistry in Our World	X	X	X	X	X									X		X				X	X	X	
25. Technology in Our World	X	X			X									X	X					X	X	X	

A Cautionary Tale: Inappropriate and Inadequate Curriculum

A review of the research literature on reading will certainly lead to many references to the existence of inadequate or inappropriate instruction being the cause for most student failure in learning to read. In fact, Lyon (1996), one of the major advocates for scientifically-based evidence in education—in reading and in the Response-to-Intervention model, maintains that **inadequate and inappropriate instruction is the cause for massive over-identification of children for special education**. The abundance of these references in reading research, however, almost pales in comparison to those found in mathematics and science research. It is difficult to find a study that does not at least allude to the need for preschool education in mathematics and science, for better teacher preparation to teach mathematics and science, for better curriculum, for more effective teaching strategies, for better assessments to measure progress, and on and on. Clearly, many prominent researchers, mathematicians, scientists, and mathematics and science educators believe that the vast majority of student failure to learn science is the result of inappropriate or inadequate instruction, especially given that most children are more dependent on the school to teach them mathematics and science than they are for literacy development.

Among the reasons for poor achievement that researchers say lead to **"inadequate" instruction** are the following:

- Limited exposure to science concepts before entering school.
- Weak educational background of parents.
- Health problems that cause students to miss school.
- Student stress, anger, anxiety, and fear resulting from dysfunctional homes and/or unsafe neighborhoods.
- Students' behavioral problems.
- Lack of teacher knowledge in science.
- Lack of adequate curriculum materials.
- Lack of adequate practice/repetition in curriculum materials.
- Lack of adequate technology to facilitate instruction, assessment, and record-keeping, especially.
- Lack of adequate time to learn science, especially for those children who start school significantly behind their peers; who are not yet proficient in English; and/or who have learning disabilities.
- Lack of adequate time to teach science in the school schedule.

"Inappropriate" instruction occurs as well. Examples follow:

- Poor or non-existent curriculum planning.
- Lack of attention to the importance of sequencing.
- Poor assessments and their use.
- One-size-fits-all approaches.
- Lack of teacher knowledge and use of research-based instructional strategies.
- Lack of attention to the tremendous cognitive load required in order to learn scientific vocabulary—for all students, and especially for struggling learners.
- Curriculum materials that do not align with standards.
- Curriculum materials that do not help students merge conceptual knowledge with procedural knowledge.
- Emphasis on procedures at the expense of concept development and emphasis of concept development with little attention to development of procedural fluency.
- Interference of misconceptions and erroneous beliefs about scientific topics that require "unlearning" and then learning.

- Political inference in teaching science topics, such as evolution, climate change, sex education, etc.
- Failure to understand the language needs of ELLs in learning science.
- Failure to understand the needs of students with dyscalculia.
- Failure to understand how dyslexia affects science performance.

How NewPath Can Help

The multiplicity of ways in which NewPath's print and digital materials can be used to deliver curriculum is a major support for teachers who otherwise can be overwhelmed. Having what one needs in the classroom, regardless of individual student needs, facilitates the kind of adequate and appropriate instruction that everyone expects from schools.

Many of the issues around "inadequate" instruction have to be solved in collaboration with parents, the neighborhood, the school/district administration, and the larger community. Teachers can ensure that students have opportunities to make up missed lessons, that they have engaging homework to help them catch up, that parents are provided resources to help them help their children, that students who require extended practice/repetition have those opportunities, and that the classroom is a nurturing and safe haven. NewPath's materials enable and facilitate these actions.

NewPath's materials also help to remove the possibility of "inappropriate" learning resources. They neatly align with any other standards-based materials that may be in use, they supplement with plenty of varied practice/repetition, and they provide the much-needed instruments for continuous progress monitoring. They are also strong in all phases of the lesson delivery, in facilitating differentiation or individualization of instruction, and in motivation of students. If teacher knowledge is weak, NewPath can provide training in the use of its materials, as well as special-topic sessions to strengthen teachers.

Problem Areas in Science Teaching/Learning

The job of the teacher is to deliver a curriculum for all children with appropriate instructional strategies and materials so that, according to the neuroscientists, neural pathways can be developed and strengthened and connections can be made between different areas of the brain to make rapid recall and application possible. In other words, the goal is to move new knowledge into long-term memory. Dehaene (1997) says it this way: "A good teacher is an alchemist who gives a fundamentally modular human brain the semblance of an interactive network."

One of the major challenges for students in learning science is vocabulary acquisition. Yager (1983) noted that "The number of new vocabulary words in a science textbook exceeds the number of vocabulary words in the first year of a foreign language course." Vocabulary words alone are a huge cognitive load for all students, and especially so for struggling learners, whether they are ELLS, students with learning disabilities, and/or students who are economically disadvantaged. Marzano (1998) wrote that "At a practical level, it is fairly obvious that students must understand a certain amount of the basic vocabulary in a subject area before they can understand facts, generalizations, and concepts within a content area." Science vocabulary is a major part of what scholars mean when they speak about Academic English and its importance in school success. [See sections on struggling learners for more discussion on this topic.]

Another challenge for science teachers is that many of the concepts critical to understanding science are abstract—gravity, for example. We can't see gravity, just its effects.

And a third major challenge is overcoming misconceptions. Some are due to lack of previous life experiences, others are due to what some call magical thinking, others are due to lack of understanding of scientific thinking, and others occur because of weak skills in mathematics and literacy.

How NewPath Can Help

NewPath has the educator's back! The systematic ways in which the NewPath materials were developed assure that science vocabulary (Academic English) is a major emphasis in all products; that abstract concepts are made as concrete as possible with concept maps, illustrations, and multiple examples; and that misconceptions are corrected with sound presentations and activities with sufficient repetition and practice opportunities.

For more information on critical topics in science, NewPath recommends the following:

Bruer, J. T. (1993). *Schools for thought: A science of learning in the classroom.* Cambridge, MA: MIT Press. (See especially Chapter 5, pp. 127-171.)

National Research Council (2011). *A framework for K-12 science education: Practices, crosscutting concepts, and core ideas.* Washington, DC: National Academies Press.

National Research Council (2000). *National science education standards.* Washington, DC: National Academies Press.

National Research Council (2000). *How people learn: Brain, mind, experience, and school.* Washington, DC: National Academies Press. (See especially pp. 171-189.)

Rudolph, J. L. (2007, Feb.). An inconvenient truth about science education. Teachers College Record.

Chapter III. Lesson Design

Sequencing and Pacing

Among the first steps in curriculum development are the design of the following guides for teachers' use:

- Scope and sequence guide for planning lesson delivery to ensure appropriate sequencing and coverage of the content standards and sufficient time for student mastery.
- Pacing guides to ensure that all standards are taught to mastery level and that all standards to be formally assessed for accountability are taught prior to the end of grading periods and prior to the dates for summative assessment.

Every science teacher knows that sequencing is very important in teaching this subject area. Some science topics simply cannot be understood without mastery of prerequisite knowledge and skills. Ritter and Nerb (2007) state that

> *The order in which material is presented can strongly influence what is learned, how fast performance increases, and sometimes even whether the material is learned at all. This is true for both skills and facts and remains true whether the material is presented by an instructor or explored alone by a learner.*

The National Research Council makes it clear in their prelude to the current National Science Standards that sequencing is important. The sequence is as follows:

- Unifying concepts and processes in science
- Science as inquiry
- Physical science
- Life science
- Earth and space science
- Science and technology
- Science in personal and social perspectives
- History and nature of science

The explanation for the sequence follows:

> This sequence of the seven grade-level content standards is not arbitrary. Each standard subsumes the knowledge and skills of other standards. Students' understandings and abilities are grounded in the experience of inquiry, and inquiry is the foundation for the development of understandings and abilities of the other content standards. The personal and social aspects of science are emphasized increasingly in the progression from science as inquiry standards to the history and nature of science standards. Students need solid knowledge and understanding in physical, life, and earth and space science if they are to apply science.

The pacing guide cannot be done externally or by a third party without access to the school district's master calendar. Those charged with this responsibility must know precisely which days are available for instruction, blocking out days lost due to district benchmarking, state testing, holidays, professional development days, and other priorities. The pacing guide, then, will recommend to teachers the numbers of days to plan for teaching each unit, assessing, re-teaching, and reassessing learning. The standards (along with prerequisite knowledge and skills) included in the state assessment should be prioritized so that they are taught to mastery before the testing dates. Then other standards can finish out the school year.

Herr (2008) provides a sample sequencing and pacing guide in his book, *The Sourcebook for Teaching Science: Strategies, Activities, and Instructional Resources, Grades 6-12*. He suggests that "It is essential that every science teacher develop a long-term plan" to help "pace instruction to ensure sufficient time for key concepts, activities, and assessments."

How NewPath Can Help

Once teachers have their pacing guide (which reflects the scope and sequence guide decisions), then they can begin to construct lessons for each unit/module using NewPath's Online Learning. A beginning step might be to identify which NewPath topics will be used in each unit.

If teachers have lessons saved from previous years that they would like to reuse, then these lessons can be accessed, edited, and then saved again for retrieval.

For more information on sequencing, the following book is helpful:

Ritter, F. E. & Nerb, J. (2007). Call to order: How sequence effects in humans and artificial systems illuminate each other. In F. E. Ritter, J. Nerb, E. Lehtinen, & T. M. O'Shea (Eds.), *In order to learn: how the sequences of topics influence learning* (pp. 3-19). New York City, NY: Oxford University Press.

National Research Council (2000). *National science education standards*. Washington, DC: National Academies Press.

For more information on sequencing and constructing a pacing guide, see Chapter 8 of the following book:

Ainsworth, L. (2010). *Rigorous curriculum design: How to create curricular units of study that align standards, instruction, and assessment* (pp. 79-96). Englewood, CO: Lead+Learn Press. (Ainsworth provides a sample pacing guide on pp. 88-90.)

Herr, N. (2008). *The sourcebook for teaching science: Strategies, activities, and instructional resources, grades 6-12*. San Francisco, CA: Jossey-Bass.

Alignment of Curriculum Resources/Materials

The next important step in developing the grade-level curriculum is to identify the appropriate curriculum materials and resources that are available for curriculum delivery—by unit/module and then by specific lesson. The list should include everything that is used, including state/district-adopted textbooks, sets of manipulatives or models, digital resources, video, print materials, library materials, and, of course, all the NewPath materials. Many experts recommend that a matrix be developed, such as the one that follows, to align available resources with the units/modules to be taught.

Alignment of Curriculum Materials and Resources with Science Units

Unit Name	Textbooks, etc.	NewPath Products/Topics
Unit Name	Textbook, Chapter, Pages Video Title District fluency worksheets Manipulatives	• Curriculum Mastery Game, Topics • Flip Charts, Topics • Visual Learning Guide,Topics • Take-Home Edition of Curriculum Mastery Games • Interactive Whiteboard, Topics • Online Learning, Topics

For more information on the alignment of curriculum content standards and materials, NewPath recommends the following:

Ainsworth, L. (2010). *Rigorous curriculum design: How to create curricular units of student that align standards, instruction, and assessment.* Englewood, CO: Lead+Learn Press.

Assessments for Learning

Good lesson design is critical to effective teaching. It depends, in its initial stage, on understanding the following:

- Content standards define what is to be taught at each grade level.
- Proficiency (or performance) standards define what should be assessed and how.

In other words, proficiency standards define what mastery of the content standards should look like in terms of student behavior.

What educators have learned in recent years is that having upfront a clear picture of what the summative assessment will be is required in order to inform the design of individual lessons. In other words, **teachers need to teach with the end in mind**. When they do, their teaching is more effective, and students are more likely to be better prepared for the assessments.

In addition to the **summative assessment** for a unit/module, there should also be numerous **formative assessments**—or continuous progress monitoring—so that the teacher knows every day where each child is in his or her path to mastery of the content standards. Researchers are finding that formative assessments are far more powerful in improving student learning than summative assessments. Their purpose is not so much to grade students' work, but to inform teacher decisions about what to do in the next lesson to ensure that mastery is attained. Using results of assessments to plan next lessons is what is called **data-driven decision-making**.

Another purpose for formative assessments is to motivate students. When they know how they are doing and are given appropriate support, they tend to persevere and make progress. Research also indicates that **self-assessment** is likely to motivate students and, thus, improve learning.

Heretofore, before the wonders of modern technology, constructing those assessments, administering them, checking the responses, tracking individual student progress, providing multiple and varied opportunities for practice, providing each student with meaningful corrective feedback, and then reassessing and re-evaluating were simply impossible in almost any classroom. No teacher had enough hours in the day to complete all those tasks. NewPath knew at the onset of their design of curriculum programs the importance of assessment, so they are embedded in each product. Teachers may use some for diagnosis or pre-teaching to determine what the students already know. At other times the materials can be used for practice and review and/or for students' self-assessment. Many teachers will want to use the materials for continuous progress monitoring. And some of the activities can serve as summative assessments for the unit/module previously taught.

A 2008 study explored "using a teaching approach that attempts to balance test preparation with creating 'teachable moments' for students." He used "a sequence of assessments to introduce topics through formative assessment in order to identify students' understanding," and then began instruction "based on an evaluation of students' knowledge and alternative conceptions." He found that "using assessments as a pedagogical tool provided the teacher an opportunity to isolate students' learning in three areas: (1) conceptual understanding, (2) analysis skills, and (3) use of science discourse." His conclusion was that "sound classroom instruction and preparation for testing are not mutually exclusive."

In the official position statement on elementary school science published by the NSTA, there is a section on assessment recommendations:

- Include a variety of assessment methods that can be used to evaluate overall student achievement and guide decisions about instruction and practices.
- Be continuous and embedded in the instructional materials.
- Capture the interest of students to better engage them in the assessment process.
- Occur frequently to allow for modification, enrichment, and remediation.
- Include questions that are sensitive to gender and varied cultures.

How NewPath Can Help

A major strength of the NewPath materials is attention to the importance of assessment, whether for individual students, small groups, or the whole class. NewPath materials have a wide variety of standards-based assessments that are useful and timesaving to teachers for their full range of assessment responsibilities. They include, in general, the following:

- pre-assessments to identify what students already know about a topic;
- diagnostic assessments to identify student strengths and weaknesses relating to the assessed topics;
- continuous-progress monitoring to measure learning as a student moves through a unit/module;
- students' self-assessments to let them know how they are doing;
- more formal, teacher-supervised formative assessments to determine mastery of prerequisite skills before moving forward; and
- summative assessments for a unit-module.

