An Empirical Evaluation of Knowledge, Attitudinal, and Behavioral Outcomes from Project Breathe:

2003-2004

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Executive Summary

This report contains findings and recommendations from a multi-disciplinary academic research team that was retained by InnerLink, Inc. to conduct an analysis of behavioral health and academic outcomes from students who used *Project Breathe* during the 2003-04 academic year. *Project Breathe* is a comprehensive repository of tutorials, learning modules, video clips, worksheets, laboratory experiments, and online information available for instruction in respiratory health and smoking prevention. The innovative curriculum provides the theory, skills and practical applications to facilitate a student becoming an informed advocate for smoking prevention.

The primary focus of the academic research team's work was to analyze student responses to a survey developed by InnerLink for *Project Breathe* in two main areas, changes in students' knowledge and attitudes toward smoking. The evaluators were Debra Vredenburg, Ph.D., Jeffrey Wimer, Ph.D., and Elizabeth Thyrum, Ph.D., each of Millersville University. Dr. Vredenburg is an Assistant Professor of Psychology whereas Dr. Wimer is an Assistant Professor of Wellness and Sport Sciences, and Dr. Thyrum is an Associate Professor of Psychology.

Using a series of statistical tests and computer software, the research team discovered that *Project Breathe* users stated fewer intentions to smoke cigarettes after completion of the *Project Breathe* activities than before exposure to the online leaning tool. These data were collected from a modified CDC survey and found to be statistically significant. Results also suggest that, although students in this sample showed no statistically significant changes in their overall pretest to posttest learning on the academic survey, new learning was noted in students' understanding of the scientific method, smokeless tobacco and spirometry—an

instrument that is used by pulmonary physicians for assessing their patients. Analyses of the first year (2003-2004) sample population suggest that students who interact with *Project Breathe* show statistically significant changes in their smoking-related attitudes. Improved research controls and enhanced tutorials, such as pop-up answer screens that tell students why a question is correct or incorrect may provide future evidence that interaction with *Project Breathe* can also affect significant gains in academic knowledge as well as student attitudes.

Project Abstract

An Empirical Evaluation of Knowledge, Attitudinal, and Behavioral Outcomes from Project Breathe: 2003-2004

Project Breathe is a web-based tobacco education and prevention program that is available to students in elementary and secondary schools across Lancaster County, PA and surrounding counties. As part of an early assessment of the impact of this program, 409 students used the program and completed portions of the online academic and behavioral assessments. For the purposes of this analysis, data from 280 students (grades 6-12) who completed both pretests and posttests as part of their in-school work with the *Project Breathe* program were examined. Several analyses were conducted, including a series of *t*-tests to explore changes from the pretest to posttest data. Results from analyses on the modified CDC behavioral intentions questionnaire indicated that students were significantly less likely to have intentions to smoke cigarettes in the near future and up to 5 years into the future ($t = -5.34, p < .001$). These data suggest that students who interact with *Project Breathe* are likely to favorably change their smoking-related intentions.

Outcomes and Assessment

General Overview

Due to an incomplete data set (i.e., not all students completed both the pre- and post-tests, some students completed only the academic questions and skipped the behavioral intention items [or vice versa], and some students omitted individual questions), the total number of students per analysis will vary. To properly gauge the effectiveness of *Project Breathe*, only the responses from students who completed both the pretests and posttests were analyzed. The symbol (N) refers to the number of students in the statistical analysis. P values (shown as the symbol *p*) indicate the probability that t-test results are due to chance. Therefore, $p \leq .05$ represents a meaningful difference between groups.

Academic Performance

An academic performance score was computed for the pretest and posttest. This score reflected the total number of correct answers. Therefore, the maximum number of correct responses was 12; the minimum was zero. There were 157 students who completed both the pretests and posttests in their entirety. A paired-samples t-test was used compare the pretest to the posttest performance. The results showed that there was not a statistically significant improvement in their overall academic performance (t (156) = -.090, p = .928). Students averaged 8.12 (SD = 2.18) points on the pretest and 8.13 (SD = 2.18) on the posttest.

