Effective programs are designed to match the developmental stages of the learner.

Children learn in completely different ways than adults. Programs and presentations should be designed to match your audience's developmental needs, interests, abilities, and learning styles as well as their cognitive development, attention spans, coordination abilities, interests, and ways that they interact with their surroundings.

Age	Characteristics	Effective Techniques/Methods	Also Consider
Grades K-2	- Play is important, especially creative, dramatic activities - Actively construct knowledge - Learning is result of interactive processes - Concrete thinkers: believe only what can see - Have difficulty controlling impulses, regulating behavior	- Develop a sense of connectedness and empathy for the natural world by *becoming* things – hop like a rabbit, slither like a snake, roar like a mountain lion - Allow to actively construct knowledge - Use manipulatives (large size) - Engage all senses - Activities that last 5-10 minutes	- Allow children to *become* things before objectifying them – e.g., fly like a bird before identifying different kinds of birds - Should not sit still or listen passively for more than 5-10 minutes
Grades 3-5	- Beginning to transition to abstract thinking: begins to understand concepts as well as objects - Beginning to formulate hypotheses and use systematic problem-solving strategies - Works well in social groups and independently - Likes to memorize and learn facts	- Exploration - Develop sense of place through direct experiences and immersion in nature - Free play - Cooperative learning groups - Active constructors of knowledge - Use manipulatives - Engage all senses - Evaluate different perspectives and move away from dichotomous thinking (good vs. bad) through role plays - Activities that last 15-30 minutes	- Should not sit still or listen passively for more than 15 minutes - Avoid abstract concepts that cannot be related to the child's life – e.g., timelines - Avoid negative experiences in nature-- because many naturalists trace their "environmental" roots to special places they connected to at this age

Age	Characteristics	Effective Techniques/Methods	Also Consider
Grades 6-8	- Continue transition to abstract thinking - Able to hypothesize, propose solutions, and evaluate - Developing an understanding of ethical principles - Self-conscious; concerned how he/she is perceived by others - Socially responsible; primed to play a role in the health of nature and society - Able to understand metaphors and complex issues - In a period characterized by "Storm and Stress"	- Service-learning opportunities - Activities that use physical energy and foster higher-level thinking and problem-solving skills - Activities that are student-driven and experiential. The instructor can begin by engaging the learner and sharing key information. Then the learner should engage in an activity that allows the learner to apply knowledge and answer questions - Cooperative learning groups - Allow students to create their own predictions, pose hypotheses, and/or design their own investigations - Allow students to use research to investigate environmental issues. - Activities that last 20-40 minutes	- Should not sit still or listen passively for more than 20 minutes - Avoid too much lecture - Avoid singling out individuals and making him or her feel different from others - Avoid talking "down" to this group – they need to feel adult-like

Age	Characteristics	Effective Techniques/Methods	Also Consider
Grades 9-12	- Continue transition to abstract thinking - Able to hypothesize, propose solutions, and evaluate - Able to understand metaphors and complex issues - Self-conscious; concerned how he/she is perceived by others; peer groups shape individual behaviors and actions - Socially responsible; primed to play a role in the health of nature and society - Concern for what the future holds for them personally	- Cooperative learning groups - Discussion methods - Use analogies that reflect student interest - Involve students in planning the direction of their learning. - Experiential activities that are more self-directed - Allow students to create their own predictions, pose hypotheses, and/or design their own investigations. - Allow students to use research to investigate environmental issues. - Activities that last 20-40 minutes	- Should not sit still or listen passively for more than 20 minutes. - Avoid too much lecture - Avoid singling out individuals and making him or her feel different from others. - Avoid talking "down" to this group – they need to feel adult-like - Time constraints such as sports, social commitments, and work

References:

National Resource Council. 1996. National Science Education Standards. National Academy Press.

Epstein, H.T. The Fourth R or Why Johnny Can't Reason. http://www.brainstages.net/index.html.

Falk, J.H. and L.D. Dierking. 2002. Lessons Without Limit: How Free-Choice Learning Is Transforming Education. Alta Mira Press.

Theory of Cognitive Development. 2006. Wikipedia.

1996. Principles of child development and learning that inform developmentally appropriate practice. National Association for the Education of Young Children.

2006. Sharing Science with Children: A Survival Guide for Scientists and Engineers. North Carolina Museum of Life and Science, Durham, NC.