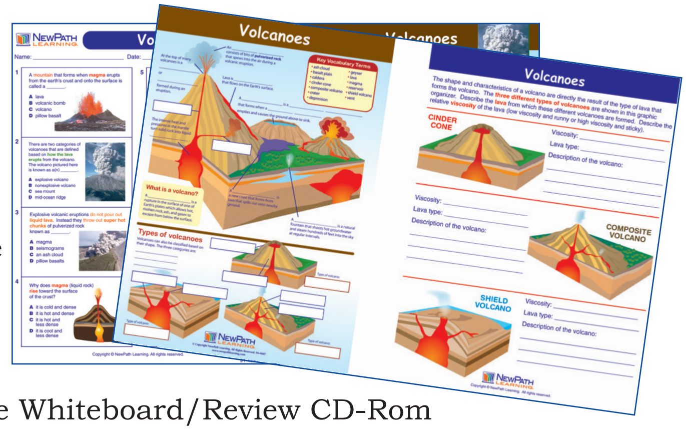
Following is a summary of the specific assessments embedded in the five NewPath products.

Curriculum Mastery Games. Each game includes standards-based questions, organized by topic. Playing the game provides practice/ repetition on concepts (including vocabulary) and procedural knowledge. Plus, teacher observation of students' performance as they play and teacher review of student scores are also continuous progress monitoring. Students needing more time on task for practice may play the same game multiple times.

Flip Charts. Teachers will use the Flip Charts to introduce and/or review key standards-based concepts and procedural knowledge with the whole class or with a group. Student responses to the activities on the reverse side of each page can be used as a kind of formative assessment to monitor student understanding.

Individual students can use the Flip Charts for independent learning, practice, review, and self-evaluation. They may also be allowed to refer to them when playing the Curriculum Mastery Games.

The Activity Guide includes numerous activities that teachers can use to check understanding, either individually, in groups, or for the whole class.



Visual Learning Guides. The Visual Learning Guides feature the same ten topics as are included in the Flip Charts. They are designed to be used individually for review of concepts and procedural knowledge—and then to assess understanding. These formative assessments (or, perhaps, continuous progress monitoring) include problems to solve using visual representations, mathematical vocabulary to define and use in context, and both story and "naked" problems.

Interactive Whiteboard CD-ROM. The Interactive Whiteboard/Review CD-Rom allows for the questions to be answered on the computer. The teacher can project the game questions on a screen or whiteboard for group or whole-class practice and review.

Students can also review content using the digital flashcards, individually, in groups, or as a class. The CD also affords a student many opportunities for self-assessment.

Additionally, the teacher can select questions from one topic or multiple topics to construct a custom assessment (independent practice, continuous progress monitoring, formative assessment, or summative assessment). This assessment can be administered on the computer or with printouts (online program) to individual students, small groups, or the whole class.

The software will provide students with immediate corrective feedback, reports on each student's time on task, number of attempts, percent answered correctly, and number of questions remaining. Students' scores can also be printed by topic for analysis.

Online Learning. Online Learning includes everything a teacher needs to create diagnostic tests, continually monitor student progress, provide for self-assessment, provide summative assessments, and keep track of student grades—for individual students, small groups, or the entire class:

- **Premade lessons**, each one including a game board, worksheet, flash card activity, and a quiz.
- **Teacher-created lessons**, which may include diagnostic quizzes, guided and independent practice, checking for understanding, continuous progress monitoring, summative quizzes, and tracking tools to monitor. These lessons can be saved for repeated or later use, or they may be created for immediate use only—for individuals, groups, or whole class.
- Teachers may create **worksheets** for use as diagnostic tools, guided practice, independent practice, continuous progress monitoring, or summative quizzes.
- Teachers can select a topic (aligned with state standards) for a **board game**, which can be used for students to practice or as continuous progress monitoring.
- Teachers can select a standard or a topic (aligned with state standards) to create a set of **flash cards** for diagnosis, practice, and/or continuous progress monitoring. Teachers can select the questions to use, or the computer will select questions randomly from the designated topic.
- Teachers can select a standard or a topic (aligned with state standards) to create **quizzes**. Teachers can select the questions to be included, or the computer can select random questions related to the designated topic or standard. Student scores are recorded in the "Student Progress Reports."
- Students can **"Review the Quiz," "Retake the Quiz,"** or **"Print the Quiz"** by clicking on appropriate links. Any of these options provide an opportunity for review, and/or preparation for the next assessment.

- Students can conduct **self-assessment** using "Review the Quiz," "Retake the Quiz" or "Print the Quiz." They can also select and play games, activities, worksheets, and quizzes for practice and self-assessment.
- Teachers may monitor student progress by clicking on the **"Student Progress Reports."** Reports include
  - all class averages by student;
  - class averages by subject and topic;
  - class averages by student, subject, and topic; and
  - student averages by subject and topic.

  These data may be used
  - to determine whether re-teaching of a concept is necessary and, if so, for whom—the whole class? a small group? or an individual student?
  - to indicate which students need more practice and repetition;
  - to provide information to a tutor or intervention teacher about a student's needs—or for the tutor or intervention teacher to provide information back to the classroom teacher;
  - to provide information to parents about student progress;
  - to be used as student grades and/or as summative reports to parents; and
  - to inform program evaluation.

For more information on assessments of all kinds, NewPath recommends the following:

Big Picture.

Ainsworth, L. (2010). *Rigorous curriculum design: How to create curricular units of study that align standards, instruction, and assessment.* Englewood, CO: Lead+Learn Press. (See especially Chapter 12.)

Brown, B. A. (2008). *Assessment and academic identity: Using embedded assessment as an instrument for academic socialization in science education.* Teachers College Record, 110: 2116-2147.

Herr, N. (2008). *The sourcebook for teaching science: Strategies, activities, and instructional resources, grades 6-12.* San Francisco, CA: Jossey-Bass. (See especially pp. 525-526 on "Assessing Student Performance.")

Mercer, C. D. & Mercer, A. R. (2005). *Teaching students with learning problems (7th ed.).* Upper Saddle River, NJ: Pearson. (See especially Chapter 3, "Assessing Students for Instruction.)

National Science Teachers Association (2002). *Official Position: Elementary School Science.* Arlington, VA: NSTA.

Reeves, D. B. (1998). *Making standards work: How to implement standards-based assessments in the classroom, school, and district.* Denver, CO: Center for Performance Assessment. (See Chapters 4-5, 9.)

Wiggins, G. & McTighe (1998). *Understanding by design.* Alexandria, VA: Association for Supervision and Curriculum Development.

Formative Assessment and Continuous Progress Monitoring

Cotton, K. (2000). *The schooling practices that matter most.* Alexandria, VA: Association for Supervision and Curriculum Development. (See pp. 12-13.)

Marzano, R. J. (2010). *Formative assessment and standards-based grading.* Bloomington, IN: Solution Tree.

Noyce, P. E. & Hickey, D. T. (2011). *New frontiers in formative assessment.* Cambridge, MA: Harvard Education Press.

Pashler, H., Bain, P., Bottge, B., Graesser, A., Koedinger, K., McDaniel, M., & Metcalfe, J. (2007). *Organizing instruction and study to improve student learning* (NCER 2007-2004). Washington, DC: National Center for Education Research, Institute of Education Sciences, U.S. Department of Education. (See Recommendation 5: Use quizzing to promote learning. Research supports teachers' use of pre-testing or diagnosis and then continuous progress monitoring.)

Popham, W. J. (2008). Transformative assessment. Alexandria, VA: Association for Supervision and Curriculum Development.

Wolfe, M. J. (2005). *Using assessment to support learning* (pp. 177-195). In S. Wagner (Ed.), PRIME. Ohio Department of Education. (This excellent discussion of formative assessment is strongly recommended. The following quotation from the document will tell you why. "Teaching without assessing is like driving with your eyes closed. Knowing when to stop and when to proceed, noticing warning signs, and avoiding obstacles are all key components to successful teaching and safe driving. Everyone is aware of the importance of real time feedback while driving, but not everyone understands the importance of real time assessment in instruction." Check with your own state department of education to see if there are similar documents that can be of assistance to teachers in planning how to design, administer, and evaluate assessments.)

Self-Assessment

Glasser, W. (1990). *The quality school: Managing students without coercion.* New York, NY: Harper and Row. (Glasser is a major advocate for the importance of self-assessment.)

Lesson Design

And some say teaching isn't rocket science! One needs only to review already in these pages the amount of knowledge and skill that a teacher is required to have in order to participate as an expert in curriculum planning, and he or she will see the complexity. Before a single lesson is designed, the teacher must thoroughly know and understand the **content and proficiency standards** that guide decisions on what to teach. She has already, as well, made expert decisions on what the **diagnostic, formative, self-evaluative, and summative assessments** will be so that she knows why she is making the decisions she is making about **lesson design, choice of materials, and selection of instructional strategies**. Too, because her first job is student observation, she has to be ready to change course quickly if the decisions she made are not having the effect required, if students are not learning.

If teaching is rocket science, then lesson plans are the rocket's launch and mission plans. Lesson plans sometimes carefully reflect the **"direct instruction"** model. Some see this model as behaviorist and are critical if they are among those who support **"constructivist" lessons**. The truth is that the **teacher must be the master of both approaches** and use them sometimes separately, and sometimes blended, depending upon the lesson to be taught. There are distinct advantages and appropriateness for each approach, but no good teacher uses only one. Sadly, many educators have been caught up in the math wars, and they worry that direct instruction over-emphasizes fact/algorithm acquisition at the expense of understanding concepts deeply, which is more likely to happen with a constructivist lesson. Others worry that the over-emphasis of constructivism ignores the critical importance of fact/algorithm fluency and that students do not deeply learn concepts or become adept at problem solving if they do not also acquire fluent procedural knowledge. Good practice is frequently somewhere in the middle of the extreme points of view.

Another debate is on which model to use with which students. Again, all students need both approaches. Some students, however, struggle to learn for a variety of reasons. While some students may quickly acquire fluency, others may require a hundred or more repetitions before they acquire automaticity. Forcing them to move forward before they have fluency will doom them to failure. Students without fluency (rapid and accurate recall), for example, use up all their working memory in remembering, leaving no time for problem solving. They are error-prone because they have to manually do the operations as quickly as possible while their peers only have to quickly recall the answer. These struggling students are the ones who never get their work done as quickly as others, and they don't finish the test. They become so frustrated that they give up and quit. Forcing them into a constructivist lesson requiring a level of prior knowledge before they are ready is not appropriate. At the same time teachers must not withhold from them appropriate constructivist instruction for deep understanding of the critical science concepts. According to the NSTA, an appropriate science lesson would include a blended approach

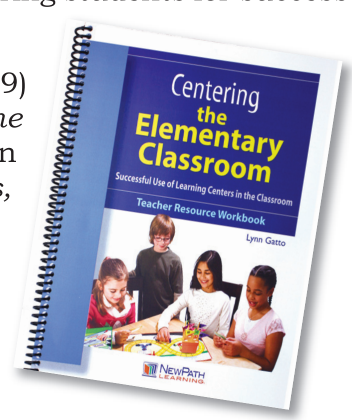
- concept application
- inquiry
- process skills

The outline of a good lesson, regardless of the strategies to be used, is as follows:

- **Opening:** Review previous lesson. Help students access the prior knowledge that they have in order to do well in the lesson of the day. State clearly the learning goal for the day and relate it to the overall goal of the unit/module. Teach vocabulary that will be necessary for understanding. Provide advance organizers as appropriate.
- Use appropriate strategies for teaching concepts and for teaching procedural knowledge. For procedures, model the desired behavior. Then have students perform along with you. Check for understanding.
- Provide opportunities for guided practice (continuous progress monitoring), giving immediate corrective feedback. Students should be performing well in guided practice before independent practice is required (such as homework).
- **Closing:** Review the accomplishments of the lesson. Preview the goal of the next lesson. Assign independent practice.
- Provide opportunities for independent practice (in class and/or as homework), which is, in reality, a kind of formative assessment.
- Assess progress and re-teach as necessary (whole class, small groups, or individuals).

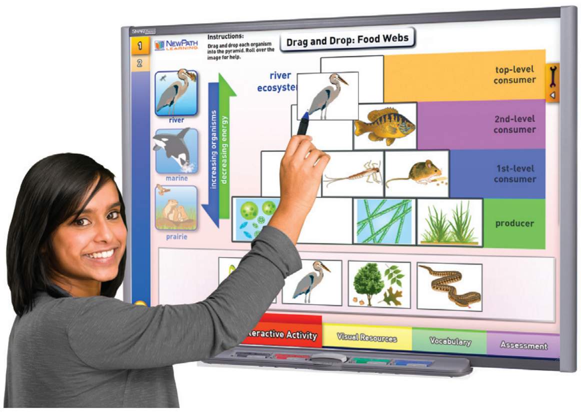
It is important to note that a lesson may take more than one class period to complete. An entire class period or more might be required just for explanations and modeling—before guided practice, and certainly before independent practice. Guided practice—and then independent practice—should be directly related to the proficiency standards and should be preparing students for success on the summative performance tasks.

More information about the design of lessons can be found in Gatto's (2009) *Centering the Classroom: Successful Use of Learning Centers in the Classroom* (pp. 14-18). Herr (2008) includes an outline for a science lesson plan in his book, *The Sourcebook for Teaching Science: Strategies, Activities, and Instructional Resources, Grades 6-12* (p. 519).



How NewPath Can Help

Readers are reminded that Chapter I includes a table, "Use of NewPath Materials in Each Stage of the Lesson Design." Suggestions are provided on which NewPath materials are appropriate for each phase of the lesson. Both the Interactive Whiteboard CD-ROM and Online Learning include suggested lesson plans and tools for the creation of lesson plans that can be saved, printed, edited for re-use, and made accessible to students and their parents. Teachers may use random selection of activities by topic, or they can select precisely how many questions and which specific questions they wish to include in specific activities/quizzes.