Then the pretest and posttest answers for each individual question were analyzed. The percentage of students who gave the correct answer for the pretest and posttest questions were investigated. Improvements were demonstrated on questions regarding scientific method (question 6 & 7), diagnosis using spirometry (question 9) and smokeless tobacco (question 11). See Table 1.

Table 1.

Percentage of Correct Answers for the Academic Questions

	Pretest Percentage Correct	Posttest Percentage Correct	N
1. The respiratory system delivers oxygen to the body and gets rid of the body's excessive carbon dioxide. *Answer: True*	94.2	91.6	190
2. The heart and blood vessels comprise the respiratory system. *Answer: False*	46.3	46.8	188
3. Which of the following is responsible for delivering oxygen to every cell in your body? *Answer: All of the Above*	67.2	58.1	186
4. Smoking has been proven to: *Answer: Increase the risk of cancer, lung disease and heart disease*	26.2	22.4	183
5. COPD is a long-term effect of smoking that stands for Chronic Obstructive Pulmonary Disease. *Answer: True*	90.3	87.6	185
6. Doctors utilize the scientific method to help them diagnose and treat patients. *Answer: True*	73.2	77.0	183
7.When doing an experiment, one of the most important things is to be sure that your data shows what you want it to. *Answer: False*	56.4	71.3	181
8. It is easer to start smoking than to quit. *Answer: True*	87.0	75.0	184
9. Lung disease can be diagnosed in a physicians[*sic*] office using a low-cost test called spirometry. *Answer: True*	58.1	72.1	179
10.Which of the follow [*sic*] is an early sign of asthma? *Answer: All the above*	51.4	50.8	183
11. A safe alternative to smoking is smokeless tobacco. *Answer: false*	56.1	61.1	180
12. You can help reduce the risk and severity of heart disease and lung disease if you get someone to quit smoking. *Answer: true*	89.7	89.1	184

Behavioral Intentions Survey

Below are the pretest and posttest results from the modified version of the Centers for Disease Control and Prevention survey, which assessed behavioral intentions and attitudes toward smoking. To create a likert-type interval scale that would allow for statistical comparisons of the data, the responses were coded in the following way:

definitely yes = 1,
probably yes = 2,
don't know = 3,
probably no = 4,
and definitely no = 5.

Therefore, higher numbers indicated less agreement with the statements—a more negative attitude toward smoking.

All of the items, except for one, showed a statistically significant change from pretest to posttest, meaning that there was a difference in the pretest and posttest scores that was not simply due to chance alone, but rather the intervention (in this case, *Project Breathe*). Additionally, a composite attitude score consisting of items 1-8 was created. There were 257 students who completed both the pretests and posttests in their entirety. Overall, students indicated greater negative attitudes toward smoking on the posttest than on the pretest, thus demonstrating a significant change in attitude in the predicted direction (t (256) = -5.34, $p <$ .001). The average composite score for the pretest was 32.33 (SD = 5.80) and the posttest 33.99 (SD = 5.43).

Table 2. contains the average scores, t-values and probability level for items 1-8 on the survey. The total number of students who took both the pre- and post-test ranged from 280 to 271 per individual question.

Table 2.

Changes in Behavioral Intentions and Attitudes toward Smoking

	Pretest Average	Posttest Average	t-value	Probability Level (2-tailed test)
1. Do you think you will be smoking in 5 years from now?	4.47	4.58	-2.04	.042
2. Do you think you will ever use chewing tobacco or snuff?	4.70	4.74	-.80	.422 nonsignificant
3. Do you think that you will try a cigarette soon?	4.35	4.50	-2.69	.008
4. Do you think you will ever try a cigarette?	3.91	4.16	-4.17	.000
5. Do you think you will smoke a cigarette at anytime during the next year?	4.41	4.55	-2.72	.007
6. If one of your best friends offered you a cigarette, would you smoke it?	4.42	4.52	-2.02	.045
7. There is too much fuss being made about the dangers of smoking.	3.73	4.20	-5.21	.000
8. I would not like it if my friend were to smoke.**	2.30	2.67	-3.29	.001

**Students may have misunderstood the last item.

A breakdown of the percentage of students who answered either definitely yes, probably yes, don't know, probably no, or definitely no on the pre- and post-tests is provided in Table 3.

