



BS1 Analytical Thinking Skills: Essential Training for 21st-Century Forensic Scientists

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The goals of this presentation are to: (1) provide attendees with an overview on creating a stand-alone analytical thinking course in graduate curriculums; (2) instruct attendees on structuring a course to address real-world forensic science problems; and, (3) inform attendees on teaching students a specific methodology to break down complex problems.

This presentation will impact the forensic science community by providing students the skills for working in the field in the 21st century.

Forensic science can be considered a three-pronged science designed to train students in theory, research, and application; however, students can face particularly significant challenges without analytical thinking skills and understanding how to apply them to real-world forensic problems.

While analytical thinking skills are important for all scientists, they are particularly critical for forensic science students who must be able to comprehend complex scientific theories, principles, and methodologies, synthesize all of their knowledge, and apply it in real-world situations with unpredictable challenges. To complicate this challenge, many forensic scientists are regularly expected to testify, under oath in court, as to the analytical thinking process they applied to the problem. A weakness or flaw in their analytical thinking or in the application of the science to real-world problems, and the subsequent flawed or weak explanations to the trier of fact, could result in a serious appellate issue for the case, which could summarily damage or even end a young scientist's career.¹

Forensic scientists are also often asked to serve on multidisciplinary commissions, panels, etc., to collaborate on specific forensic science problems, identify causation, and recommend viable solutions.

Dr. Richard Bloom, a well-known psychologist and educator, created the *Taxonomy of Educational Objectives Book*, which identified levels of cognition ranging from basic comprehension of scientific theories and principles to much more complicated levels of cognition.¹ Later revised, the book identified analytical thinking, creativity, and evaluation as the highest levels of cognition requiring specific teaching methodologies in order to develop and maintain these skills.²

In their 1992 paper presented at the annual meeting of the American Educational Research Association, Franklin and Theall noted that college instructors in soft disciplines utilized a wider range of teaching behaviors than those utilized by instructors in science disciplines.³ Twenty-two years later, Benton and Cashen opined that Science, Technology, Engineering, and Math (STEM) instructors relied predominately on lectures in their courses, rather than more advanced levels of instructional behaviors to help students reach higher levels of cognition, including analytical and creative thinking.⁴ This study conducted a review of ten forensic science graduate programs. Five programs were Forensic Science Education Programs Accreditation Commission (FEPAC) -accredited, and five were not. Results indicated none of these programs included a stand-alone analytical thinking course in their curriculums.

Part 1: Demonstrate how to break down a real-life forensic science problem into its most basic component parts in order to identify causation. Students will see that most real-life forensic science problems are complicated and multilayered, and they need a method to break the problem into manageable parts.

Part 2: Students will learn how to develop hypotheses to test causation using research methodologies, both qualitative and quantitative.

Part 3: Using a collaborative and multidisciplinary framework, students will learn how to use analytical and creative skills to identify relevant conclusions and, from those conclusions, develop creative but scientifically sound recommendations for solutions.

Currently, many graduate forensic science programs do not offer stand-alone analytical thinking courses. These skills are either not directly taught or are minimally covered in other courses. Without a solid understanding of analytical thinking skills, forensic science students are not being adequately equipped to face career challenges in the 21st century.

Reference(s):

1. Bloom, B. 1956. *Taxonomy of Educational Objectives Book, Handbook 1: Cognitive Domain* (New York: Longman).
2. Anderson, Lorin W., and David R. Krathwohl. 2001. *A Taxonomy for Learning, Teaching, and Assessing: A Revision of Bloom's Taxonomy of Educational Objectives*. (New York: Longman).
3. Franklin, Jennifer, and Michael Theall. *Disciplinary Differences: Instructional Goals and Activities, Measures of Student Performance, and Student Ratings of Instruction*. (1992).
4. Stephen Benton and William Cashin, *Student Ratings of Instruction in College and University Courses in Higher Education: Handbook of Theory and Research*, ed. Michael Paulsen (New York: Springer, 2014), 29.

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