Components of the lesson outline for the **Whiteboard Life Science** lessons (available separately) include the lesson presentation (a series of narrated, visual presentations), interactive activities (including a virtual lab investigation), visual resources (for use in reviewing or in a teacher's free-style presentation), vocabulary lessons, and assessments.

Teachers are encouraged to become skilled in the use of these tools, for they open up many opportunities for student learning. Lesson plans can be created for individual students, for students in small groups with similar needs, or for the whole class.

Teachers can feel confident that the NewPath materials include a balanced approach—covering both conceptual and procedural knowledge.

For more information on lesson design, NewPath recommends the following:

Ainsworth, L. (2010). *Rigorous curriculum design: How to create curricular units of study that align standards, instruction, and assessment.* Englewood, CO: Lead+Learn Press. (See Chapter 16.)

Cawelti, G. (Ed.) (1999). *Handbook of research on improving student achievement.* Arlington, VA: Educational Research Service. (See p. 14.)

Ellis, A. K. & Fouts, J. T. (1997). *Research on educational innovations (2nd ed.).* Larchmont, NY: Eye on Education.

Gagnon, G. W., & Collay, M. (2001). *Designing for learning: Six elements in constructivist classrooms.* Thousand Oaks, CA: Corwin Press.

Hattie, J. (2009). *Visible learning: A synthesis of over 800 meta-analyses relating to achievement.* New York City, NY: Routledge. (See pp. 26-29, 204-207, 217-218, 243-244.)

Herr, N. (2008). *The sourcebook for teaching science: Strategies, activities, and instructional resources, grades 6-12.* San Francisco, CA: Jossey-Bass.

Kirschner, P. A., Sweller, J., & Clark, R. E. (2006). Why minimal guidance during instruction does not work: An analysis of the failure of constructivist, discovery, problem-based, experiential, and inquiry-based teaching. *Educational Psychologist*, 41(2), 75-86.

Mercer, C. D. & Mercer, A. R. (2005). *Teaching students with learning problems (7th ed.).* Upper Saddle River, NJ: Pearson.

NSTA (2004). *Official position: Science education for middle level students.* Arlington, VA: NSTA.

Sousa, D. A. (2001). *How the special needs brain learns.* Thousand Oaks, CA: Corwin Press, Inc.

Chapter IV. Instructional Strategies

The teacher's selections of research-based instructional strategies are, perhaps, her most important (and creative) decisions. These decisions have to be made keeping the whole class in mind, as well as the needs of individual students, especially those who are economically disadvantaged, who are not yet proficient in English, and/or who have learning disabilities—and those who are gifted/talented. Awesome responsibilities! Instructional strategy decisions are what a rocket ship commander does every day in flight to ensure the success of the mission. They are, therefore, the fuel that powers curriculum delivery and the fuel that powers student learning because, in part, they are closely connected to the relationship that a teacher has with her students.

The following instructional strategies reflect the findings of scientific studies, including those from education, cognitive psychology, and neuroscience. Their incorporation into unit/lesson designs predict **higher levels of student learning**, and, after all, moving new learning into long-term memory is the goal of all instruction.

Time-on-Task

One of the most studied and oldest topics of education research supports the obvious: that the more time that students spend studying, other things being equal, the more they learn (Cawelti, 1999). Educators have learned, however, that time alone may not result in higher levels of learning. The time must reflect educational goals, and students must be engaged.

Mercer and Mercer (2005) synthesize the research on engaged time-on-task as follows:

> The finding that academic learning time is related positively to more student learning is consistent in the research for both general education students and students with learning problems. To foster a positive and productive learning environment, students should spend as much time as possible engaged in meaningful academic tasks.

How NewPath Can Help

Given the variety of NewPath products, there are myriads of ways that teachers can use them to extend engaged learning time:

- Students can play the Curriculum Mastery Games or use the Mathematics Visual Learning Guides **before school** begins each morning.
- Teachers can use the game question cards as flash cards, Visual Learning Guides, Online Learning activities, or Interactive Whiteboard CD-ROM activities as **sponge activities** to engage students while they take care of their administrative responsibilities. These same activities can be used for children who finish their work early.
- The Science **Flip Charts** can be used to review concepts previously taught and to assist students in recalling background knowledge that is prerequisite for the day's lesson.
- Students who have already learned a concept can be assigned activities from Online Learning, from the Interactive Whiteboard CD-ROM, the Curriculum Mastery Game, or the Visual Learning Guides to provide **practice for fluency** while the teacher works with a small group of students in the back of the classroom.

- The teacher may wish to use the Flip Charts, Bulletin Board Charts, and/or Visual Learning Guides to **review a concept** with a small group of students that requires tutoring or re-teaching. She may also wish to use the Flash Cards, Worksheets, or other resources from Online Learning to ensure that students are on their way to mastery..
- **Intervention programs** that add additional time for struggling students (such as ESL, Title I tutoring, and/or Special Education) may also use the NewPath materials, especially those incorporating review activities, varied practice opportunities, test preparation, and continuous progress monitoring assessments. If re-teaching is required, then the Flip Charts, Visual Learning Guides, Bulletin Board Charts, Curriculum Mastery Posters, Premade Lessons, and Teacher Created Lessons will be helpful.
- **After-school programs** provide other opportunities to extend time on task. Depending on student needs, any of the NewPath materials may be appropriate for a large group, small group, or individual student.
- Students may be assigned NewPath activities for **homework** to extend engaged learning time, for **independent practice**, and for **self-assessment**. If students have computer access at home or elsewhere after school, then the whole range of Online Learning is available to them. If not, then teachers can print lessons, activities, worksheets, etc. for students to complete at home. The Take-Home Editions of the Curriculum Mastery Games may be good options for homework.
- **Summer school programs** provide even more opportunities to extend time on task. Depending on student needs, any of the NewPath materials may be appropriate for a large group, small group, or individual student.

- **Parents** can also access the Online Learning site to assist their child in reviewing lessons, in making up work due to absences, in tutoring a child, in helping a child achieve fluency, and even in administering a quiz to check for understanding.
- NewPath's **Take-Home Edition of the Curriculum Mastery Games** (available separately) can also extend learning time.

For more information on time-on-task, NewPath recommends the following:

Cawelti, G. (Ed.) (1999). *Handbook of research on improving student achievement*. Arlington, VA: Educational Research Service.

Cotton, K. (2000). *The schooling practices that matter most*. Alexandria, VA: Association for Supervision and Curriculum Development. (See pp. 10-12.)

Hattie, J. (2009). *Visible learning: A synthesis of over 800 meta-analyses relating to achievement*. New York City, NY: Routledge.

Mercer, C. & Mercer, A. R. (2005). *Teaching students with learning problems (7th ed.)*. Upper Saddle River, NJ: Pearson/Merrill Prentice Hall.

Pashler, H., Bain, P., Bottge, B., Graesser, A., Koedinger, K., McDaniel, M. & Metcalfe, J. (2007). *Organizing instruction and study to improve student learning* (NCER 2007-2004). Washington, DC: National Center for Education Research, Institute of Education Sciences, U. S. Department of Education. (See Recommendation 6, pp. 40-41.)

Multi-Sensory Processing Strategies

Multi-sensory processing strategies are again and again validated as powerful instruction by the research of cognitive scientists, neurobiologists, linguists, and other experts who study how people learn, remember, retrieve, and apply knowledge and skills. They are, according to Mercer and Mercer (2005), "based on the premise that some students learn best when content is presented in several modalities (p. 306). Multi-sensory processing uses multiple levels of processing so that learning is retained and so that it can be retrieved, regardless of the sensory modality in which it was originally encoded.

The power of multi-sensory processing strategies, in conjunction with practice/repetition exercises, is that they strengthen weak neural pathways and build new ones to compensate when a neural pathway is absent or damaged. Kandel (2006), the Nobel Prize winner, explains:

> *. . . brain circuitry has a built-in redundancy. Many sensory, motor, and cognitive functions are served by more than one neural pathway—the same information processed simultaneously and in parallel in different regions of the brain. When one region or pathway is damaged, others may be able to compensate, at least partially, for the loss.*

Research on the efficacy of multi-sensory processing strategies has been building for almost a century. These strategies are sometimes described using other labels. Stephen Krashen is an advocate for what he calls "comprehensible input," and others use the term "nonlinguistic encoding." Importantly, multi-sensory approaches to instruction are not the same as learning styles. Instead of accommodating a student's so-called learning preference (a learning style approach), multi-sensory strategies are provided to **all students so that encoding occurs in multiple modalities**, not in just the one an individual student may prefer. Multi-sensory instruction is, therefore, one of the most powerful teaching/learning strategies.

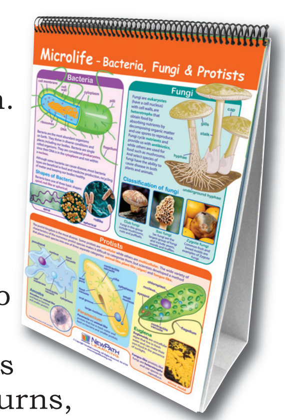
How NewPath Can Help

NewPath consciously incorporated multi-sensory processing strategies in the design of each of its products. **Auditory, visual, and kinesthetic modalities, at a minimum, are employed in each lesson.**

Curriculum Mastery Games

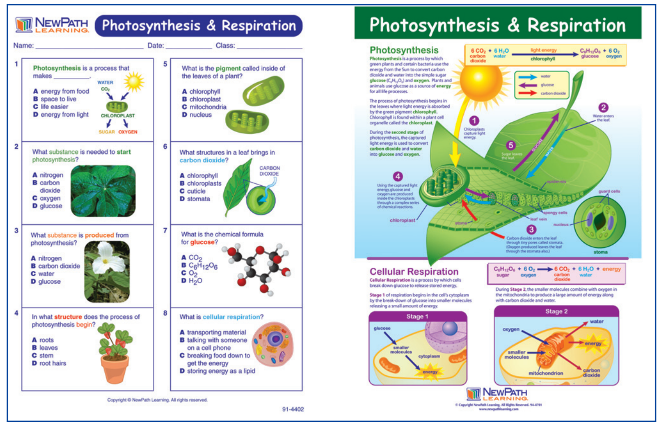
- The teacher's oral instruction and directions provide **auditory** stimulation, as do students' reading of the game questions and providing answers as the game moves forward.
- The game's questions are accompanied by drawings in bright colors, thereby providing **visual** stimulation. Game boards are also brightly colored and illustrated.
- Students gather in a circle, assemble the game, roll a die, move a game piece, pick up cards and then place them at the bottom of the stack, write down their scores, and replace the game pieces in the box—all **kinesthetic/tactile** activities.

Flip Charts



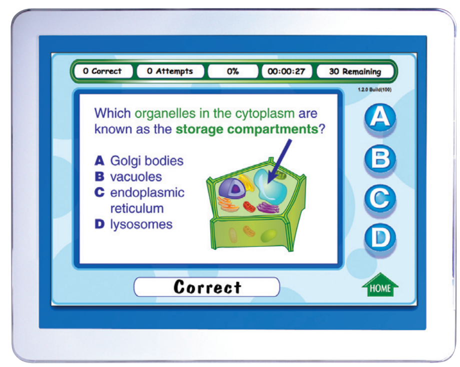
- The teacher's oral instruction and directions provide **auditory** stimulation.
- Each Flip Chart illustrates the targeted science concept with colorful drawings, simulations of manipulatives, fact tables, etc., providing **visual** stimulation.
- Teachers can incorporate **kinesthetic** stimulation in the Flip Chart activity by asking students to come forward and point to an illustration, to raise their hands if they understand or have a question, to take notes or write the problems for solution on their own paper, etc. If the Flip Chart is used with an individual student or with small groups of students taking turns, answers to questions are written on the backside of each chart—and then erased for re-use, providing another opportunity for kinesthetic stimulation.

Visual Learning Guides



- The teacher's oral instruction and directions provide **auditory** stimulation.
- The Visual Learning Guide enables students to **visualize** mathematical ideas, making them semi-concrete. Students developmentally move from concrete (manipulatives), to semi-concrete (depictions of the concrete, such as drawings, illustrations, diagrams, or photographs), and then to the abstract (mathematical notations or numbers and signs). The Visual Learning Guides provide powerful steps toward students' acquisition of abstract understandings. Visual Learning Guides are illustrated in bright colors and attractive layouts for the concept review, the practice exercises, and the worksheet/quiz on the back.
- The Visual Learning Guides also require **kinesthetic** stimulation. Students write answers to the practice questions and the worksheet/quiz. They also write the definitions for the targeted vocabulary words/phrases and draw an example, illustration, or number problem to depict the meanings. These pages, similar to the Flip Charts, are also erasable for re-use.

Interactive Whiteboard Life Science Lessons



- One feature is a series of narrated presentations on a life science concept, providing **auditory** stimulation.
- The application has a plethora of **visual** resources—the graphics and animations that accompany the lesson presentations; the bank of virtual resources that a teacher can access at any time for presentations or reviews, and illustrated vocabulary activities. The application also allows the teacher (or a student) to highlight specific information through the use of arrows, text, or callouts provided with the Custom Tool Box.
- Students use the keyboard, mouse, and other **kinesthetic** movements in doing the interactive activities and/or taking the assessments. The highlight feature is also kinesthetic if done by the student—using a finger to draw an arrow or a circle around a specific part of an illustration or graphic, for example.

Online Learning

- The teacher's instruction and directions provide **auditory** stimulation.
- All the activities incorporate the colorful illustrations, drawings, diagrams, or photographs used in the hard-copy materials, providing **visual** stimulation.
- Students use the mouse, keyboard, or they write on printouts to complete the activities, providing **kinesthetic** stimulation.

For more information on multi-sensory processing strategies, NewPath recommends the following:

Erlauer, L. (2003). *The brain-compatible classroom: Using what we know about learning to improve teaching.* Alexandria, VA: Association for Supervision and Curriculum Development.

Herr, N. (2008). *The sourcebook for teaching science: Strategies, activities, and instructional resources, grades 6-12.* San Francisco, CA: Jossey-Bass. (See especially Chapter 11.)

Kandel, E. R. (2006). *In search of memory: The emergence of a new science of mind.* New York City, NY: W. W. Norton and Company.

Mangan, M. A. (2007). *Brain-compatible science (2nd ed.).* Thousand Oaks, CA: Corwin Press.