Table 3.

Percentages for Behavioral Intentions Survey

	Pretest Percentage	Posttest Percentage
1. Do you think you will be smoking 5 years from now? (N=280)		
Definitely yes	3.2	1.8
Probably yes	3.2	2.1
Don't know	8.9	9.3
Probably no	12.9	9.6
Definitely no	71.8	77.1
2. Do you think you will ever use chewing tobacco or snuff? (N =278)		
Definitely yes	1.1	1.1
Probably yes	2.9	1.8
Don't know	3.2	4.3
Probably no	10.8	7.9
Definitely no	82.0	84.9
3. Do you think that you will try a cigarette soon? (N =274)		
Definitely yes	4.4	3.3
Probably yes	6.6	2.9
Don't know	6.6	8.0
Probably no	14.6	12.4
Definitely no	67.9	73.4
4. Do you think you will ever try a cigarette? (N = 276)		
Definitely yes	5.8	4.0
Probably yes	13.0	10.5
Don't know	14.1	11.2
Probably no	18.1	14.5
Definitely no	48.9	59.8
5. Do you think you will smoke a cigarette at anytime during the next year? (N =275)		
Definitely yes	4.4	2.5
Probably yes	4.4	4.0
Don't know	8.4	6.2
Probably no	11.6	10.5
Definitely no	71.3	76.7

	Pretest Percentage	Posttest Percentage
6. If one of your best friends offered you a cigarette, would you smoke it? (N = 272)		
Definitely yes	2.9	1.5
Probably yes	5.9	3.3
Don't know	6.6	9.2
Probably no	15.8	13.6
Definitely no	68.8	72.4
7. There is too much fuss being made about the dangers of smoking. (N =274)		
Definitely yes	16.8	8.4
Probably yes	10.9	2.6
Don't know	8.0	13.5
Probably no	11.3	11.7
Definitely no	52.9	63.9
8. I would not like it if my friend were to smoke. (N =271)		
Definitely yes	53.1	45.0
Probably yes	8.5	7.0
Don't know	10.7	10.7
Probably no	10.3	10.7
Definitely no	17.3	26.6

Additional analyses on the behavioral items indicate positive results as well. Students were asked to estimate on how many days in the last month (30 days) they had smoked a cigarette. Table 4. shows the percentages for the pretest and posttest. The number of students who answered this question on both the pretest and the posttest was 268. Given that some students may have taken both the pretest and the posttest on the same day, the results would

not be accurate reflections of their behavior, and caution is warranted when interpreting these data.

Table 4.

Self-reported Number of Days of Smoking

During the past 30 days (one month), on how many days did you smoke cigarettes?	Pretest Percentages	Posttest Percentages
0 days	89.6	93.7
1-2 days	3.0	1.5
3-5 days	1.9	.4
6-9 days	1.5	.4
10-19 days	.4	.4
20-29 days	2.2	1.5
All 30 days	1.5	2.2
Total	100%	100%

The results for the last two items on the survey are less clear because of missing data. Item 10 asked students who smoked to estimate the usual number of cigarettes they had smoked on a given day during the past 30 days (one month). The percentages for the pretest and posttest estimates are presented in Table 5. Note that 40 students completed item 10 in the pretest and only 22 completed it in the posttest. Furthermore, given that some students may have taken both the pretest and posttest on the same day, these results would not be accurate reflections of their behavior and must be interpreted with caution.

Table 5.

Self-reported Number of Cigarettes Smoked

During the past 30 days (one month), on the days you smoked, how many cigarettes did you usually smoke?	Pretest Percentage N= 40	Posttest Percentage N =22
Number of cigarettes:		
0	70	77.3
1	7.5	0
2	2.5	0
3	2.5	0
4	2.5	0
5	0	4.5
6	5.0	0
7	2.5	0
8	7.5	18.2
total	100%	100%

Lastly, we examined whether self-identified smokers were willing to quit. This was the last item on the survey, question 11, which read, "Do you plan to quit smoking?" Only 13 students completed this question on both the pretest and posttest. There was no significant difference in their responses. Below is a breakdown of the frequencies for each response in Table 6. It is difficult to draw conclusions about this finding because of the small sample size, making the results highly unreliable.

