Watch Your Language: Translating Science-Based Research for Public Consumption

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Abstract

Communications professionals involved with agriculture and natural resources have a stake in developing a scientifically literate public. Much of the terminology used to discuss science-based research issues has its foundation in Latin and Greek. Research has demonstrated that scientific literacy is directly affected by the educational process. However, limited work has been done about the relationship between scientific literacy skills and coursework in the sciences and foreign language. The purpose of this research was to explore this relationship. A descriptive survey was administered to a sample of undergraduate students at a large southeastern university. The survey was designed to assess the respondents' ability to define a set of scientific terms as a function of the respondents' educational background in science and foreign language. The results of the study indicated that coursework in sciences at the college level, and a major in a science-related field, were the most significant predictors of the respondents' ability to accurately define the scientific terms. This suggests that a strong background in science coursework, in addition to the traditional journalism courses, may provide the foundation that allows communicators to translate science-based information to the general public.

"Watch your language" may have an entirely different meaning for communicators who translate science-based research information for use by the general public than it did when Mom issued that warning. For communicators in the agricultural and natural resource disciplines, part of the job is to write for both specialized and general audiences. To promote science literacy and ultimately knowledge, this requires using the appropriate scientific term followed by a definition.

The concept of developing a scientifically literate public has gained momentum in the past decade (Maienschein, 1999). Organizations such as the American Association for the Advancement of Science, the National Academy of Sciences, and the National Science Foundation have all

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developed interpretations of what being scientifically literate means (National Research Council, 1996). Traditionally, those who communicate about science may have only the most cursory background in science or science communications (Treise and Weigold, 2002). Nelkin (1995) states that after formal schooling, people rely on the "filter of journalistic language and imagery . . . as major sources of information about these implications for their lives" (p. 2).

Bandura (1994) states that people are "self-reactors with a capacity for self-direction," meaning that they choose what they pay attention to and what they ignore (p. 63). Topics that require a lot of decoding are simply abandoned in favor of the familiar (Gregory, 2000). Fiske (1995) acknowledges that some people are "cognitive misers." They do not like to exert a lot of effort to think. To be scientifically literate, one must possess the ability to take newly presented information and interpret it in relationship to what one already knows. To effectively deal with continually changing scientific issues, individuals need to possess at least a basic knowledge of science.

To provide the framework for interpreting scientific information, the American Association for the Advancement of Science states that people need a basic inventory of key science concepts as a basis for learning (1990). These key concepts include the need to grasp the meaning of scientific terminology that goes beyond simply memorizing vocabulary. Systems, such as the one to classify taxonomy by Carolus Linnaeus, were developed to standardize and bring meaning to scientific endeavors (Hagberg, 1952). To a considerable extent, language determines how people see, comprehend, and characterize the world around them (Whorf, 1956). While many cultural linguists believe that domination of any one language in global affairs is a dangerous issue, this dictum does not apply to Latin in its service as the common language of science. Languages such as Latin supply word roots which provide a framework with which individuals can use as decoding skills to go from the known to the unknown (Arsky & Cherny, 1996).

Purpose and Objectives

The purpose of this study was to explore and describe the relationship between the ability to decode (define) scientific terms and the respondents' foundation in science and language curriculum. The terms developed for this study were both product- and process-oriented and represented terminology commonly found in mass communication.

The objectives of the study were to assess the respondents' overall ability to correctly decode and/or define a variety of scientific terms and to

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explore the relationship between the level of accuracy in defining the terms and the respondents' educational background in the sciences and foreign languages.

Methods/Procedures

The research design for this study was a one-shot case study in which a survey was administered to a convenience sample (*N*= 87) of undergraduate students attending a large southeastern university. The respondents were students in an agricultural writing course. To conduct this study, respondents were first asked to define a set of 15 scientific terms including six health-related terms, three biological terms, two technical terms, two environmental terms, one physics related term, and one made-up term.

The terms were selected by a panel of experts based upon the following criteria: 1) it was a commonly used term (e.g., menopause), and/or, 2) it had obvious word roots (e.g., xeriscape). A made-up word, purgaraphobia (fear of cleaning/vomiting), was developed to determine if any of the respondents were able to decode the word from its roots.