Marzano, R. J. (1998, December). *A theory-based meta-analysis of research on instruction.* Aurora, CO: McREL.

Mercer, C. D. & Mercer, A. R. (2005). *Teaching students with learning problems (7th ed.).* Upper Saddle River, NJ: Pearson/Merrill Prentice Hall.

Pashler, H., Bain, P., Bottge, B., Graesser, A., Koedinger, K., McDaniel, M. & Metcalfe, J. (2007). *Organizing instruction and study to improve student learning* (NCER 2007-2004). Washington, DC: National Center for Education Research, Institute of Education Sciences, U. S. Department of Education. (See Recommendations 3 and 4, pp. 37-39.)

Rose, D. H. & Meyer, A. (2002). *Teaching every student in the digital age: Universal design for learning.* Alexandria, VA: Association for Supervision and Curriculum Development.

Sousa, D. A. (2001). *How the special needs brain learns.* Thousand Oaks, CA: Corwin Press.

Sternberg, R. J. (2003). *Cognitive psychology (3rd ed.).* Belmont, CA: Wadsworth/Thompson Learning.

Willis, J. (2006). *Research-based strategies to ignite student learning: Insights from a neurologist and classroom teacher.* Alexandria, VA: Association for Supervision and Curriculum Development.

Practice and Repetition

Multiple and varied practices and repetitions are necessary not only to move new learning into long-term memory for access, recall, and application, but also to develop fluency, automaticity, mastery, and/or proficiency in science. Few instructional materials include enough practice even for general education students, much less for those who have learning difficulties or disabilities. Practice must also be varied and engaging, or students lose interest and motivation. NewPath materials include as much repetition/practice as any student would require, and there is great variety among the activities.

Kandel (2006) explains the difference between explicit memory and implicit memory, both extremely important in mastering science. Explicit memory, he says, “is the conscious recall of people, places, objects, facts, and events.” Explicit memory is generally the memory required for concept development in science. Kandel further explains that “implicit memory often has an automatic quality. It is recalled directly through performance, without any conscious effort or even awareness that we are drawing on memory.” Implicit memory, then, in science is the development of fact fluency. Kandel goes on to explain: “Constant repetition can transform explicit memory into implicit memory.”

Students do not master science through the development of explicit memory of concepts alone, nor through the development of implicit memory of facts and algorithms alone. The combination of the two, with one essential to the development of the other, is a major goal of developing mathematical understanding.

Questions arise about how many repetitions or exposures are required before a student can explain a mathematical concept or automatically recall (with speed and accuracy) a set of mathematical facts. Research indicates that many of us can “own” a word or concept in approximately 15 exposures. Students with learning difficulties or disabilities, however, require many more, sometimes one hundred or more!

How NewPath Can Help

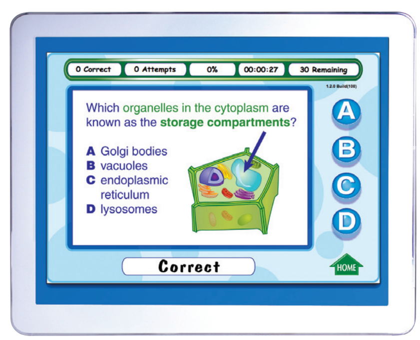
Providing those varied, multiple, and engaging repetitions and opportunities for practice is a major strength of NewPath. The use of NewPath materials frees teachers from the tedium of constructing those hundreds of exposures on every topic, and the incorporation of technology enables them to track student progress on the multiple activities with little effort, again saving hundreds of hours.

There are countless ways in which a student can be exposed to a scientific concept or fact in the five NewPath products. Every single question or problem is aligned by topic and also to the state curriculum standards. For example, in grades 6-8 science, a student is exposed to concepts such as ecosystems, genetics, planetary systems, and alternative energy sources. They also learn more about how to conduct scientific investigations, the meaning of scientific inquiry, how science is important in everyday life, and how to produce graphic displays of data.

Curriculum Mastery Games. All the grades 6-8 topics are addressed, for example, in the Curriculum Mastery Games. Each topic includes 25 questions. As children play the game, they not only are "exposed" to the questions they have to answer to participate in the game, but they also are exposed to all the questions since students read the questions and answer them orally. If the class is working, then, on the concept of "photosynthesis," for example, then playing the game enables each student to have 25 possible exposures to that challenging concept.

Flip Charts. The ten topics covered in the Flip Charts also include "photosynthesis" as one of ten topics. The student exposed to this resource, therefore, sees and hears a review of "photosynthesis" with multiple examples, including multiple problems to solve, words related to the concept to define and illustrate, and then a worksheet. Another 15 or so exposures would be possible in using the Flip Charts.

Visual Learning Guides. The Visual Learning Guides for grades 6-8 also include "photosynthesis" as an example of a targeted concept. Again, the student may possibly be exposed to that concept, with exercises, another ten or more times.



Interactive Whiteboard CD-ROM. This resource includes the 25 questions about "photosynthesis" that the student may have encountered in the Curriculum Mastery Game and in the Flip Charts, Visual Learning Guides, and in interactive flash cards. The teacher may vary the activities in which they are used.

Online Learning. "Photosynthesis" questions, flash cards, activities, worksheets, games, and quizzes add as many other practice/repetition exposures as are needed for any student to achieve mastery. Online Learning includes all the print materials, plus additional resources and tools for teachers, students, and parents.

With the digital resources (Interactive Whiteboard CD-ROM and Online Learning), the teacher has access to all grade levels available in the event a student or a group of students needs practice/repetition of concepts and/or skills taught in earlier grade levels or if a student performing at high levels needs to be able to move forward.

Every teacher needs the whole bundle of NewPath materials to meet all the individual needs of the diverse students in her class. She may also need more than one grade level of materials. Most students will not need every possible practice activity or repetition that is possible. The teacher will want to use some of the materials for some topics, perhaps, and others for other topics. She will, however, need them all for the students who are economically disadvantaged, who are not yet proficient in English, and/or who have learning disabilities.

Having them all enables her to have the multiple and varied activities that are needed to sustain motivation, as well as for what is necessary for mastery.

Having them all also enables her to have one system of materials to use in the classroom, for small groups, for interventions, for tutors to use, for parents to use at home with their children, and for extended learning time. One of the things we know is that when teachers have too many different sets of materials to learn, implementation with fidelity rarely occurs. Teachers do not have the time to learn multiple programs and to use multiple assessment and tracking programs.

For more information on practice/repetition, NewPath recommends the following:

Cotton, K. (2000). *The schooling practices that matter most.* Alexandria, VA: Association for Supervision and Curriculum Development. (See pp. 25-26.)

Herr, N. (2008). *The sourcebook for teaching science: Strategies, activities, and instructional resources, grades 6-12.* San Francisco, CA: Jossey-Bass. (See especially Chapter 11.)

Kandel, E. R. (2006). *In search of memory: The emergence of a new science of mind.* New York City, NY: W. W. Norton and Company.

Marzano, R. J., Norford, J. S., Paynter, D. E., Pickering, D. J., Gaddy, B. B. (2001). *A handbook for classroom instruction that works.* Alexandria, VA: Association for Supervision and Curriculum Development. (See Module 10, pp. 130-142, including rubrics for skills and processes, planning tools, etc.)

Marzano, R. J., Pickering, D. J. & Pollock, J. E. (2001). *Classroom instruction that works: Research-based strategies for increasing student achievement.* Alexandria, VA: Association for Supervision and Curriculum Development.

National Research Council (1999). *How people learn: Brain, mind, experience, and school.* Washington, DC: National Academy Press.

Pashler, H., Bain, P., Bottge, B., Graesser, A., Koedinger, K., McDaniel, M. & Metcalfe, J. (2007). *Organizing instruction and study to improve student learning* (NCER 2007-2004). Washington, DC: National Center for Education Research, Institute of Education Sciences, U. S. Department of Education. (See Recommendation 1, pp. 35-36.)

Sprenger, M. (1999). *Learning and memory: The brain in action.* Alexandria, VA: Association for Supervision and Curriculum Development.

Tileston, D. W. (2000). *10 best teaching practices.* Thousand Oaks, CA: Corwin Press. (See Chapter 4.)

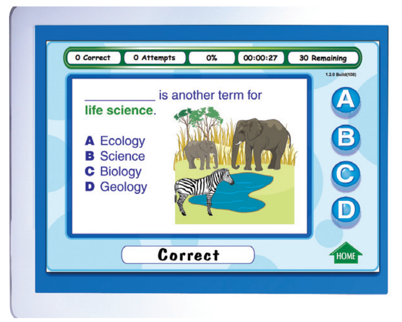
Corrective Feedback

Practice makes perfect—IF the practice is perfect. Students who repeatedly practice the wrong definition of the concept of gravity will have a very difficult time in unlearning and then relearning the concept. According to Marzano, Norford, Paynter, Pickering, and Gaddy (2001), "providing feedback is the most important thing that a classroom teacher can do to enhance student achievement." Hattie (2009) draws a similar conclusion: "feedback is among the most powerful influences on achievement. Most programs and methods that worked best were based on heavy dollops of feedback."

How NewPath Can Help

Immediate corrective feedback is built into each of NewPath's products.

- Students receive immediate feedback when they answer questions in the **Curriculum Mastery Games**. The back of each question card provides the correct answer. If the student answered correctly, he/she self-congratulates and receives the cheers of his/her peers. If the answer was incorrect, seeing the correct answer immediately provides immediate corrective feedback.
- Students as individuals or in small groups receive immediate corrective feedback from the teacher as they respond to the questions and problems on the **Flip Charts**. If the black-line copy-masters are used for further practice, then the teacher provides feedback when she checks the work and returns it to the student.
- Individual students will receive immediate corrective feedback if using the **Visual Learning Guide** with a teacher, peer, tutor, or parent. If working independently, the student will receive feedback when the activities are completed and checked for accuracy.
- Students using the **Interactive Whiteboard CD-ROM** will receive immediate corrective feedback from the computer as they work through activities. In addition, a printout provides the student and teacher with time on task, number of attempts, percent answered correctly, and number of questions remaining. Students receive immediate feedback on the **Interactive Whiteboard Life Science** assessment, whether used as continuous progress monitoring or summative measurement.



- All of the activities available on **Online Learning** provide immediate corrective feedback as the student works through them. In addition, the online classroom manager provides a printout with further information.

For more information on corrective feedback, NewPath recommends the following:

Brookhart, S. M. (2008). *How to give effective feedback to your students*. Alexandria, VA: Association for Supervision and Curriculum Development.

Cotton, K. (2000). *The schooling practices that matter most*. Alexandria, VA: Association for Supervision and Curriculum Development. (See 24-25.)

Hattie, J. (2009). *Visible learning: A synthesis of over 800 meta-analyses relating to achievement*. New York City, NY: Routledge. (See pp. 173-178)

Marzano, R. J., Norford, J. S., Paynter, D. E., Pickering, D. J., Gaddy, B. B. (2001). *A handbook for classroom instruction that works.* Alexandria, VA: Association for Supervision and Curriculum Development. (See Module 14, pp. 185-196, including recommendations for classroom practice, sample rubrics, self-assessment guidelines, planning tools, etc.)

Marzano, R. J., Pickering, D. J., & Pollock, J. E. (2001). *Classroom instruction that works: Research-based strategies for increasing student achievement.* Alexandria, VA: Association for Supervision and Curriculum Development.

Worked Examples

Research on the effective teaching of mathematics and science indicates that using worked examples of problems is a very effective teaching strategy, up to the point where the goal is fluency development (Renkl & Atkinson, 2007). Worked examples, according to Hattie (2009) "typically consist of a problem statement and the appropriate steps to the solution." It is an effort to show students, he says, what success looks like. Research also indicates that students learn more if teachers alternate between worked examples and asking students to solve similar problems on their own than they do when just given problems to solve on their own (Pashler, Bain, Bottge, et al, 2007). Again, worked-out examples are important only in the initial stage of learning a concept. Renkl & Atkinson (2007) explain: "Although studying examples plays an important role in initial skill acquisition, empirical evidence indicates that problem-solving is superior to studying examples in later phases." Most elementary students would be in that initial stage of problem-solving, whether in a mathematics or science class, but many, if not most, middle school students should be at the stage where they can move forward.

The concept of "worked examples" might include working through the steps of a scientific investigation in a science class, rather than working through the steps of an algorithm in mathematics. Mangan (2007) points out that "The methods that scientists use to actually do science are as important as the actual science content." She quotes from a NSTA publication, *Pathways to the Science Standards* (Lowery, 1997), in delineating the science processes that students should master by eighth grade:

- Ask questions that can be answered by scientific investigations.
- Design and conduct a scientific investigation.
- Use appropriate tools and techniques to gather, analyze, and interpret data.
- Develop descriptions, explanations, predictions, and models based on evidence.
- Think critically and logically to discover the relationship between evidence and explanations.

How NewPath Can Help

NewPath's **Flip Charts, Bulletin Board Charts, Curriculum Mastery Posters**, and **Visual Learning Guides** provide on the first page graphics, words, and scientific notation to illustrate the steps to solving a problem. Teachers can review these steps with students, turn the page over, and give to them a similar problem to solve on their own. If they cannot and need more help, the teacher can again turn the page over and review the problem-solving steps. The accompanying Activity Guide provides black-line masters for students to be walked through the steps outlined on the Flip Chart and then to solve problems on their own.

The **Visual Learning Guides** can be used similarly. Students can study the steps to the problem solution on page one, be walked through the steps of solving the problem on page 2, and then work independently on pages 3-4.

Using the **Interactive Whiteboard CD-ROM** and/or **Online Learning**, teachers can organize lesson plans with alternating worked examples and problems for students to solve or investigations to conduct. The **Interactive Whiteboard Life Science** application includes a virtual lab investigation, along with a Lab Activity Guide.

For more information on worked examples, NewPath recommends the following:

Hattie, J. (2009). *Visible learning: A synthesis of over 800 meta-analyses relating to achievement*. New York City, NY: Routledge. (See pp. 172-173.)

Pashler, H., Bain, P., Bottge, B., Graesser, A., Koedinger, K., McDaniel, M. & Metcalfe, J. (2007). *Organizing instruction and study to improve student learning* (NCER 2007-2004). Washington, DC: National Center for Education Research, Institute of Education Sciences, U. S. Department of Education. (See Recommendation 2, pp. 36-37.)