Table 6.

Do You Plan to Quit Smoking?

	Pretest Number	Posttest Number
Definitely yes	0	0
Probably yes	4	2
Don't know	7	7
Probably no	0	2
Definitely no	2	2

Research Questions

As specified in the contractual agreement, we investigated several research questions posed by InnerLink, Inc. Listed below are the research questions and findings.

Contractual Questions

1. *What impact did PB have on health attitudes?*

From the preliminary data, it appears as though Project Breathe is having a positive influence on the health attitudes of students. It is clearly suggested by the data from the modified-CDC Behavioral Intentions Survey that students are endorsing greater anti-smoking attitudes after using Project Breathe.

2. *At what age or gender were attitudes most influenced by PB?*

3. *Which tutorials were most effective and in which age and gender groups?*

4. *Did students who were smokers, lived with smokers have a different experience or outcomes than those were not smokers?*

5. *How was PB used and by whom? Tutorials only?*

* Questions 2-5 cannot be answered, as this information (including demographics) was not provided by InnerLink, Inc.

Additional Research Questions

Below we have addressed additional questions posed by Dr. Robert Gillio via an e-mail correspondence of June 30, 2004.

1. *Does PB tutorials advance knowledge in the academics required in the curriculum?*

There is evidence that *Project Breathe* does increase knowledge in the areas

of scientific method (questions 6 & 7), physician diagnosis (question 9) and smokeless

tobacco (question 11) on the academic survey.

2. *In those students that saw CDC behavioral results, did they also have an academic*

benefit?

A Pearson Product Moment correlation coefficient was calculated between the posttest

behavioral intentions composite score (questions 1-8 combined) from the survey and the

overall posttest academic score. Coefficients (r values) closer to the value of ±1.00 are

considered strong relationships. There was no relationship between the variables ($r = -.055$, p

$=.655$).

3. *Did behavior results occur in students that already had a high knowledge level*

of tobacco issues before doing PB?

To test this question, another Pearson Product Moment Correlation coefficient was

calculated between the pretest academic score and the posttest composite score for behavioral

intentions. There was no relationship between the two ($r = .067$, $p = .589$).

4. *Was there any correlation between certain facts learned and the change in*

attitude? Was learning about cancer correlated with a higher change in attitude or

planned smoking behavior?

To address these questions, the posttest results from the academic questions were

correlated with the composite posttest attitude score from the Behavioral Intentions survey.

Point bi-serial correlations were run on the true/false questions and Pearson Product Moment

correlations on the multiple-choice items. No correlations were statistically significant or

close to thereof. The correlation r-values ranged from .016 to .182 .

Recommendations

The academic research team has several recommendations for improving *Project Breathe* and future research studies and collaboration. The recommendations are for consideration purposes only and <u>not</u> presented in any order of priority.

1. Develop "pop-up answer screens" for each academic test question. These pop-up answer screens would provide students with immediate feedback and the rationalization for why they answered an item correctly or incorrectly, and perhaps improve future knowledge in the area of respiratory health and smoking prevention.

2. Continued emphasis should be placed on making sure that *Project Breathe* users complete pretest and posttest assessments in order to ensure valid evidence-based outcomes. Missing data pose a serious threat to the quality of any research project. The InnerLink staff should continue to explore possible incentives for users who complete both pre- and posttests, and further develop mechanisms to track users (and instructors) in order to increase user compliance. In one possible example, perhaps an InnerLink employee could be assigned to send e-mail reminders to instructors who use *Project Breathe* in an effort to make sure their students complete posttests. Also, efforts such as making sure that there are "blocks" placed on the *Project Breathe* site is important. That is, users should not be able to navigate the *Project Breathe* site until completion of all pretest questions, and users should not be able to go to the next question on tests until they answer all previous questions. Additionally, upon initial log-on to Project Breathe, the computer should prompt students to complete questions

pertaining to basic demographics (e.g., age, gender, etc.) as specified in the research team's written communication from February, 2004.

