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ABSTRACT

This research describes the evaluation of a science curriculum newsletter called BioRAP which serves as a vehicle to teach current health science content. The research objectives were to estimate the relationships of socioeconomic status, ethnic group, gender, grade, student ability, and classroom use characteristics with student knowledge and self-efficacy outcomes after use of the newsletter. Topics covered in the specific newsletters studied include cancer, sun and skin, AIDS, and product safety. Results indicate that the newsletter continues to demonstrate positive achievement and student satisfaction outcomes with greatly expanded distribution and use by a diverse sample of youngsters, and that students clearly learn meaningful science content from BioRAP. The perspective and theoretical framework of BioRAP is also outlined. (DDR)

# A Health Newsletter To Teach Science Knowledge: BioRAP!

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## A Health Newsletter to Teach Science Knowledge: *BioRAP!*

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**Objectives and Purpose.** Keeping up with rapid developments in science poses a daunting challenge to publishers and school budgeters. Given that scientific information doubles every 10 to 15 years (Wilson, 1993), the facts and wisdom typically available via printed materials in schools are quickly outdated. Biomedical and technical developments advance at a particularly rapid pace. This research describes the evaluation of a newsletter, ***BioRAP,*** as a new vehicle to teach current health science content.

The objectives of the research were to estimate the relationships of socioeconomic status (SES), ethnic group, gender, grade, student ability, and classroom use characteristics with student knowledge and self-efficacy (SE) outcomes after use of ***BioRAP.*** Topics covered in the specific newsletters studied are all health-science related: Cancer, AIDS, Sun & Skin, and Product Safety. The research questions asked were:

- Do selected biographic and environmental variables predict student achievement on ***BioRAP*** topics?
- Do ethnic group, SES, or newsletter issue moderate the prediction of achievement?
- What SE perceptions do students have for general and specific health science tasks?
- Do ethnic group, SES, or newsletter issue moderate the prediction of efficacy perceptions?

**Perspective & Theoretical Frame.** ***BioRAP*** was developed by the nonprofit organization *Connecticut United for Research Excellence (CURE)* to teach youngsters about specific science topics and the scientific method in general. ***BioRAP*** issues are written for 6th to 8th grade students. Each ***BioRAP*** issue is 8 pages long and has several "columns," e.g, a description of the scientific method applied to contemporary problems, a cartoon presentation of facts, a profile of a science related career, a crossword puzzle of words introduced in the issue, a column on international extensions of information, etc. Distribution and evaluation of ***BioRAP*** is supported by a two-year Science Education Partnership Award (SEPA) from NIH (R25 RR10721-02). The objectives of SEPA funding include extending information about interaction of learner and classroom characteristics with achievement outcomes, revision and assessment of Teachers' Guide materials for ***BioRAP,*** national distribution of the newsletter, and estimation of students' self-efficacy for using science information. Funding has supported national distribution of ***BioRAP*** to over 200,000 students in geographically diverse states.

Distribution and systematic evaluation of ***BioRAP*** has been ongoing since 1992. To date there are 8 different issues of the newsletter covering a range of science topics. Materials are available in both print and electronic formats. Electronic dissemination of ***BioRAP*** is via the World Wide Web. The public posting of ***BioRAP***, without charge to teacher or student users, makes it particularly attractive as a classroom addition, given evidence of its effectiveness in conveying content and student satisfaction with the newsletter. Previous evaluation of ***BioRAP*** focused on development and use of psychometrically sound measures of student knowledge and satisfaction and identifying levels of student knowledge prior to ***BioRAP*** use (Froman & Owen, 1994a). A limited number of variables related to these outcome measures were studied. Pre-to-post testing was used to estimate levels of student knowledge. Across nearly 4,000 student tests, knowledge levels substantial pre-to-post change, moving from about 30% mastery of the topics to about 75 % at posttest. Achievement was independent of gender. Older students (8th grade) performed slightly better than younger (6th and 7th grade) ones. When asked to "grade"

***BioRAP***, students awarded an average mark of B to the newsletter (Froman & Owen, 1994b). Students' "grades" given to the different, specific columns in ***BioRAP*** were used to revise the newsletter format.

A social cognitive perspective frames the current research. In particular, student self-efficacy (SE) perceptions are of interest. SE, one's confidence for performing specific tasks, has been found to be predictive of behaviors chosen, attempted, persevered at, and succeeded at (Bandura, 1986). SE is distinct from knowledge alone about a task or behavior, and its importance in influencing behavior is now well documented (Bandura, 1997). Previous research showed that ***BioRAP*** changes students' knowledge, but little was known about the relationship between using the newsletter and students' sense of SE for health science-related tasks. Thus, items about specific and general perceptions of SE for science and health issues were included. Data on student SES and ethnicity were also collected for the current research.

