Signs: Simple Studies Offer Strategies to Engage Undergraduate Students

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Abstract

This article describes three studies that were designed to provide undergraduate students with opportunities for hands-on experience in research. Students were involved in all aspects of the studies - from the development of the research questions to the reporting of the results. The studies examined the effectiveness of signs and posters in influencing three health behaviors: taking stairs instead of elevators, complying with a smoking policy, and cleaning fitness equipment after use. In the stair study and the fitness equipment study, signs and posters were associated with significant increases in the desired behaviors. The smoking policy study results indicated that signs and posters were not effective in motivating people to comply with the policy.

Both the original and the updated competency based frameworks for health educators include an area of responsibility as well as competencies and sub-competencies that focus on research and evaluation skills for entry level health educators (National Commission for Health Education Credentialing, Inc, 1996; National Commission for Health Education Credentialing, Inc., Society for Public Health Education, and American Association for Health Education 2006). In addition, health educators are encouraged to use evidence-based or research-based interventions and strategies in implementing their health education.

In health education, linkages between research and practice are vital to the profession. There have been, however, concerns about gaps between research and practice. Kerner (2006) writes that little is known about how to ensure that what is learned from scientific research informs and improves what is done to reduce the burden of chronic disease in the US. One way to bridge this gap is to engage future health education practitioners in the practice of research. Becker (2005) asserts that through participation in research, undergraduate students become better prepared to make informed decisions, work and communicate in teams, and solve complex problems. Lopatto (2006) contends that undergraduate research is valuable because it may facilitate empowered learning, informed learning, and responsible learning. And Crowe (2006) posits that participating in undergraduate research stimulates students' enthusiasm for the subject. The results of Lopatto's (2004) study of students at 41 institutions supported the hypothesis that the educational experience of undergraduate students is enhanced by their participation in research.

In order to provide undergraduate health education students opportunities to actively participate in the research process from start to finish, small scale studies were integrated into the curriculum of an upper level undergraduate health education class. Completing a research study during the course of one semester poses a major challenge, so efforts were made to investigate problems and methods amenable to completion in a short period of time. Because observational studies evaluating the effectiveness of signs and posters are feasible to complete during a one semester course, signs and posters became the general theme of the studies. The purposes of the studies reported here were to determine if signs and posters were effective in promoting three different behaviors: using stairs instead of elevators, complying with the college policy regarding outdoor smoking, and cleaning fitness equipment after use.

Signs

Signs are ubiquitous in our society; they are widely used to advertise goods and services, convey directions and information, and communicate regulations, reminders, and warnings. Signs and posters have been used for centuries as a basic form of communication designed to influence and direct behavior.

Researchers have evaluated the effectiveness of signs and their impact on a variety of behaviors, including health related behaviors. Signs encouraging individuals to use stairs rather than elevators or escalators have been studied and have been found to significantly increase stair use in a variety of settings, including a Centers for Disease Control and Prevention (CDC) building (Kerr, Yore, Ham, & Dietz, 2004), a bank, airport, office building, and library (Coleman & Gonzalez, 2001), and a shopping mall (Kerr, Eves, & Carroll, 2001).

Nutrition behaviors positively impacted by signs include increased purchases of low fat snacks (French et al, 2001), and increased purchases of brown rice instead of white rice (Jason & Frasure, 1980). In addition, researchers have found that handwashing behavior (Burak, Tellier, & Dembiec, 1998), recycling (Werner, Byerly, White, & Kieffer, 2004), and medication safety (Pape et al., 2005) have been positively and significantly impacted by signage.

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The Studies

All three studies were conducted on a medium sized suburban college campus with an enrollment of approximately 10,000 students. The studies were approved by the college's Institutional Review Board (IRB). All three used observational methods to determine the effectiveness of signs and posters. Two of the studies were integrated into an undergraduate class; the third involved undergraduate students, but it was not part of a class curriculum.