Renkl, A. & Atkinson, R. K. (2007). An example order for cognitive skill acquisition. In F. E. Ritter, J. Nerb, E. Lehtinen, & T. M. O'Shea (Eds.), *In order to learn: How the sequence of topics influences learning* (pp. 95-105). New York City, NY: Oxford University Press.

Reading, Writing, and Communicating Science

The National Research Council has included in its standards for teaching science the importance of students learning to communicate their learning—and it has recognized that reading and writing strategies can help students learn science.

The proposed new standards to be released by 2013 also include an emphasis on communicating science. For example, Dimension 1: Scientific and Engineering Practices, includes the following competencies that require high levels of literacy:

- Asking questions and defining problems
- Constructing explanations
- Engaging in argument from evidence
- Obtaining, evaluating, and communicating information

One of the best resources on developing student vocabulary, science reading skills, and science writing skills in Herr's (2008) book, *The Sourcebook for Teaching Science: Strategies, Activities, and Instructional Resources, Grades 6-12*. Chapter I, "Building a Scientific Vocabulary," is a treasure chest for teachers. It includes sections on biology, chemistry, physics, and earth/space science. There are pages and pages of lists of scientific prefixes and suffixes, roots and their meanings, and names (with meanings) of the elements, for example. Spending significant amounts of time on vocabulary development is not only critical for struggling learners, but it is important to the success of all students, especially since science has a multitude of new words and terms each year for students to learn. Learning vocabulary is, of course, closely related to understanding concepts. Research tells us, as well, that students with weak scientific vocabularies have great difficulty in reading their textbooks and other materials about scientific topics.

It is important to know that students need to encounter a new word or term around 15 times before they "own" it (see section on Practice/Repetition). Some words are acquired through reading or hearing them used in others' speech. Others are taught explicitly, as teachers do in each subject area. In order for students truly to know a word, they must know it in at least six ways, and each of these pieces of information is stored in a separate area of the brain. When a word is recalled, then, all six areas of the brain are activated, making recall quicker or richer. Cognitive psychologists call it "depth of encoding." (See related information in section on "multi-sensory processing strategies.")

Students must learn how to (1) decode a word, (2) to spell it, (3) to pronounce it, (4) to associate it with a graphic or concrete image or perhaps an experience or emotion, (5) to define it, and (6) to use it in context.

Willis, a neuroscientist AND a middle school teacher, explains:

> The more ways that something is learned, the more memory pathways are built. This brain research discovery is part of the reason for the current notion that stimulating the growth of more dendrites and synaptic connections is one of the best things teachers can do for the brains of their students.

Then she continues, as follows:

> The more regions of the brain that store data about a subject, the more interconnection there is. This redundancy means students will have more opportunities to pull up all those related bits of data from their multiple storage areas in response to a single cue. This cross-referencing of data strengthens the data into something we've learned rather than just memorized.

How NewPath Can Help

One of the strengths of NewPath materials is the emphasis on development of Academic English, important not only to English Language Learners (ELLs), but also to students who are economically disadvantaged and students with learning disabilities. Marzano (1998) notes, based on scores of scientific studies, that "At a practical level, it is fairly obvious that students must understand a certain amount of the basic vocabulary in a subject area before they can understand facts, generalizations, and concepts within a content area."

Some of the ways in which NewPath uses English language arts strategies in its activities follow:

- NewPath is consistent in its use of scientific terms across all its products.
- The materials reflect the terms most consistently used in science standards so that students are not confused.
- The Interactive Whiteboard Life Science modules all include a feature on vocabulary development.
- Many of the questions used in the Curriculum Mastery Games, the Interactive Whiteboard CD-ROMs, and Online Learning are asking students either to define a word or phrase or to reflect an understanding of a definition in their responses.
- Concept development, review, re-teaching, and practice activities in the Flip Charts introduce, reinforce, and provide additional exposures to critical scientific vocabulary or concepts.
- The Visual Learning Guides all include a page where students are asked to write definitions of key words or terms and to draw illustrations of them.
- The variety of practice/repetition activities in NewPath materials enables students to master critical scientific vocabulary.
- Teachers may require students to answer the questions posed in the Curriculum Mastery Games in complete sentences to reinforce their communication of science and to help them to understand and remember.
- Teachers may occasionally require students to draw or write about the strategies they have used in solving a scientific problem.
- Students can be asked to write e-mails to their parents explaining what they are learning or to make brief explanations to their parents at an open house or parent conference.
- Individual students can be assigned to write a lesson summary for a student who was absent.
- Students can be asked to keep science learning logs (journals or blogs) as places for them to reflect on their learning, to draw illustrations, to organize, and to keep track of their own progress, as well as to think deeply about the concepts that they are learning.

One of the reasons that NewPath has developed multiple products using the same science topics is that the variety of the products assists and supports teachers in their commitment to development science vocabulary among their students. There are opportunities for adequate exposure to critical words and terms so that mastery is possible.

For more information on reading, writing, and communicating science, NewPath recommends the following:

Ainsworth, L. (2010). *Rigorous curriculum design: How to create curricular units of study that align standards, instruction, and assessment.* Englewood, CO: Lead+Learn Press.

Herr, N. (2008). *The sourcebook for teaching science: Strategies, activities, and instructional resources, grades 6-12.* San Francisco, CA: Jossey-Bass. (See Chapter I on "Building a Scientific Vocabulary." Chapter II includes very helpful information on "Developing Science Reading Skills." See Chapter III on "Developing Science Writing Skills.")

Marzano, R. J. (2004). *Building background knowledge for academic achievement.* Alexandria, VA: Association for Supervision and Curriculum Development.

Marzano, R. J. & Pickering, D. J. 2005). *Building academic vocabulary: Teacher's manual.* Alexandria, VA: Association for Supervision and Curriculum Development.

National Research Council (2011). *A framework for K-12 science education: Practices, crosscutting concepts, and core ideas.* Washington, DC: National Academies Press.

Wheeler-Toppen (2011). *Science the "write" way.* Arlington, VA: National Science Teachers Association.

Willis, J. (2006). *Research-based strategies to ignite student learning.* Alexandria, VA: Association for Supervision and Curriculum Development.

Individualized Learning

Given the diversity in today's classrooms, and it continues to grow, teachers must find ways to do more and more differentiation/individualization/ personalization/customization in delivering the curriculum. Rose and Meyer state that "Universal Design for Learning provides a framework for individualizing learning in a standards-based environment through flexible pedagogy and tools. It challenges teachers to incorporate flexibility into instructional methods and materials as a way to accommodate every student in the classroom." The goal is for each student to be taught in his or her "zone of proximal development" (Dixon-Krauss, 1996).

How NewPath Can Help

The good news is that technology makes individualization more and more possible. For example, after a concept is initially taught by the teacher, all the necessary reinforcement, review, repetition, and practice can be totally individualized. Any given student can be assigned appropriate worksheets, flash cards, activities, games, and quizzes from Online Learning to provide adequate and varied practice until mastery is attained. A peer, tutor, intervention teacher, parent, or the classroom teacher can assist as needed.

When several students have the same needs or some of the same needs, small groups can be assembled, and the teacher can use the Curriculum Mastery Games, Flip Charts, Visual Learning Guides, AND the technological resources (Interaction Whiteboard CD-ROM and Online Learning) to design individual/small group learning plans.

For more information on individualization, NewPath recommends the following:

Dixon-Krauss, L. (1996). *Vygotsky in the classroom.* White Plains, NY: Longman Publishers.

Rose, D. H. & Meyer, A. (2002). *Teaching every student in the digital age: Universal design for learning.* Alexandria, VA: Association for Supervision and Curriculum Development.

Tomlinson, C. A. (2001). *How to differentiate instruction in mixed-ability classrooms (2nd ed.).* Alexandria, VA: Association for Supervision and Curriculum Development.

Cooperative Learning

One of the strategies that is motivational for students is cooperative learning. There is almost universal agreement, says Hattie (2009), that cooperative learning is effective, especially when compared to competitive and individualistic learning. Among the reasons for its effectiveness are the promotion of achievement, positive interpersonal relationships, social support, and self-esteem.

How NewPath Can Help

Teachers who wish to incorporate cooperative learning strategies in their use of the NewPath materials will find them very compatible.

- Students playing the **Curriculum Mastery Games** use cooperative learning in working through the game. They must cooperate, take turns, clarify the rules, keep track of progress, be respectful of others in the group, reinforce each other, and even tutor each other. They also must be cooperative in keeping the game box organized and in storing it after use.
- Use of cooperative learning strategies can also facilitate the use of the **Flip Charts** and related activities, especially if they are used with small groups.
- The **Visual Learning Guides** may be used individually or in, perhaps, pairs, for a cooperative learning activity. Children can work collaboratively to discuss the necessary strategies and steps to solve the problem and then to solve the problems. They can also tutor and quiz each other.
- Children may also work in pairs or in very small groups in their use of the activities included in the **Interactive Whiteboard CD-ROM**.
- Children may be allowed to work in pairs or in very small groups in their engagement of the activities in **Online Learning**.
- Cooperative learning teams could be asked to design a game or other learning activities to help students learn a concept, using the materials available in Online Learning or in the Interactive Whiteboard CD-ROM.

For more information on cooperative learning, NewPath recommends the following:

Cotton, K. (2000). *The schooling practices that matter most*. Alexandria, VA: Association for Supervision and Curriculum Development. (See pp. 13-17.)

Glasser, W. (1990). *The quality school: Managing students without coercion*. New York City, NY: Harper and Row.

Hattie, J. (2009). *Visible learning: A synthesis of over 800 meta-analyses relating to achievement*. New York City, NY: Routledge. (See pp. 212-214.)

Mangan, M. A. (2007). *Brain-compatible science (2nd ed.)*. Thousand Oaks, CA: Corwin Press.

Marzano, R. J. (2007). *The art and science of teaching: A comprehensive framework for effective teaching*. Alexandria, VA: Association for Supervision and Curriculum Development. (See p. 82.)

Marzano, R. J., Norford, J. S., Paynter, D. E., Pickering, D. J., Gaddy, B. B. (2001). *A handbook for classroom instruction that works*. Alexandria, VA: Association for Supervision and Curriculum Development. (See Module 12, pp. 161- 174, including rubrics, planning templates, and student self-assessment form.)

Instructional Technology

Universal Design for Learning (UDL) is a set of principles that has had an enormous impact on the design of instructional materials of all kinds, including instructional technology. Its purpose is to design both lesson presentations and instructional materials flexibly so that they accommodate all the different ways that students learn—to make content more accessible. The original concept came from special education, but educators in general now see the advantages of such materials with all kinds of students. The three principles are as follows:

- Provide multiple, flexible methods of presentation that give students various ways to acquire information.
- Provide multiple, flexible methods of expression that offer students alternatives for demonstrating what they know.
- Provide multiple, flexible options for engagement to help students get interested, be challenged, and stay motivated. (Rose and Meyer, 2002)

Several researchers (Hattie, 2009; Christensen, Horn, & Johnson, 2008; Center for Policy Studies and Hamline University, Feb. 2008; and Dede, June 2010) finding positive effects for the use of technology in instruction also see technology as having the potential to transform instruction so that it is not only more effective, but also so that learning is extended beyond school. Studies show that technology can:

- make true individualization possible;
- facilitate acceleration of learning;
- change the role of teachers to learning coaches;
- make rich diagnostic assessments accessible; and
- be a source for innovations needed to create 21^{st} century schools.

Several important research studies' findings are important in understanding the potential effectiveness of using NewPath's Interactive Whiteboard CD-ROMs and Online Learning products with all types of learners:

- A 2000 study found significant gains in achievement across the curriculum when students from preschool through high school were taught in a technology-rich environment. (North Central Regional Educational Laboratory, 2005).
- Using computers to solve simulations significantly improved math scores. (North Central Regional Educational Laboratory, 2005).
- Computer technology is a powerful tool for teaching limited-English-proficient students. (North Central Regional Educational Laboratory, 2005)
- Teachers' use of data in making instructional decisions improves student learning. Technology plays a vital role in enabling data-driven decision-making. (North Central Regional Educational Laboratory, 2005)
- "Blended instruction," a combination of face-to-face and online instruction produces greater learning than face-to-face only or online only. (Means, Toyama, Murphy, Bakia, & Jones, 2009)
- More time-on-task in online courses produces the most positive outcomes. (Means, Toyama, Murphy, Bakia, & Jones, 2009)
- Teachers who are effective in improving the achievement of disadvantaged children tend to use technology to target instruction more effectively; to incorporate a variety of strategies; to support teacher-guided instruction; to increase student involvement in instruction; to facilitate remediation and reinforcement; to promote advanced thinking strategies; to increase access to resources; to motivate students; and to meet the needs of the whole child. (Edmunds, 2008)

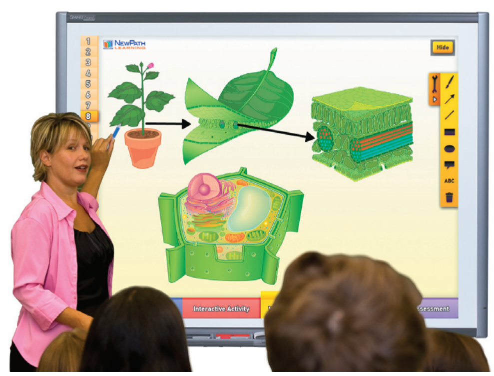
In 2008, Clayton Christensen, with colleagues Michael Horn and Curtis Johnson, wrote an important book: *Disrupting Class: How Disruptive Innovation Will Change the Way the World Learns*. He has subsequently been hailed as a visionary in the ways in which technology could be used to personalize or customize learning for all students. Many of the national education professional organizations immediately asked him to keynote their next annual conference. The following paragraph from that book predicting the future actually described exactly the mission of NewPath, and its materials and software were already in use in America's schools. No one needs to wait for the future.