**Data Source, Methods & Techniques.** For the multistate distribution of ***BioRAP***, contacts were made with school systems in various ways (i.e., professional meetings for science teachers, state organizations similar to CURE) and teachers were invited to participate. Free issues of ***BioRAP*** and accompanying Teachers' Guides, were offered for classroom use before ***BioRAP*** had been posted on the Web. So many teachers and students participated (>105,000 students) that data collection and analysis was limited to a sample of slightly under 16,000 student responses representing seven geographically diverse states. The sample included approximately 68% low SES, 30% middle SES and 2% high SES students. Ethnic group distribution shows about 63% of the sample to be Caucasian, 32% African American, 3% Hispanic and 2% Asian.

Student data collection sheets were systematically developed in previous research (Froman & Owen, 1997) and include 7-item, multiple-choice achievement tests specific to each issue. Item selection was based upon difficulty and discrimination indices (discrimination >.30 in pilot testing of items) and content sampling for each issue. Eight SE items were included for each issue. Four of the SE items on each form were specific to topics in the issue (i.e., "suggesting ways to reduce cancer" for the Cancer issue) and four were generic and common across all issues (i.e., "using information from science class in my own life"). Students self-reported efficacy perceptions on a 1 (very little confidence) to 5 (quite a lot of confidence) scale. These 4-item SE variables, hereafter referred to as the Issue Specific and Generic SE measures, showed simple factor structure on factor analysis for each 4-item group, explained between .79 and .87% of the item covariance, and showed alpha estimates from .74 to .84. Issue Specific and General SE were correlated with each other ($r$ = .49 to .52 across the issues) and SE scores and knowledge scores had correlations ranging from .15 to .18 on the four issues. Thus, SE perceptions, as expected, were relatively distinct from knowledge.

Additionally, data were collected describing SES, how BioRAP was used in classes (for award of a grade, supplemental instruction), and student achievement. For achievement, students self-reported the grades they typically get in school on a 5-point scale from "Mostly As" (5) to "Mostly Fs" (1).

**Analyses, Results, and Conclusions.** Across the four ***BioRAP*** issues, and across wide diversity in student SES, ability, and ethnic groups, achievement levels ranged from 71% to 73% correct. In self-efficacy measurement, General SE (across all issues) showed a mean of 3.98 (SD = .84) on a 5-point scale. Issue Specific SE was weaker, showing an average of 3.67 (SD = .82), with a range of 3.41 to 4.06 across the four issues.

Three direct regressions were arranged to predict (1) student achievement on ***BioRAP*** content items (2) General SE, and (3) Issue Specific SE. Each regression used three types of predictors: (1) biographical variables (e.g., gender, effect-coded ethnic group, self-reported GPA), (2) environmental variables (e.g.,

classroom use of ***BioRAP*** for award of a grade or not), and (3) either SE scores or achievement (depending on which outcome was specified). A canonical correlations for each issue using the three outcome variables (two SE measures and content achievement) as one vector and the predictors from the regressions as the second vector were also conducted.

When student achievement was regressed on the entire group of 12 predictors, adjusted $R^2$ across the four issues ranged from .16 to .21, which represent medium-large effect sizes (Cohen, 1988). Because the large sample size inflates the statistical significance of predictor variables, we focus on their effect sizes, or partial correlation squared). For each ***BioRAP*** issue, the only notable predictor was self-reported GPA, with $r_{part}^2$ = .04 to .08, or medium to medium-large effects. The prediction models were very stable across issue, suggesting that the results were not issue-dependent. Importantly, grade level, gender, SES, and ethnic group were *not* useful predictors of achievement on the ***BioRAP*** tests.

The prediction of General SE and Issue Specific SE gave quite similar results. For General SE, adjusted $R^2$ ranged from .32 to .38, and for Issue Specific SE, .30 to .37; these are all large effect sizes. In calculating partial effect sizes for individual predictors, only the counterpart SE measure showed strong explanatory power ($r_{part}^2$ = .24 to .30, large effect sizes). Like the achievement outcomes, science efficacy judgments were relatively independent of such things as grade level and ethnic status. And, like the prediction of achievement, ***BioRAP*** issue had no bearing on the regression results.

There were some issue specific differences found in the canonical correlations, but and one general pattern. The pattern showed student achievement of content to be related to self-reported GPA and satisfaction with the newsletter.

**Discussion and Educational Importance.** This research represents the most inclusive study to date of the outcomes of using ***BioRAP.*** In general, ***BioRAP*** has continued to demonstrate positive achievement and student satisfaction outcomes with greatly expanded distribution and use by a diverse sample of youngsters. Significant, meaningful gains in student knowledge are noted from pre-use estimates. When the sample of students was broadened to include of a wide range of SES, ethnic, ability and age groups, and when there were no conditions imposed upon newsletter use (i.e., for a graded classroom activity), achievement of content knowledge continued to be demonstrated. The regressions suggest that achievement and student SE depend very little on which ***BioRAP*** issue is used, student gender, age or ethnicity. Implications of the findings taken in total and considered in light of the current posting of ***BioRAP*** on the Web, are that the newsletter has the potential to be one of the most cost efficient means of getting current health science information to students. Students clearly learn meaningful content from ***BioRAP***. The consistency of students' award of a grade of B or better to ***BioRAP*** suggests that student consumers like the intellectually sound newsletter.