The definitions were coded by three independent coders using a scale of 0 – 3 where: 0 = no response, 1 = incorrect response, 2 = correct response but incomplete, and 3 = correct and complete response. Independent coder reliability was evaluated using Cohen's Kappa where results reported a reliability between coder 1 and coder 2 (.91), between coder 2 and coder 3 (.93) and between coder 1 and coder 3 (.91). Respondents were also asked to self-report about foreign language and science course work in high school and college as well as their major.

Results

The educational background of the respondents was stronger in the sciences than in foreign language; 65.5% (*N* = 57) declared themselves majors in a science-based field while 34.5% (*N* = 30) declared themselves majors in other fields. Nearly all of the respondents (*N* = 86) had science coursework at the college level with *M* = 22.13 hours. Only 25% (*N* = 22) had any foreign language at the college level with *M* = 1.64 hours.

The science-based majors had more than twice as many science credits at the college level. Science and foreign language course work at the high school level and foreign language course work at the college level were closely matched between the science-based and nonscience-based majors. None of the respondents reported majoring in languages.

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Table 1. *Means and Standard Deviations For Credit Hours of Course Work in the Sciences and Foreign Languages*

Science Major Course Work Background	*N*	*M*	*SD*	Non-science Major Course Work Background	*N*	*M*	*SD*
Science				Science			
High school	56	12.82	5.67	High School	30	11.50	4.14
College	55	27.15	6.83	College	30	11.07	6.05
Foreign language				Foreign Language			
High school	57	7.37	3.39	High School	30	7.30	2.89
College	56	3.68	1.54	College	30	1.90	3.10

The respondents were comprised of females 65.5% ($N = 57$) and males 34.5% ($N = 30$), ranging in age from 18 to 49 with a median age of 21. The ethnic makeup of the group was Caucasian (66.7%), Black (11.3%), Latin (10%), Asian (6%), and others (4.7%) who were a combination of African, European, and Middle Eastern.

Based on the coding scale described above, a score of 45 would indicate that the respondent had correctly and completely defined all 15 terms. For the 87 respondents, the minimum score was 10 and the maximum score was 40.2 with $M = 28.18$ and $SD = 7.26$.

The top three response types in each category were:

- Correct and complete response: menopause ($N = 69$), mitosis ($N = 64$), and osteoporosis ($N = 62$).
- Correct but incomplete response: fusion ($N = 64$), purgaraphobia ($N = 55$), and periscope ($N = 41$).
- Incorrect response: pulsar ($N = 35$), xeriscape ($N = 22$) and indigenous ($N = 16$).
- No attempt to respond: xeriscape ($N = 52$), pulsar ($N = 26$) and myocardial infarction ($N = 20$).

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Table 2. *Distribution of Responses in Defining Scientific Terminology*

Term	Correct (*N*)	Partial (*N*)	Incorrect (*N*)	None (*N*)	*M** (*N*)	*SD* (*N*)
Periscope	23	41	14	9	1.9	.92
Fusion	18	64	3	2	2.13	.57
Antibiotic	55	24	4	4	2.49	.79
Pheromone	37	31	6	13	2.05	1.07
Mitosis	64	16	6	1	2.64	.66
Myocardial infarction	41	23	3	20	1.98	1.20
Xeriscape	8	5	22	52	.64	.95
Leukocytes	42	24	7	14	2.08	1.10
Menopause	69	14	2	2	2.72	.62
Indigenous	44	10	16	17	1.93	1.22
Purgaraphobia	14	55	2	16	1.77	.94
Pulsar	12	14	35	26	1.14	1.00
Osteoporosis	62	19	6	0	2.64	.61
Genome	39	18	13	17	1.91	1.18
Carcinogen	54	18	5	10	2.33	1.02

*A coding scale of 0-3 was used where: 0 = no response, 1 = incorrect response, 2 = correct response but incomplete, and 3 = correct and complete response

An analysis of the relationship between the level of accuracy in defining the terms and the respondents' educational background in science and foreign language at the college level indicated that subjects who had more than two classes (6 credit hours) of foreign language coursework (classified as “high foreign language”) had the highest mean scores (*M* = 31.82) followed by subjects who were classified as “high science” with 4 classes (12 credit hours) of science coursework (*M* = 29.77). The results also indicate that subjects who had less than two classes (6 credit hours) of foreign language coursework (classified as “low foreign language”) had higher mean scores (*M* = 27.29) than subjects who were classified as “low science” with 4 classes (12 credit hours) of science coursework (*M* = 24.72).