> *The tools of the software platform will make it so simple to develop online learning products that students will be able to develop products that help them teach each other. Parents will be able to assemble tools to tutor their children. And teachers will be able to create tools to help the different types of learners in their classrooms. These instructional tools will look more like tutorial products than courseware. But rather than being "pushed" into classrooms through a centralized selection process, they will be pulled into use through self-diagnosis—by teachers, parents, and students.*

How NewPath Can Help

It is important to note that NewPath anticipated the research on the effectiveness of "blended" instruction. Horn and Stacker (2011) conclude in their study that "homeschooling and full-time virtual schooling will not substitute for mainstream schooling, as their rapid growth flattens out at around 10 percent of the K-12 schooling population."

Teachers can create lessons that blend their own presentations, textbook information, manipulatives, NewPath's print materials, and NewPath's digital components. NewPath's Interactive Whiteboard CD-ROM and Online Learning include not only digital reproductions of all the print materials, but also tools to create an infinity of lesson plans, worksheets, games, activities, and quizzes for individuals, small group or whole-class uses. They also include tools for recording and reporting student progress, saving teachers enormous numbers of hours. In addition, they enable the teacher to communicate with parents and for parents to access the lesson plans, activities, and results of their child's assessments.



NewPath also understood another research finding: that technology, including classroom projection/interactive whiteboard technology, can be extremely useful in supporting students' needs for visualization and modeling (Brann, Gray, Piety, & Silver-Pacuilla, 2010). The research report notes that technology can describe "processes that occur at speeds and scales that are not easily observable by the naked eye." Also, static figures—illustrations, diagrams, images—displayed on an interactive whiteboard or computer screen "provide opportunities to see relationships in ways that language alone cannot express." In NewPath's print materials and in their digital resources, a major objective is to provide visuals and models so that students have access to that powerful support for learning.

For more information on instructional technology, NewPath recommends the following:

Brann, A., Gray, T., Piety, P. J., & Silver-Pacuilla, H. (2010). *Using technology to support struggling students in science*. Center for Implementing Technology in Education. Go to **http://www.cited.org**

Christensen, C. M., Horn, M. B., & Johnson, C. W. (2008). *Disrupting class: How disruptive innovation will change the way the world learns*. New York City, NY: McGraw Hill.

Hattie, J. (2009). *Visible learning: A synthesis of over 800 meta-analyses relating to achievement*. New York City, NY: Routledge. (See pp. 222-225, 227-229, 239-231, 234-236.)

Herr, N. (2008). *The sourcebook for teaching science: Strategies, activities, and instructional resources, grades 6-12*. San Francisco, CA: Jossey-Bass. (See especially Chapter IV.)

Horn, M. B. & Staker, H. (2011, January). *The rise of K-12 blended learning*. Mountain View, CA: Innosight Institute.

Means, B., Toyama, Y., Murphy, R., Bakia, M., & Jones, K. (2009). *Evaluation of evidence-based practices in online learning: A meta-analysis and review of online learning studies*. Washington, DC: United States Department of Education.

North Central Regional Educational Laboratory (NCREL) (2005). *Critical issue: Using technology to improve student achievement.*

NSTA (1999). *NSTA position statement: The use of computers in science education.* Arlington, VA: NSTA.

Rose, D. H. & Meyer, A. (2002). *Teaching every student in the digital age: Universal design for learning*. Alexandria, VA: Association for Supervision and Curriculum Development.

Student Motivation and Games

Csikszentmihalyi (1991), one of the foremost authorities on motivation, says that we all want more of what he calls "flow," or "the optimal experience" that is the result of a series of conditions:

> *When people reflect on how it feels when their experience is most positive, they mention at least one, and often all of the following: First, the experience usually occurs when we confront tasks that we have a chance of completing. Second, we must be able to concentrate on what we are doing. Third and fourth, the concentration is usually possible because the task undertaken has clear goals and provides immediate feedback. Fifth, one acts with a deep but effortless involvement that removes from awareness the worries and frustrations of everyday life. Sixth, enjoyable experiences allow people to exercise a sense of control over their actions. Seventh, concern for the self disappears, yet paradoxically the sense of self emerges stronger after the flow experience is over. Finally, the sense of the duration of time is altered; hours pass by in minutes, and minutes can stretch out to seem like hours. The combination of all these elements causes a deep enjoyment that is so rewarding people feel that expending a great deal of energy is worthwhile simply to be able to feel it.*

He adds, then, that if schools wish to increase learning, they need to create more flow-like experiences for students.

Herr (2008) includes an entire chapter on the value of games in science classes in his *Sourcebook for Teaching Science: Strategies, Activities, and Instructional Resources*. Some of his advice follows:

> *Classroom games provide an active alternative to traditional review sessions, which are often passive, teacher-centered events that require minimal student involvement. Reviews that simply tell students what will be on the exam present information in a repetitive manner, or require little student involvement are largely ineffective and should be replaced by activities centering on students and requiring their participation. Active learning events such as classroom games are more effective in promoting student learning than teacher-centered review sessions. Students are likely to study in preparation for the game and again for the test, particularly if the game has highlighted their areas of weakness.*

Herr recommends forming teams, allowing them to stay together over time, organizing occasional tournaments, and keeping track of win-loss records. These activities build camaraderie, promote accountability, encourage enthusiasm, develop healthy peer pressure, and generally motivate student learning, he says (p. 244). His book provides numerous examples of science games, many of which could be created using the NewPath materials or adjusting some of the rules of the Curriculum Mastery Games. For example, he says Jeopardy is a good game to use since it requires students to ask questions in response to answers, so it "assesses comprehension in addition to knowledge."

How NewPath Can Help

NewPath's game-based learning is one of the ways to provide flow experiences at school. Gredler (2004) has several publications relating to the research on using games and their relationships to learning. She notes that "Educational games and simulations are experiential exercises that transport learners to another world" where they can apply "their knowledge, skills, and strategies." The use of games in learning dates back to the 1600's, she says, when war games were invented. The agreed-upon definition of games by many researchers follows:

> *"Briefly, games are competitive exercises in which the objective is to win and players must apply subject matter or other relevant knowledge in an effort to advance in the exercise and win."*

"Academic games," states Gredler, "may fulfill any of four purposes: (a) to practice and/or refine already-acquired knowledge and skills, (b) to identify gaps and weaknesses in knowledge or skills, (c) to serve as a summation or review, and (d) to develop new relationships among concepts and principles." She adds that games may also be used as "a reward for students for working hard or as a change of pace in the classroom."

Her research synthesis also includes design criteria for games. "Well-designed games are challenging and interesting for the players while, at the same time, requiring the application of particular knowledge or skills." She further concludes that "Advantages of games in the classroom are that they can increase student interest and provide opportunities to apply learning in a new context." Garris, Ahlers and Driskell (2002) concur in their research synthesis:

> In a review of research on educational games, Randel, Morris, Wetzel, and Whitehill (1992) concluded that games are consistently perceived as more interesting than traditional instruction. For example, Cohel (1969) found that 87% of students tested reported greater interest for educational games than for classroom approaches. Perfy (1977) found that seven of eight studies that measured student interest reported greater interest from game use than conventional instruction.

It is clear that NewPath's games enable a "flow" experience:

- The Curriculum Mastery Games (and their simulations in the Interactive Whiteboard CD-ROMs and Online Learning) can be completed in a reasonable amount of time.
- Students are sufficiently engaged to be able to concentrate on what they are doing.
- The purpose of the game is to master the standards-based content, and that goal is clear to the students.
- The student learns immediately whether he or she has accurately recalled the needed information, so feedback is immediate and corrective.
- Participation in the games is fun and different from most other classroom activities and assessments, so the student forgets the frustrations that may be his or her usual experiences.
- Students enjoy the games and feel a sense of control.
- The student does not have to focus on self, but his or her growing sense of mastery contributes to an overall sense of satisfaction and pleasure once the activity is completed.
- Time undoubtedly passes faster for students participating in a game in contrast to how they may feel about usual classroom activities.

The games also fulfill all four of the research-based purposes for academic games: practice, screening, review/assessment, and develop understandings.

Other NewPath activities for students also can result in “flow” experiences, for they too can be completed, allow for concentration, have clear goals, provide feedback, allow effortless involvement, provide for a sense of control, permit self to disappear, and alter the sense of time. The attractiveness of the materials, their ability to hold students’ attention, their logical presentation of information, the provision of adequate and varied practice so that success is attained, and the feedback that is available all contribute to an environment that makes learning possible.

For more information on motivation, NewPath recommends the following:

Csikszentmihalyi, M. (1991). *Flow: The psychology of optimal experience. Steps toward enhancing the quality of life*. New York City, NY: Harper and Row.

Garris, R., Ahlers, R, & Driskell, J. E. (2002). Games, motivation, and learning: A research and practice model *Simulation Gaming*, 33:441.

Glasser, W. (1990). *The quality school: Managing students without coercion*. New York City, NY: Harper and Row.

Gredler, M. E. (2004). Games and simulations and their relationships to learning. In *Handbook of research on educational communications* (pp 571-581). ACET.

Hattie, J. (2009). *Visible learning: A synthesis of over 800 meta-analyses relating to achievement*. New York City, NY: Routledge. (See pp. 47-49 on motivation and pp. 230-231 on simulations/gaming.)

Herr, N. (2008). *The sourcebook for teaching science: Strategies, activities, and instructional resources*. San Francisco, CA: Jossey-Bass. (See especially Chapter 13, “Games for Learning Science.”)

Avoiding De-Motivation

Neuroscience has found that negative learning environments that make students feel isolated, humiliated, stressed, angry, anxious, and/or afraid actually block students’ ability to learn. Judy Willis (2006) explains: “When the amygdala is in this state of stress, fear, or anxiety-induced over-activation, new information coming through the sensory intake areas of the brain cannot pass through the amygdala to gain access to the memory circuits.” Conversely, when the environment is positive with feelings of contentment, joy, play, and a comfortable, but stimulating, amount of challenge, children learn more. Willis says they show better working memory, improved verbal fluency, better episodic memory, more flexible thinking, and are more creative at solving problems.

The barrier to learning that occurs in stressful situations is sometimes referred to as the “affective filter.” Willis says that this affective filter is “an emotional state of stress in students during which they are not responsive to processing, learning, and storing new information.” She continues to explain that “during periods of high stress, new learning just doesn’t get in to the information processing centers of the brain.”

Mangan (2007) makes the following suggestions:

> A necessary component of the emotional backdrop for successful learning is a classroom climate where students feel safe when motivated and involved. Before students can be receptive to learning, they must feel welcome, comfortable, and accepted by their teacher and peers. Teachers must treat their students with understanding and respect, encouraging them to trust in themselves, think for themselves, come to their own conclusions, and make their own discoveries. Encourage laughter. Smile frequently. Let the students know that they are loved, appreciated, and valued.

NSTA's position paper on elementary school science takes this research seriously. One of their planks is that "The learning environment for elementary science must foster positive attitudes toward self and society, as well as science."

How NewPath Can Help

NewPath's materials can contribute to a positive learning environment in many ways:

- The materials present adequate challenge, yet are not so difficult for students that they become frustrated and anxious.
- Games are fun and, therefore, make the classroom more comfortable.
- Students can be assigned activities and problems in their zone of proximal development so that success is almost guaranteed.
- Materials are engaging and, therefore, hold students' attention, making learning more enjoyable.
- Immediate corrective feedback lets students know how they are doing, decreasing anxiety.
- Students can self-evaluate whenever they want.
- The materials free up teacher time from having to create lessons, search for or create learning activities, construct assessments, evaluate assessments, and keep track of student progress. They have more time, then, to concentrate on motivating and supporting students in a more positive classroom.
- NewPath's games support cooperation, collaboration, and positive social relationships in the classroom.

For more information on de-motivation, NewPath recommends the following:

Cotton, K. (2000). *The schooling practices that matter most.* Alexandria, VA: Association for Supervision and Curriculum Development.

Hattie (2009). *Visible learning: A synthesis of over 800 meta-analyses relating to achievement.* New York City, NY: Rutledge. (See pp. 48-49.)

Mangan, M. A. (2007). *Brain-compatible science (2nd ed.).* Thousand Oaks, CA: Corwin Press.

Mercer, C. D. & Mercer, A. R. (2005). *Teaching students with learning problems* (7th ed.). Upper Saddle River, NJ: Pearson. (See especially Chapter 1, "Creating Responsive Learning Environments" and Chapter 5, "Promoting Social, Emotional, and Behavioral Development.")

NSTA (2002). *Official position: Elementary school science.* Arlington, VA: NSTA.

Willis, J. (2006). *Research-based strategies to ignite student learning: Insights from a neurologist and classroom teacher.* Alexandria, VA: Association for Supervision and Curriculum Development.

Wolf, P. (2001). *Brain matters: Translating research into classroom practice.* Alexandria, VA: Association for Supervision and Curriculum Development.

Chapter V. Meeting Needs of Special Populations

Interventions

The typical elementary school includes in its programming several different kinds of interventions to meet the needs of special populations, most of whom are economically disadvantaged, are not yet proficient in English, and/or have learning disabilities ranging from mild to severe. Familiar programs, then, include Title I, ESL, and Special Education. Additionally, schools may provide tutoring before and/or after school, Saturday sessions, summer school, or other extended-time opportunities to learn.

With the latest reauthorization of the Individuals with Disabilities Education Act (IDEA) came another initiative to support special-needs students, Response-to-Intervention (RTI). Schools are now required to identify at the first possible opportunity any student who is falling behind his or her peers in learning, to diagnose the problem, and to provide an appropriate intervention. Many educators are now coming to see that RTI serves as a kind of umbrella for all its intervention programs since it is neither appropriate nor possible to do both.

RTI requires schools to provide a standards-based, high quality curriculum for all students at all grade levels and in all subject areas, but especially in reading/language arts and mathematics. Such a program should be successful with approximately 80 percent of the students. The remaining 20 percent, then, are provided interventions in tiers, depending on their needs. Assessments diagnose intervention needs, measure progress, determine whether a student has responded positively and adequately to the assigned intervention, and inform decisions about whether a student returns to the regular classroom, stays in a tier for an extended period of time, or is assigned to the next level for more intense intervention.

Tier I is the regular classroom. Teachers, of course, continually provide interventions as a part of their regular instruction. They re-teach individuals, small groups, or even the whole class, as necessary. They pull individuals or small groups of students aside for tutoring, practice, review, or re-teaching with a different approach. They make special assignments for some students to do at school and/or at home—usually more practice. They ask peers to help tutor. If these efforts are not successful in bringing a student on par with his or her peers, then data from continuous progress monitoring are examined by a teacher committee, and the student is likely to be assigned to a Tier II intervention.