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BioRAP®
Biological Research for Animals & People.

# Looking for AIDS: Answers

When were you born? In the 1980s?

Did you know that the decade of the 1980s also was a time when scientists were first grappling with a frightening new disease called AIDS?

During your lifetime, AIDS, which stands for **Acquired Immune Deficiency** (dee-FISH-en-see) **Syndrome,** has become a major health crisis. In the United States, one out of every 250 people has the deadly AIDS virus.

AIDS is caused by the **human immunodeficiency** (ih-MEW-no-dee-FISH-en-see) **virus,** also known as HIV. This virus also is called the AIDS virus. It is different from other viruses, such as those that cause colds. The AIDS virus cannot infect people as easily as many other viruses. It can take a long time — up to 10 years or more — for the AIDS virus to make people sick. So a person can be infected with the virus but look and feel healthy, often for years.

Some people who have the AIDS virus are children, such as those who go to the Pediatric AIDS Clinic at Yale-New Haven Hospital in Connecticut. These young people are from a few weeks old to 14 years old. Most were born with the AIDS virus because their mothers had it.

These children want to have normal lives. "They go to school," says a nurse who works at the clinic. "They eat, drink and sleep like anyone else. The only difference is that they go to the doctor a lot and take medicines a lot."

Biological research is helping these children. New treatments are keeping them healthier for longer periods of time.

Still, we have a long way to go to conquer AIDS. There is no vaccine to protect against AIDS, as there are for other diseases. There is no cure. Researchers are working hard to find ways to overcome AIDS. HIV is the most intensely studied virus in the world.

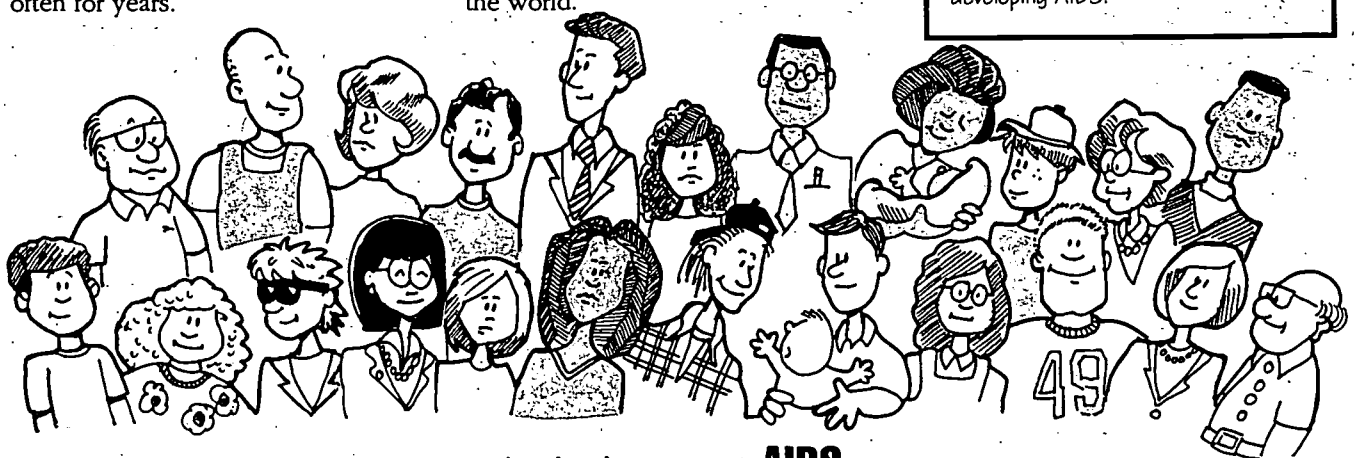
In the meantime, you can protect yourself from AIDS while still being good friends to people who have the virus.

## What AIDS Does To The Body

A few weeks after being infected with the AIDS virus, people may feel as if they have the flu with symptoms such as fever. They soon feel better, and many appear healthy for years. But the virus stays in their bodies.

Eventually, most people infected with HIV get AIDS. They become very sick because the virus has weakened their immune systems. The immune system is the part of the human body that fights disease.

People with AIDS are tired and lose weight easily. They get pneumonia and tuberculosis (diseases that can affect the lungs), brain infections, cancer and other illnesses. Sadly, many people die a year or two after developing AIDS.



Anybody can get **AIDS.**

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