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# The Comparative Effects of Individualized and Group Instruction in BSCS Biology on the Ability of Students to Think Critically\*

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Research in the area of critical thinking ability many times involves the use of the *Watson and Glaser Critical Thinking Appraisal* (WGCTA) (5). These abilities involve inference or drawing conclusions from facts or premises, recognition of assumptions or hypotheses, deduction or working from basic premises to conclusions, interpretation of data to derive or explain its meaning, and the evaluation of arguments or evidence. The items on this instrument are not specifically limited to science. As a result, when researching the effect of an instructional procedure in science, the teachers and all other subjects the students are exposed to need to be controlled.

To determine the effect of individualized, or group instruction on the ability of students to think critically, the WGCTA was utilized in this study while the teachers and subject variables were controlled throughout. The WGCTA was given on a pretest and posttest basis. The total test and its subtests were analyzed using an analysis of covariance.

The results in table 1 reveal a statistically significant difference on the WGCTA: Evaluation of Arguments and WGCTA Total Test. The general trend for all of the subtests and the total test is a greater score, on the adjusted posttest mean, by students in the individualized section. Thus the results of this study indicate that students in an individualized approach to BSCS Biology develop a greater ability to think critically than do students taught BSCS Biology by a group approach.

The results of this study point to the idea that the approach used in teaching science affects the ability of the students to think critically. This is supported with studies conducted by Kastrinos (4) and Johns (3). They showed that the approach used in teaching science influences the critical thinking abilities of the student. Another study by Yager and Wick (6) also considered the teacher variable. Using the BSCS Blue Version in their study, they showed that the teacher can also influence the student's ability to think critically.

Too often we who teach science forget to think of students as individuals.

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\*This article is the third in a series appearing in the *Iowa Science Teachers' Journal* (2).

Table 1  
Analysis of Covariance Results for the Watson and Glaser  
Critical Thinking Appraisal and Its Subtests

$H_0: \mu_G - \mu_I = 0$	$\alpha = 0.05$	$N_G = 20$	
$H_1: \mu_G - \mu_I \neq 0$	$F(1,37) = 4.105$	$N_I = 20$	
Instrument	Approach: Group (G) Individualized (I)	Adjusted Posttest Mean	F
WGCTA: Inference	G	8.90	
	I	9.99	1.80
WGCTA: Recognition of Assumptions	G	10.19	
	I	11.21	1.30
WGCTA: Deduction	G	16.17	
	I	17.43	1.47
WGCTA: Interpretation	G	14.08	
	I	16.17	5.74*
WGCTA: Evaluation of Arguments	G	9.05	
	I	10.15	2.92
WGCTA: Total Test	G	58.14	
	I	65.11	7.85*

\*Statistically significant difference

We have a tendency to classify all students into one pattern of learning and we forget that each student has his own level of critical thinking abilities. To group all students into the same pattern of learning and the same rate of progress is to ignore this fact and is psychologically unsound. Perhaps the time is long overdue for us to reevaluate our group approach to teaching science.

#### FOOTNOTES

1. Fulton, Harry F., "A Comparison of Achievement in Biology in an Individualized and Group Approach to BSCS Biology" (In Manuscript to the *Iowa Science Teachers' Journal*).

2. Fulton, Harry F., "A Consideration of Student Understanding of Science in Two Approaches to BSCS Biology" (In Manuscript to the *Iowa Science Teachers' Journal*).

3. Johns, Kenneth W., "A Comparison of Two Methods of Teaching Eighth Grade General Science—Traditional and Structured Problem-Solving," University Microfilms, Ann Arbor, Michigan, 1966.

4. Kastrinos, William, "The Relationship of Two Methods of Teaching to the Development of Critical Thinking by High School Students in Advanced Biology," *Science Education*, Vol. 48, March 1964, pp. 187-196.

5. Watson, G., and E. M. Glaser, *Watson-Glaser Critical Thinking Appraisal*, Revised Form Zm, Harcourt, Brace and World, New York, 1961.

6. Yager, Robert E., and John W. Wick, "Three Emphases in Teaching Biology—A Statistical Comparison of Results," *Journal of Research in Science Teaching*, Vol. 4, March 1966, pp. 16-20.