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ABSTRACT

This study examined the performance of college students and elementary school teachers on the Cultural Literacy Science Assessment (CLSA) developed by Cannon and Jinks (1992), which is based partly on science-related terms in "The Dictionary of Cultural Literacy" by E. D. Hirsch et al. A total of 330 students and teachers completed the 52-item assessment. The subjects included: (1) junior and senior elementary education majors; (2) elementary education teachers pursuing graduate study; (3) junior and senior liberal arts majors; (4) junior and senior science majors; and (5) freshman and sophomore science majors. The study found that the scores of junior and senior science majors were significantly higher than the scores of the other four groups, and that liberal arts majors scored higher than elementary education teachers. The scores of males were significantly higher than those for females, although this result may be faulty due to the fact that no effort was made to control for gender within the five groups of subjects. These results could indicate that the CLSA does not present a generalized sample of science terms, and is thus questionable as a measure of science literacy. Implications for teacher education are discussed. (MDM)

COLLEGE STUDENT PERFORMANCE ON THE CULTURAL LITERACY SCIENCE ASSESSMENT INSTRUMENT

by

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A long-standing concern in science education has been the goal to create a scientifically literate citizenry. Cultural Literacy: What Every American Needs to Know (Hirsch, 1987) promoted the argument that a general body of knowledge that all culturally literate persons should know could be identified, and a suggested list of 5,000 terms, The Dictionary of Cultural Literacy, was offered as a starting point (Hirsch, 1988). Cannon and Jinks (1992) identified 1,431 of these terms as being science-related, and developed the Cultural Literacy Science Assessment (CLSA) survey instrument from this list. The CLSA included 52 randomly selected terms from the Hirsch list set in a multiple-choice format, plus a set of eight demographic items, three of which are discussed here. Cannon and Jinks tested a group of introductory education course students and a group of upper-level business course students, and found that achievement on the CLSA was not influenced by sex, size of high school, age or possible future careers in business or education. They concluded that the science terms from the Hirsch cultural literacy list were general, and thus were potentially valid as a measure of science literacy.

The goal of this study was to test the CLSA against a larger and more varied population of college students for the variables of gender, score and size of high school to see if the results from the Cannon and Jinks study was supported.

Methodology

Students were categorized by college major and by level of enrollment (Table 1). College major was defined by the particular college of the university to which the student was assigned, i.e. Education, Pure and Applied Sciences, or Liberal Arts. Level of enrollment ranged from freshman/sophomore to graduate student. Students in the College of Pharmacy and Health Sciences follow undergraduate programs which were very similar to that of the College of Pure and Applied Science majors, therefore students in these two colleges were combined to form the group of science majors. The College of Pure and Applied Sciences has offered degrees in agriculture, aviation, chemistry, physics, biology, geosciences, mathematics, and computer science; but, for this study, agriculture and aviation students were not tested. An attempt was made to collect data from business majors; but, final totals of business majors were considered too small to provide valid measures. The CLSA was administered in regular classes taught by the various colleges involved during the 1993 Spring and Summer academic semesters. Students were instructed to choose the best answers possible, and to leave blank any questions to which they could only "wild guess". Overall scores were machine graded and comparisons of means by major were analyzed via Scheff'e ANOVA using equalized n's.

TABLE 1
STUDENTS ACCORDING TO COLLEGE MAJOR AND COLLEGE LEVEL

Group Title:	n:
Elementary Education Juniors and Seniors	67
Elementary Education Graduate Students	47
Liberal Arts Juniors and Seniors	64
Pure and Applied Science Freshmen and Sophomores	50
Pure and Applied Science Juniors and Seniors	102
Total:	330

Gender:

Males = 111

Females = 218

(Note: numbers do not add up to 330 due to one omitted answer)

Results

Significant differences were found between scores by college, and between class levels for the College of Pure and Applied Science majors. As verified in Table II, the scores of junior and senior science majors were significantly higher than each of the other four ($p < 0.001$). The scores of the freshmen and sophomore science majors were significantly higher than for the elementary education graduates ($p < 0.001$). With unequalized n's, the freshmen and sophomore science majors were significantly higher than the elementary education juniors and seniors at the 0.05 level; but, this disappeared when n's were equalized.

Liberal arts juniors and seniors scored significantly higher than the elementary education graduates at the 0.01 level with n's unequalized, but this disappeared when n's were equalized. Thus, these results accord with the results for business and education majors in the Cannon and Jinks study.

