Teaching at Higher Levels of Cognition

The cognitive domain is based upon the theory of varying levels of complexity (Bloom, Englehart, Furst, Hill, & Krathwohl, 1956).

Accomplishing higher order thinking (application, analysis, synthesis, and evaluation) requires background knowledge in teaching methods and distinguishing between previous experience and new situation (Bloom, et al., 1956, Pickford, 1988, Cano, 1988).

Comparison Between Bloom's Taxonomy and the Newcomb-Trefz Model*

Bloom's Taxonomy	Newcomb-Trefz Model
Knowledge	Remembering
Comprehension	
Application	Processing
Analysis	
Synthesis	Creating
Evaluation	Evaluating

* Whittington & Newcomb,1991

Literature Review Based upon the Newcomb-Trefz Model

Over three-quarter of the faculty in the College of Agriculture at Ohio State indicated that they would welcome changes in cognitive level of assignments and exams (**Newcomb & Trefz, 1987**).

Ohio State faculty from Agricultural Economics, Horticulture, Animal Science, Poultry Science, Agricultural Engineering, Food Science, and Agricultural Education aspired to have about 70% of their discourse at the lower levels of cognition. Participants also aspired to write 75% of their tests at the lower levels of cognition. Participants were then assessed based upon their discourse in the classroom and 95% of the discourse was in the lower levels, and 80% of their tests were written at the lower levels. (**Whittington & Newcomb, 1991**).

Undergraduate students (n=118) in four introductory courses in Animal Science, Plant Science, Food Science, and Agricultural Economics at Ohio State were tested at the beginning of the courses and completion of the courses based upon cognitive performance in general (American Testronics, 1988a, 1988b; Beggs, 1988) and in specific subject matter areas. In addition, relationships were determined between cognitive performance and the following variables: (1) cognitive level of course experiences (quizzes, discourse, and assignments), (2) student academic ability, and (3) instructor professional experiences.

Cognitive performance did not increase outside of the subject matter areas studied. Cognitive performance in the subject matter increased approximately 30% between the pretest and posttest. Moderate positive associations were found among cognitive performance and the following variables: (1) instructor professional experience, (2) course quizzes, and (3) student academic ability (**Miller & Newcomb, 1990**).

Researchers utilized the Florida Taxonomy of Cognitive Behavior (FTCB) developed by Brown, Ober, Soar, and Webb (1968) to assess teacher discourse. In addition, these same researchers utilized the Developing Cognitive Abilities Test (DCAT) for the purpose of assessing cognitive performance. The DCAT was developed by Beggs (1988) and measures variables in the following three constructs: (1) general abilities, (2) application skills, and (3) critical thinking (**Miller and Newcomb, 1990**).

Vocabulary Useful in Developing Objectives and Test Items at Various Cognitive Levels*

Remembering	Processing		Creating	Evaluating
acquire	analyze	infer	combine	appraise
cite	apply	interpolate	compose	argue
define	associate	interpret	constitute	assess
identify	categorize	outline	construct	conclude
label	change	paraphrase	create	consider
list	choose	point out	derive	decide
name	classify	predict	design	evaluate
recall	prepare	compare	develop	judge
recite	compute	rearrange	devise	standardize
recognize	contrast	relate	document	validate
reproduce	convert	reorder	formulate	weigh
state	deduce	rephrase	integrate	
	demonstrate	represent	modify	
	describe	restate	originate	
	detect	restructure	organize	
	determine	summarize	plan	
	differentiate	transfer	produce	
	discriminate	transform	propose	
	distinguish	translate	reorganize	
	draw	use	revise	
	estimate		rewrite	
	explain		specify	
	extend		synthesize	
	extrapolate		tell	
	generalize		transmit	
	illustrate		write	

* Chamberlain & Kelly (1981); Clegg (1968); Hall (1983); Whittington (1992)