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Table 3. *Accuracy of Respondents in Defining Terms with a Range of 0-45*

	N	*M*	*SD*
High science[a]	60	29.77	7.39
Low science	27	24.72	7.55
High foreign language[b]	17	31.82	6.62
Low foreign language	70	27.29	7.55

[a] High science = 12 or more credit hours at the college level and low science = 11 or fewer credits at the college level.

[b] High foreign language = 6 or more credit hours at the college level and low foreign language = 5 or fewer credits at the college level.

To assess these relationships predictively, multiple linear regression was conducted to explore which variables would significantly explain the largest portion of the variance associated with the respondent's level of accuracy in defining the terminology. Using the stepwise method, the independent variables of science-based major ($r = .423$, $p = .000$), cumulative science coursework ($r = .436$, $p = .000$), and cumulative foreign language coursework at the college level ($r = .231$, $p = .033$) were regressed against the dependent variable of overall score. The cumulative foreign language at the college level variable was subsequently dropped from the model. The final model with science-based major and cumulative science coursework at the college level explained approximately 23% of the variance in demonstrated ability to accurately define scientific terminology.

Conclusions and Recommendations

The results of this study indicate that extensive coursework in the sciences at the college level as well as being in a science-based major contribute to one's ability to accurately decode scientific terminology. Coursework in sciences at the high school and coursework in languages at the high school or college level were not, however, significant predictors of the ability to define scientific terms. Although generalization of the results is limited to this sample, these findings indicate that substantial coursework in sciences provides the background needed to decode and define scientific terminology, even outside of one's area of specialization, and thus enable respondents to possess to a greater degree the skills needed to be considered scientifically literate.

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The major limitation to the study was that the sample was not representative of the general public. Because the students were enrolled in an agricultural communications class, they would be more likely to have a more in-depth background in the sciences than in foreign languages. While convenience sampling can be a functional first-step in investigating an issue, additional research efforts should expand the pool of respondents to include participants whose foundation in foreign languages and science-based courses is more representative of the population.

Based on these findings, it can be argued that products, concepts, and processes described in scientific terminology used by experts may be counter-productive to communication. Communicators anticipating a career related to agricultural or natural resource industries may benefit from additional coursework in science.

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References

American Association for the Advancement of Sciences. (1990). Science for All Americans, New York: Oxford University Press.

Arsky, J.M. & Cherny, A.I. (1997). The ethno-cultural, linguistic, and ethical problems of the “Infosphere.” International Information and Library Review, 29, 251-260.

Bandura, A. (1994). Social Cognitive Theory of mass communication. In J. Bryant & D. Zillmann (Eds), Media effects: Advances in theory and research (pp.61-90). Hillsdale, NJ: Lawrence Erlbaum Associates.

Fiske, S. (1995). Self and identity. In A. Tesser (Ed.), Advance Social Psychology (pp. 149-193). NY: McGraw-Hill, Inc.

Gregory, A. (2000). Planning and Managing Public Relations Campaigns (2nd ed.). London: Kogan Page.

Hagberg, K. (1952). Carl Linnaeus. Jonathan Cape: London.

Maienschein, J. and Students. (1999). Commentary: To the future – Arguments for scientific literacy. Science Communicator 21(1), 75-87.

JAC, Vol. 88, No. 1, 2004, 43-50, ©ACE

National Research Council. 1996. National science education standards. Washington, D.C.: National Academy Press.

Nelkin, D. (1995). Selling science: How the press covers science and technology. Rev. ed. New York: Freeman.

Treise, D. & Weigold, M.F. (2002). Advancing science communication. Science Communications, 23(3), 310-322.

Whorf, B.I. (1956). Language, Thought and Reality. Selected Writings. Cambridge, Mass.: The MIT Press.

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