3. Modify the current behavioral instrument that is used in *Project Breathe*. Specifically, new questions should replace current questions 9 and 10 on the modified CDC survey. Due to the inconsistencies in the time periods between completion of the pretest and posttest (i.e., some students may have taken both the pre- and posttests on the same day while others may have taken them days or even weeks apart), conclusions drawn from these two questions are technically inconclusive and should be treated with caution. In addition, question 8 should be reworded to avoid confusion.

4. As discussed in the recommendation above, the time interval between the pretest and posttest should be standardized or at least assessed. It is difficult to know how much time has elapsed between pretest results and posttest results. Perhaps these data are currently captured via the grade book feature of *Project Breathe*, and therefore, it would be interesting for future investigations, if Interlink, Inc. provided these data on a Microsoft Excel (database) format to the research team.

5. Improved informed consent procedures are needed. Efforts should be devoted to ensuring that students who participate in *Project Breathe* for research purposes are fully informed. This <u>may</u> be accomplished via an "I accept" clause after entering the site, a signed waiver distributed by a teacher, or a take-home parent/guardian permission slip.

6. The evaluation team continues to believe that the current academic test is not appropriate for all ages, and therefore, should be divided into two exams (i.e., a middle school test and a high school test) based on appropriate learning and language norms. For example, a term such as spirometry is, in our view, not appropriate for a curriculum advertised for K-12 students. Kindergarten, and many elementary students, will not understand this and other terms. Therefore, we suggest that a professional development tutorial be developed for instructors of *Project Breathe* so that they understand how academic tests may be appropriately used and for which grade levels. *Project Breathe* contains some excellent resources for elementary school teachers, however the tutorials, in our view, are more appropriate for middle and high school students. It is not clear which tutorials (if any) are appropriate for Kindergarten students, however, advertising for Project Breathe does not currently make this distinction. Furthermore, the tutorials that are appropriate for middle and high school students should include recommended grade ranges.

7. Consider development of a *Users Guide Manual* that would accompany materials in the Project Breathe Experiments Kit, which is distributed to teachers. The manual would inform new users how to access the program and recommend how to incorporate the tutorials and other activities into existing curriculum including recommendations specifically targeted for elementary, middle, and high school teachers. Perhaps this manual could also be placed online.

8. To support the interdisciplinary approach that Project Breathe has taken, perhaps consider adding tutorials or other components that emphasize the social components and decision-making aspects of remaining smoke free.

Future Study

Given the early success of *Project Breathe*, further study is warranted. In fact, there are several areas of study (and research questions) that should be investigated. For example,

1. How do instructors use *Project Breathe?* This could be determined by analyzing the results of a "customer satisfaction survey" provided to InnerLink, Inc. by Dr. Wimer on July 10, 2004. Portions of this survey could be used to gauge how *Project Breathe* is used as a professional development tool to enhance a teacher's day-to-day interactions with his or her students.

2. In which student age groups does *Project Breathe* appear to have the most impact?

3. Do boys or girls have better results with *Project Breathe*?

4. Do students from urban areas use *Project Breathe* more often (and with better results) than students from rural or suburban areas? This could be determined by having students enter their Zip Code of residence when they log on.

5. How does living in a residence with another smoker (a person who smoked in the last 30 days) influence *Project Breathe* user results?

6. Does a user's ethnicity or race influence results or *Project Breathe* usage patterns (i.e., being African-American, Asian/Asian-American, Caucasian, Latino/a, Native-American, Other)?

7. What effect does *Project Breathe* have on poor-performing or at-risk students? This could be determined by having students enter their grade average from their most recent report card (i.e., A, A/B, B, B/C, C, C/D, D, Below D) and calculating how they respond to the various tutorials.

8. What effect does Project Breathe have on a school population? This could be determined by measuring student attitudes (in perhaps a homeroom setting) at the beginning of a new academic year (September) and again at the end of the school year (May). In addition, focus groups and interviews could be conducted with students and staff. These results could then be compared with a "control school" in which *Project Breathe* was not utilized.

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Appendix

The following pages include hard copies (with notes) of SPSS analyses used in developing this report.