In a study of the effect of high school restructuring on student achievement, Lee and Smith (1994) found that students who attended smaller high schools consistently posted higher gains in science. The CLSA did not produce any such significant differences in this current study nor did it in the Cannon and Jinks study. It should be noted the Lee and Smith study involved only students in the first two years of high school, whereas the CLSA studies tested college students. Therefore, the gains, which result from attending smaller high schools, may become reduced by a leveling effect of attending college. Also, the Lee and Smith study

TABLE 2
SCORES BETWEEEN COLLEGE AND CLASS LEVEL

	Group 1	Group 2	Group 3	Group 4	Group 5
Mean	25.739	23.065	27.239	35.435	29.391
SD	6.606	6.984	7.525	4.708	6.305
n*	46	46	46	46	46

*sample sizes equalized

Scheffe ANOVA: .001 Level, Equal n's

	Group 1	Group 2	Group 3	Group 4	Group 5
Group 1					
Group 2					
Group 3					
Group 4	*	*	*		*
Group 5		*			

Group 1: Elementary Educ. junior and seniors
Group 2: Elementary Educ. graduates (veteran teachers)
Group 3: Liberal Arts junior and seniors
Group 4: Science juniors and seniors
Group 5: Science freshmen and sophomores

analyzed only achievement test scores, and the relationship between these scores and the CLSA scores were not known.

Scores of males were significantly higher than those for females ($p < .001$), but this significance may be spurious because no effort was made to balance the five groups of college majors; thus, there is no assurance of randomness. For example, the ratio of males to females in the elementary undergraduate group was 6:40, this group scored significantly lower than some of the other groups. Henceforth, gender differences may be exaggerated.

These results could indicate that the CLSA does not present a generalized sample of science terms, and is thus questionable as measure of science literacy. However, the results simply reflect different levels of exposure to science among the four groups. It was not surprising that the science majors scored the highest on this test. Of particular concern were the low scores made by the elementary education graduate students (veteran elementary teachers). Anecdotal reports indicate that teachers, who hold life-time certificates, tend not to return for additional college coursework as often as do "newer" teachers who are required to update their certification periodically. This lack of exposure to additional training and refresher courses may block these teachers from being able to stay up to date with the science terms presented by the CLSA. In addition, these teachers, even if they do return for additional college training, do not usually enrole in further courses of study in the sciences. Most teachers did not receive as much college science coursework as do the present undergraduates.

Due to current changes in graduation requirements, the new teacher will receive additional hours in the science disciplines and this could be adventageous to the knowledge bank of methodology in education.

The difference in overall scores between the two elementary groups was not significant, nor was there any significant difference between the elementary juniors and seniors and the liberal arts juniors and seniors. This suggests that the CLSA may be generalizable for undergraduate non-science majors.

E.D. Hirsch (1987) presented an argument for cultural literacy that implicitly included the concept of science literacy. He has since set up the Core Knowledge Foundation to provide an educational program for elementary schools that focuses on increasing cultural literacy (Hirsch, 1993). To date, more than 50 elementary schools in the United States have implemented this program into their curriculums, and many of these schools have reported increases in academic achievement. Hirsch argued that the power of this program was derived from students sharing a broad general knowledge base (Hirsch, 1993). Bryk (1994, p.7) also poined out that "disadvantaged students benefit from schools where a greater commonality of advanced academic work is demanded of all". Thus, there was evidence that curriculums, which focus on enhancing cultural literacy (and by extension, science literacy), can increase achievement. Hirsch, however, has been criticized recently for championing an approach to science education that involved a mastery of facts whereby ". . . if students learned

more shared facts, they would create a much-needed cultural context for themselves" (NSTA, 1993, p.1-2). This criticism may be misdirected; because, for Hirsch, the development of a science vocabulary does not imply a "simple memorization" of facts and terms. Rather, he argued for the development of a basic knowledge of facts, principles, concepts and issues of science which will enable citizens "to make nontechnical judgments about technical questions" (Hirsch, 1987, p.150-151). The Content Core also contained a significant amount of science content; yet, at the same time it recognized a need for a "less is more" approach (pp.viii-ix) and this was true for Science For All Americans as well. Perhaps the positions held by the NSTA and other science education organizations, and by Hirsch, were not as far apart as it sometimes seems. The CLSA is not designed to be "prescriptive"; but, "descriptive", and with this in mind, it may be of use in providing additional information regarding the issue of science literacy.

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