In Tier II a small group of students with similar needs is provided an additional 30 minutes of intervention instruction daily (above the time allotted for general instruction) for a period of several weeks. Research-based alternative strategies and materials are used—or the time is spent in varied practice activities since many children need repeated exposures to new information before they own it. Continuous progress monitoring is done to measure each student's response to the intervention and to determine if it is positive and adequate so that he or she can return to the regular classroom. At the end of the assigned intervention period, the teacher committee either returns the student to the regular classroom schedule, maintains him or her in the Tier II intervention for additional weeks, or assigns him or her to Tier III for personalized and more intense intervention.

No more than about six percent of a school's population should ever need Tier III interventions, according to the RTI experts. These are the children who most likely have some degree of learning disability, and those not successful in Tier III are then referred to special education.

Tier III is personalized, one-on-one, and the additional time provided each day is 60 minutes—above the regular classroom instruction.

Since students needing Tier II interventions are almost certainly to be those formerly being served in Title I, ESL, and/or Special Education programs, schools are restructuring those older programs and folding them in to the RTI structure.

How NewPath Can Help

A resource for Tiers I-II (and perhaps III) is NewPath's Centering the Elementary Classroom (Teacher Resource Notebook) by Lynn Gatto. This comprehensive, step-by-step workbook is designed to teach and inspire K-8 teachers to develop engaging and effective learning centers. The workbook translates theory into practice and provides methods that are research-based and classroom-tested. Study Group Editions of the Curriculum Mastery Games, designed for learning centers or individual use, are also now available.

All NewPath materials may be used in multiple ways for multiple purposes in a school with or without an RTI implementation since the same children with the same needs exist in a school, regardless of the programs to which they are assigned. It is also important to remember that even though research has identified some predictable needs of economically disadvantaged children, ELLs, and children with disabilities, these groups are not homogeneous, and wide variations in motivation, background, culture, and academic performance exist. The following recommendations for each of the three groups are provided with caution that they will undoubtedly be inappropriate for at least some members of each group. Teacher judgment prevails.

Economically Disadvantaged Students. Students growing up in poverty have several difficulties to overcome in learning science and mathematics. Culturally, science and mathematics are not highly valued among many economically disadvantaged families (and even middle and upper-class families). Children may not ever see measurement devices. Their families may lack rulers, tapelines, yardsticks, scales, measurement cups and spoons, clocks, calculators, and/or thermometers. They may not have recipe books or talk about kitchen chemistry, for example. Inner-city children may rarely have the experience of seeing diverse plants and animals or have the opportunity to go to a science museum or a planetarium. Limited diets may mean that they do not know the names of fruits and vegetables and their health benefits. They may rarely hear scientific words used at home or in the media to which they are exposed. They may not ever be engaged in political conversations having to do with science: evolution debates; the search for "green" fuel sources; water shortages; emission standards; effects of drought; nuclear power plants; reproductive issues; funding for space exploration; weather patterns; technological innovations; causes of cancer and other diseases; and on and on. They may not personally know anyone who is a scientist.

It is important to remember that just because economically disadvantaged children come to school without prerequisite knowledge to learn science does not mean that they cannot learn science. Important instructional strategies for economically disadvantaged children are as follows:

- Provide opportunities to learn by extending instructional time and embedding scientific understandings throughout the day's activities. [See prior discussion on "time-on-task" for ways to extend learning time and for references for more information.]
- Use of multi-sensory (sometimes referred to as nonlinguistic) encoding and use of visuals to illustrate meaning. [See prior discussion of "Multisensory Processing Strategies" for how NewPath materials can be used and for references for more information.]
- Emphasis on concepts, consistently using academic vocabulary for mathematical and scientific terms. [See prior discussion of "Reading, Writing, and Communicating Science" for how NewPath materials can be used and for references for more information.]
- Explicit teaching (direct instruction) of prerequisite knowledge and skills. [Concepts may be taught explicitly when using NewPath's Flip Charts, Visual Learning Guides, and Online Learning.]

- Adequate and varied practice to develop mastery and to develop fluency/automaticity. [Adequate and varied practice is a major strength of all the NewPath materials. See prior discussion on "Practice/Repetition" for how NewPath materials can be used and for references for more information.]
- Use of graphic organizers, diagrams, or maps. [NewPath's Flip Charts and Visual Learning Guides will be important.]
- For students who are significantly behind their peers, the resources on the Interactive CD-ROM and Online Learning enable the teacher to create and assign appropriate lower-level activities for the student.

For more information on research-based instructional strategies for students who come from economically-disadvantaged homes, NewPath recommends the following:

Ferguson, R. F. (1998). Can schools narrow the black-white test score gap? In C. Jencks & M. Phillips (Eds.). *The black-white test score gap* (pp. 318-374). Washington, DC: Brookings Institution Press.

Jensen, E. (2009). *Teaching with poverty in mind: What being poor does to kids' brains and what schools can do about it.* Alexandria, VA: Association for Supervision and Curriculum Development.

Lipina, S. J. & Colombo, J. A. (2009). *Poverty and brain development during childhood: An approach from cognitive psychology and neuroscience.* Washington, DC: American Psychological Association.

National Research Council (2000). *How people learn: Brain, mind, experience, and school.* Washington, DC: National Academies Press.

Neuman, S. B. (2008). *Educating the other America: Top experts tackle poverty, literacy, and achievement in our schools.* Baltimore, MD: Paul H. Brookes Publishing Co.

Neuman, S. B. (2009). *Changing the odds for children at risk: Seven essential principles of educational programs that break the cycle of poverty.* New York City, NY: Teachers College, Columbia University.

Rothstein, R. (2004). *Class and schools: Using social, economic, and educational reform to close the black-white achievement gap.* New York City, NY: Economic Policy Institute and Teachers College, Columbia University.

English Language Learners. Students not yet proficient in English have a massive hurdle to overcome. They must learn mathematics, science, and other content areas at the same time that they are working to become proficient in English. They especially need work in vocabulary development. Although they may know a great deal of mathematics and science from schooling in their home countries, they may not understand Academic English. Many mathematical and scientific terms are never used in everyday conversation, and those that are have completely different meanings (examples: matter, mass, energy, force, cycle).

An important and interesting study was conducted in 2007 (Luykx, Lee, Mahotiere, Lester, Hart, & Deaktor) on how children's language and culture affected their performance on science assessments. The study included 1,500 students from six elementary schools serving diverse populations. The researchers stated the following in their conclusions:

> Science tests inevitably contain tacit cultural and linguistic knowledge that is not equally accessible to all students. Using "real-life scenarios" in assessment items may confuse

students whose lives do not reflect mainstream norms. Furthermore, English-medium assessments are unlikely to accurately measure ELLs' science knowledge.

The authors suggest that teachers should observe their students' reactions and responses to classroom assessments so that they can identify where there are language or cultural influences that may be confusing them. Then they should then do corrective instruction. Given the richness and diversity of NewPath's materials, there are ample opportunities for children to learn and practice accurate responses and also for teacher observation and identification of problem areas.

Instructional strategies that are most important, according to research, for ELLs include the following:

- Emphasis on concepts, consistently using academic vocabulary for mathematical and scientific terms. [See prior discussion of "Reading, Writing, and Communicating Science" for how NewPath materials can be used and for references for more information.]
- Use of advance organizers, graphics, and/or maps are used throughout the NewPath materials.]
- Use of modeling at the semi-concrete level and in problem-solving lessons (worked examples). [See prior discussions of "Multi-sensory Processing Strategies" and "Worked Examples" for how NewPath materials can be used and for references for more information.
- Use of multi-sensory (sometimes referred to as nonlinguistic) encoding and use of visuals to illustrate meaning. [See prior discussion of "Multisensory Processing Strategies" for how NewPath materials can be used and for references for more information.]
- Modeling of English pronunciation of scientific terms. [The teacher and students will model the correct pronunciation in the use of NewPath materials. One example is in having students read the questions aloud when playing the Curriculum Mastery Game. Another is in the use of the Flip Charts and Bulletin Board Charts when the teacher and/or students will read the scientific terms aloud.]
- Explicit teaching of procedures. [Procedures are taught explicitly when using the Flip Charts, Visual Learning Guides, and Online Learning.]
- Adequate and varied practice to develop mastery and to develop fluency/automaticity. [Adequate and varied practice is a major strength of all the NewPath materials.]
- Reinforcement of English language arts learning so that students can read science texts and assessments and so that science learning can be communicated. [See prior discussion of "Reading, Writing, and Communicating Science" for how NewPath materials can be used and for references for more information.]
- Individualized/differentiated learning, when needed. [See prior discussion of "Individualized Instruction" for how NewPath materials can be used and for references for more information.]

For more information on teaching ELLs, NewPath recommends the following:

Echevarria, J., Vogt, M, & Short, D. J. (2000). *Making content comprehensible for English language learners: The SIOP model.* Boston, MA: Allyn and Bacon.

Garcia, E. E. & Frede, E. C. (Eds.) (2010). *Young English language learners: Current research and emerging directions for practice and policy.* Teachers College, Columbia University.

Genessee, F., Lindholm-Leary, K., Saunders, W. M., Christian, D. (2006). *Educating English language learners: A synthesis of research evidence.* New York City, NY: Cambridge University Press.

Gersten, R. & Baker, S. (2003). English-language learners with learning disabilities. In H. L. Swanson, K. R. Harris, & S. Graham. *Handbook of learning disabilities.* New York City, NY: The Guilford Press.

Luykx, A., Lee, O., Mahotiere, M., Lester, B., Hart, J., & Deaktor, R. (2007). Cultural and home language influences on children's responses to science assessments. *Teachers College Record*, 109(4), 897-926.

National Research Council (2000). *How people learn: Brain, mind, experience, and school.* Washington, DC: National Academies Press.

Neuman, S. B. (2008). *Educating the other America: Top experts tackle poverty, literacy, and achievement in our schools.* Baltimore, MD: Paul H. Brookes Publishing Co.

NSTA (2009). NSTA position statement: Science for English language learners. Arlington, VA: NSTA.

Sousa, D. A. (2011). *How the ELL brain learns.* Thousand Oaks, CA: Corwin Press.

Children with Learning Disabilities. Many people make the mistake in thinking that a learning disability is one "thing." In truth, there are so many different kinds, manifesting themselves in so many different ways, that this area of education is one of the most complex to understand, diagnose, and design appropriate curriculum, instruction, and assessments for as many as about ten percent of the general population.

There are, of course, variations of learning disabilities (visual-spatial vs. language, for example), and there are degrees (mild to severe). There are also a variety of origins. Geary and Howard (2005) have constructed a useful model for understanding the complexity of science disabilities (with implications for science learning), as follows:

<table>
<tr><td colspan="4">Discipline Domain
(e.g., Force)</td></tr>
<tr><td colspan="4">Supporting Competencies</td></tr>
<tr><td colspan="2">Conceptual
(e.g., Base-10 Knowledge)</td><td colspan="2">Procedural
(e.g., Columnar Trading)</td></tr>
<tr><td colspan="4">Underlying Cognitive Systems</td></tr>
<tr><td colspan="4">Central Executive
(Attention and Inhibitory Control of Information Processing)</td></tr>
<tr><td colspan="2">Language System</td><td colspan="2">Visuospatial System</td></tr>
<tr><td>Information Representation</td><td>Information Manipulation</td><td>Information Representation</td><td>Information Manipulation</td></tr>
</table>

The difficulties that children with disabilities have, therefore, may occur in problems relating to concepts and/or to procedures. These problems are manifested in different ways and require different strategies to overcome them.

The origin of disabilities may not be a result of a problem with concept understanding or procedural fluency, but with the Central Executive area of the brain, where attention, self-control, sequencing, planning, organizing, and similar behaviors reside.

The origin may also be a problem in the language system or the visual-spatial system of the brain, each differing as to whether it is information representation or information manipulation.

The difficulty in understanding science disabilities is that a child rarely has just one problem, but, rather, a combination of problems (comorbidity). He/she may also have at the same time a reading disability, making treatment even more daunting. Finally, it is important to remember that a child with learning disabilities may also be a child who is economically disadvantaged or a child not yet proficient in English—or all three.

Mathematics disabilities, sometimes generally referred to as **dyscalculia**, most frequently manifest the following problems:

- Learning concepts (mathematics and scientific vocabulary; originates usually in the language system).
- Fact retrieval, or fluency in procedural knowledge (usually an auditory problem in the language system since rehearsal of math and science facts almost always is done aloud, auditorily).
- Reading mathematics, science, or other content areas (decoding words and numbers is also usually an auditory processing problem).
- Sequencing (remembering how to count, steps of problem-solving, etc.; may be an executive function problem or a problem with short-term memory).
- Direction (although reading is done left to right, mathematics requires flexibility—sometimes reading right to left or up-to-down; may be an executive function problem or a problem in visuo-spatial system).
- Discerning between "<" meaning "less than" and ">" meaning "more than" (related to problems with direction).
- Position (being able to line numbers up for problem-solving; understanding the importance of the comma in dividing thousands; understanding the position of the decimal in decimal fractions and in money; and understanding that a number's position in a larger number is related to place value. Origin may be in visuo-spatial system.)

Because many children with dyscalculia also are **dyslexic** (reading disability), improving instruction in reading/language arts will likely also improve science performance. McEwan (2000, p. 72) summarizes a study done in California about the rise in mathematics achievement scores when there had been no special efforts in that area. Rather, the teachers had been engaged for more than two years in a massive reading improvement initiative, and that work not only improved reading performance, but also mathematics performance.

Recommended instructional strategies for children with learning disabilities include the following:

- Increase time on task since children with learning disabilities may learn much slower than general education students. [See prior discussion on "time-on-task" for more information.]
- Use multi-sensory processing strategies. [See prior discussion on "multisensory processing strategies" for more information. These strategies include use of manipulatives and semi-concrete illustrations such as those found in NewPath's Flip Charts, Visual Learning Guides, and Online Learning.]

- Increase practice and repetition since more severe learning disabilities may require one hundred or more exposures before knowledge is moved to long-term memory. [See prior discussion on "practice/repetition" for more information. A major strength of NewPath materials is in this area. The products have more than adequate and varied materials to accommodate the needs of all children, including those with disabilities.]
- Develop recall fluency, which occurs, of course, from practice and repetition. In order to do problem-solving, students must have rapid and accurate recall of science facts. [NewPath's variety of materials enables and facilitates the development of fact fluency, and they also make it easy for teachers to implement a kind of cyclical curriculum so that students are constantly reviewing prior knowledge at the same time they are working on current learning goals. Children with learning disabilities need this distributed practice so that they do not lose their previously learned skills.]
- Ensure that students learn both concepts and procedural knowledge—and the connections between them. [NewPath materials include many, many activities that reinforce both kinds of learning and the relationships between them. The most direct are in the Flip Charts, Visual Learning Guides, and Online Learning materials. The questions in the Curriculum Mastery Games and the Interactive Whiteboard CD-ROM help children make the necessary connections.]
- Incorporate the use of "worked examples" in teaching students with learning disabilities. [See prior discussion of worked examples and for more information. NewPath's Flip Charts and Visual Learning Guides are especially good in this area. Online Learning enables a teacher to construct lesson plans with the alternate use of worked examples and problems to be solved.]
- Use direct instruction for best results with children who have learning disabilities. [See prior discussion on lesson design and for more information. NewPath materials lend themselves well to direct instruction approaches, including the lesson plan model that is available in Online Learning.]
- For students who are significantly behind their peers, the resources on the Interactive CD-ROM and Online Learning enable the teacher to create and assign appropriate lower-level activities.

For more information on teaching science to children with learning disabilities, NewPath recommends the following:

Meltzer, L. (Ed.) (2007). *Executive function in education: From theory to practice*. New York City, NY: The Guilford Press.

NSTA (2004). *NSTA position statement: Students with disabilities*. Arlington, VA: NSTA.

Sousa, D. A. (2001). *How the special needs brain learns*. Thousand Oaks, CA: Corwin Press.

Swanson, H. L., Harris, K. R., & Graham, S. (2003). *Handbook of learning disabilities*. New York City, NY: The Guilford Press.

Struggling Learners and RTI

Since children in need of interventions in Tier I, II, or III of a Response-to-Intervention implementation are most likely to be children who are economically disadvantaged, not yet proficient in English, and/or with learning disabilities, the specific information provided about each of these groups would apply in making decisions about instruction for children in an RTI implementation. They would also apply if children are still in traditional programs, such as Title I, ESL, and/or Special Education, whether mainstreamed, in resource rooms, or in self-contained classrooms. In any case, NewPath has appropriate materials for these interventions at any level. The abundance and the variety of practice/repetition activities ensures that whether a child needs only one re-teaching or just one more session of practice to a child who may need several years of ESL instruction or several years in a special education setting, NewPath can meet the needs in a developmentally appropriate way.

For more information on implementing RTI programs, NewPath recommends the following:

Brown-Chidsey, R. & Steege, M. W. (2005). *Response to intervention: Principles and strategies for effective practice.* New York City, NY: The Guilford Press.

Glover, T. A. & Vaughn, S. (Eds.) (2010). *The promise of Response to Intervention: Evaluating current science and practice.* New York City, NY: The Guilford Press.

Lane, K. L. & Beebe-Frankenberger, M. (2004). *School-based interventions: The tools you need to succeed.* Boston: Pearson.

Mellard, D. F. & Johnson, E. (2008). *RTI: A practitioner's guide to implementing Response to Intervention.* Thousand Oaks, CA: Corwin Press and National Association of Elementary School Principals.

National Association of State Directors of Special Education, Inc. (2006). *Response to intervention: Policy considerations and implementation.* Alexandria, VA: National Association of State Directors of Special Education, Inc.

Riley-Tillman, T. C. & Burns, M. K. (2009). *Evaluating educational interventions: Single-case design for measuring Response to Intervention.* New York City, NY: The Guilford Press.

Tileston, D. W. (2011). *Closing the RTI gap: Why poverty and culture count.* Bloomington, IN: Solution Tree Press and National Association of Elementary Supervisors and Principals.

Chapter VI. Tools to Enhance Effectiveness

Professional Development

One of the most important things about professional development relating to the use of curriculum materials is that without it, teachers rarely have the information they need to implement the materials in the ways in which they were designed. Researchers now have evidence that the biggest reason that many educational innovations fail is that they were never really implemented. Also, without training, teachers may not know the many options that are available to them in how the materials can be used and with what kinds of students.

NSTA takes the following positions relating to professional development for elementary science teachers:

- Teacher preparation and professional development must enable the teacher to implement science as a basic component of the elementary school curriculum.
- Teacher preparation and professional develop must provide for:
  - Experiences that will enable teachers to use hands-on activities to promote skill development, selecting content and methods appropriate for their students and for design of classroom environments that promote positive attitudes toward science and technology.
  - Continuing science in-service programs based on current educational research that encompass content, skills, techniques, and useful materials.
  - Participation in workshops, conferences, and meetings sponsored by local, state, and national agencies.
- Elementary school science instruction must reflect the application and implementation of educational research.
- Elementary school science programs are improved when:
  - Teachers keep abreast of appropriate science education research.
  - Educational research becomes the premise for change or innovation in elementary school science, and teachers participate in action research in elementary science.

How NewPath Can Help

NewPath offers professional development/training in the use of their materials, as well as training on special topics. NewPath offers training sessions on content knowledge, materials use and management, use of NewPath's Online Learning program, administering pre- and post-tests, and data analysis. These sessions are customized to meet the needs of those in attendance. The following list outlines the NewPath professional development program usually requested by schools:

- Meet with staff to analyze and determine specific needs and expectations
- Agree on specific timelines and benchmarks
- Design a training program that fits the specific needs of the staff
- Provide onsite training consistent with the identified needs
- Provide telephone and web-based ongoing support as needed
- Observe and analyze program implementation and benchmarks

NewPath also supplements their training with resources on the website, with guides that accompany each product, and with publications such as this one, NewPath's Teacher Resource Guide. The reading lists in this guide provide another level of professional development that can be done individually or in study groups.

For more information on professional development, NewPath recommends the following:

Murphy, C. U. & Lick, D. W. (1998). *Whole-faulty study groups: A powerful way to change schools and enhance learning.* Thousand Oaks, CA: Corwin Press.

NSTA (2002). *NSTA position statement: Elementary school science.* Arlington, VA: NSTA.

The National Staff Development Council is now known as *Learning Forward*. Their website can be accessed at **http://www.learningforward.org**. This organization has all kinds of professional development resources, including a really good journal and books.

The Association for Supervision and Curriculum Development has a wealth of professional development publications, including *Ed Leadership*, their journal, and many, many books on the whole range of topics of interest to educators. Their website is **http://www.ascd.org.**

Parent Involvement

According to a 2000 publication of the National PTA,

> . . . the most accurate predictors of student achievement in school are not family income or social status, but the extent to which a student's family is able to (1) create a home environment that encourages learning; (2) communicates high, yet reasonable expectations for the child's achievement and future career; and (3) becomes involved in the child's education and in the community (pp. 12-13).

Every school, then, is supportive of parent involvement and educators are interested in how to improve the quality of that involvement.

How NewPath Can Help

NewPath can assist teachers in involving parents in their children's science education in the following ways:

- Teachers can use the Interactive Whiteboard CD-ROM and Online Learning resources to print activities and worksheets for children to take home as homework.
- Teachers can send the Take-Home Edition of the Curriculum Mastery Games home with students to provide the children with more practice opportunities and also to involve the parents in playing the games with their child.
- If parents have a computer, they can access their child's progress reports, review student work, create at-home tutoring sessions for their child, and communicate with the teacher.
- Teachers can display the print materials and demonstrate the use of the Interactive Whiteboard CD-Rom and Online Learning at parent meetings and open houses so that parents understand what, how, and why their children are using these materials.

- Schools can use the materials in teaching science to parents with weak skills (Adult Basic Education), including some immigrant parents, so that they in turn can help their children learn and value science.

For more information on parent involvement, NewPath recommends the following:

National PTA (2000). *Building successful partnerships: A guide to developing parent and family involvement programs.* Bloomington, IN: National Educational Services.

The National PTA's website on parental involvement is **http://www.pta.org**.

Stein, S. & Thorkildsen, R. J. (1999). *Parent involvement in education: Insights and applications from the research.* Bloomington, IN: Phi Delta Kappa International.

Zemelman, S., Daniels, H. & Hyde, A. (1998). *Best practice: New standards for teaching and learning in America's schools (2nd ed.).* Portsmouth, NH: Heinemann.

Curriculum Mapping

In order to evaluate the school's curriculum/instruction/assessment program, many schools use curriculum mapping as one tool. It is a strategy designed to determine if the curriculum plan has actually been implemented, if it is truly aligned with standards, instructional materials, and assessments, and whether it is meeting the needs of the students.

How NewPath Can Help

NewPath provides in its publications the correlations of its materials with the state/national standards for each discipline. Too, these standards have been grouped into instructional topics by grade level, which are also readily available in the packets accompanying each product and in the digital materials. This *Teacher Resource Guide* is another tool for teachers to use in a curriculum-mapping project. Teachers may find especially helpful the table in Chapter II, "NewPath Materials for Grades 6-8, by Topic," which identifies which products include information/activities for each of the standards-based topics in the science curriculum.

Further, NewPath makes available various professional development sessions that are also aligned with standards. Schools electing to participate in these sessions can map them to their curriculum.

For more information on curriculum mapping, NewPath recommends the following:

Jacobs, H. H. (Ed.) (2004). *Getting results with curriculum mapping.* Alexandria, VA: Association for Supervision and Curriculum Development.

Jacobs, H. H. & Johnson, A. W. (2009). *The curriculum mapping planner: Templates, tools, and resources for effective professional development.* Alexandria, VA: Association for Supervision and Curriculum Development.

Program Evaluation

We hear a lot these days about "implementation with integrity" or "implementation with fidelity" in the context of implementing RTI programs, but, in truth, these terms apply to the implementation of any academic plan. What educators have come to see is that a program evaluation that examines only outcomes (test scores) and does not also look to see whether the overall curriculum/instruction/materials/assessment plan was consistently implemented is only telling part of the story—and nothing about how to improve. First, a school must have a research-based plan with all of the pieces aligned with the proficiency standards. If it is appropriately implemented, the outcomes should show the value added and, therefore, improved performance. If the plan was consistently implemented and the outcomes were disappointing, then the problem is most likely with one or more pieces of the plan. The outcome data will reveal weaknesses among individuals and groups of students, and these data require analysis. These analyses can then be used to refine the plan, to make it more responsive to student needs.

How NewPath Can Help

Problems in using data from summative assessments only in evaluating a school's science program are as follows:

- Adjustments cannot be made except on an annual basis, making it too late to improve the performance of the students before the next year.
- One-shot assessments are not as reliable as multiple data sources since any student may not perform well on the testing day for a variety of reasons.
- Summative assessments are restrained in the number and variety of questions that may be asked, so the results do not always inform the day-to-day curriculum decisions that teachers must make.
- Not all the standards are assessed, leaving teachers to guess about their effectiveness of the ones not assessed.

The solution to these problems is to use the results of continuous progress monitoring, which is a major feature of the NewPath materials. Teachers can view assessment results by student, by group, and by the whole class. They can see also those results by subject and topic. Therefore, they can, as frequently as necessary, make adjustments to the curriculum plan so that individuals and groups perform better.

Another tool that schools can use in program evaluation is surveys of the teachers, students, and parents—including climate indicators as well as specific information about the way science was taught at grades 6-8.

For more information on program evaluation, NewPath recommends the following:

Guskey, T. R. (2000). *Evaluating professional development.* Thousand Oaks, CA: Corwin Press.

Jones, M. & Mulvernon, S. (2003). *Leaving no child behind: How data driven decision-making can help schools meet the challenge.* Phoenix, AZ: All Star Publishing.

Killion, J. (2002). *Assessing impact: Evaluating staff development.* Oxford, OH: National Staff Development Council.

Lewis, C. C. (2002). *Lesson study: A handbook of teacher-led instructional change.* Philadelphia, PA: Research for Better Schools.

McNiff, J., Lomax, P., & Whitehead, J. (2003). *You and your action research project (2nd ed.).* New York City, NY: Routledge.

O'Sullivan, R. G. & Tennant, C. V. (1993). *Programs for at-risk students: A guide to evaluation.* Thousand Oaks, CA: Corwin Press.

Sanders, J. R. (2000). *Evaluating school programs: An educator's guide* (2nd ed.). Thousand Oaks, CA: Corwin Press.

The Joint Committee on Standards for Educational Evaluation (1994). *The program evaluation standards (2nd ed.).* Thousand Oaks, CA: Sage Publications.

Vallecorsa, A. L., deBettencourt, L. U., & Garriss, E. (1992). *Special education programs: A guide to evaluation.* Thousand Oaks, CA: Corwin Press.

Chapter VII. Conclusion

NewPath Learning hopes that this guide will provide teachers with information, ideas, support, encouragement, and confidence in teaching science in grades 6-8. We hope you see in our product designs NewPath's commitment to a **true partnership with teachers**. In each product, we have embedded support for curriculum standards alignment; for all forms of assessment, even self-assessment; and for lesson designs. We have worked hard in fashioning our products to facilitate your adoption of research-based instructional strategies to provide real opportunities to learn for all students. We have also attended to the needs of struggling learners, including for them exactly the resources they need to keep them on track with their peers. Finally, we have also provided assistance to you in various features of program implementation, including substantial tools for parental involvement and increasing time-on-task.

We trust that teachers will use the products as they have been designed to be used—implementation with fidelity. That does not mean, however, that there is no room for teacher creativity. In fact, NewPath encourages teachers to find ways to incorporate the materials in a variety of teaching activities that are not included in this guide—activities that we did not think to include. In fact, we hope you will be willing to share with other teachers what you find that works in improving student learning, and we hope to hear from you about those ideas, as well as ideas for new products.

We have tried to provide you with a comprehensive course in curriculum/instruction/assessment, along with the ways that NewPath can support you in every phase of curriculum delivery, supplemented with a reading list for further information. May your journey be a successful one!

And, for the record, teachers ARE, clearly, seriously, really, rocket scientists!