Although the classes as a whole developed the research questions and hypotheses, and much of the coordination and the work of 'fitting pieces together' was done during class time, all students had roles to play and tasks to accomplish outside of the classroom. Tasks included completion of IRB applications; review of the literature; data collection protocol development; data collection; obtaining permission to post signs; printing, enlarging, laminating signs; posting and monitoring signs; central data recording and descriptive data analysis. At the beginning of each class session, students reported their progress, shared materials, and made arrangements for the next steps of the process. The professor provided guidance, feedback, and monitoring to assure the rigor of the methods. She also assisted with the data analysis as not all of the students were familiar with significance testing. At the end of the semester, students presented the research at the college's undergraduate research symposium.

Study 1 – The Stair Project

Background.

That many Americans are overweight and insufficiently active is now common knowledge. Lack of exercise and obesity contribute to a host of health problems including hypertension, diabetes, and cardiovascular diseases. Keating, Guan, Pinero, and Bridges' (2005) meta-analysis of studies examining college students' physical activity found that between 40 and 50% of college students are inactive. Public health recommendations that individuals accumulate 30 minutes of moderate level activity per day (Pate et al., 1995) can be met with a variety of activities, including stair climbing. This study sought to determine the effectiveness of signs and posters urging individuals to use stairs instead of elevators.

Methods.

Prior to developing an observational protocol and collecting baseline data, two buildings on the campus were chosen for the study. Although all buildings on the campus have elevators, most of the buildings are two or three stories high and don't get much elevator traffic. The two buildings that were chosen were the campus library and a first-year student residence hall. These buildings were chosen because in both buildings the stairs are located next to or across from the elevators and because of the volume of elevator traffic.

Before the baseline data were collected, the signs for the project were chosen. These signs were downloaded from the CDC StairWELL to Better Health website, which has 14 downloadable ready-to-use signs available for public use (CDC, 2006). The four signs used in the study were chosen from the 14 by a group of students who chose the signs that they believed would be most motivating and would have the most appeal to the college population. The signs were printed, enlarged to poster size, and laminated. Permission was obtained to post signs, and facilities personnel were advised that the signs should not be removed.

An observational protocol was developed that designated the days and times for data collection. Four data collection periods at different times of the day were selected for data collection at each building at each of the three phases of the study: baseline before sign posting, while signs were in place, and after signs were removed. Data collectors stood or sat unobtrusively where they had a clear view of the stairs and elevators. They used tally sheets to record the number of individuals using the elevators, the number of individuals using the stairs, and the gender of the individuals. Each tally sheet was pre-printed with the name of the observer, date and time of observation, building name and location within the building. The sheet was designed in columns and rows; the column titles were "male" and "female"; the rows were "entering elevator," "exiting elevator," "going up stairs," and "going down stairs." Observers entered hash marks in the appropriate cells. Excluded from observations were disabled individuals as well as library staff who were wheeling carts and facilities staff with cleaning supplies.

Results.

During baseline data collection, 1337 individuals were observed in the two buildings; 869 (68%) used the stairs and 468 (32%) used the elevators. Signs were then posted and monitored to assure that they remained in place and were not defaced. Several weeks after the signs were in place, data were again collected on the same days of the week and during the same time periods as the baseline data collection. At this time, 1426 individuals were observed; 1070 (75%) used the stairs and 356 (25%) used the elevators.

Chi square analyses indicated a significant increase in the frequency of stair use ($\chi^2 = 33.21$, $p < .001$). After one month, the signs were removed and data were once again collected at the same days and times. At this final data collection, 1328 individuals were observed; 980 (74%) used the stairs, and 348 (26%) used the elevators. Table 1 shows the gender and building breakdowns of the data.

Study 2 – Smoking Policy

Background.

The Environmental Protection Agency declared environmental tobacco smoke a Group A carcinogen in 1993 and concluded that it posed a serious public health risk. The recent Surgeon General's Report (U.S. Department of Health and Human Services, 2006) reiterated the dangers of secondhand smoke, indicating that it has immediate adverse effects and causes premature death and disease, and concluded that there is no risk free level of exposure to secondhand smoke.

The college smoking policy prohibits smoking in most indoor campus locations, and cites risks of second hand smoke as the rationale for informing individuals who smoke outside of college buildings that they should do so 20 or more feet away from entrances and windows. The purpose of this second study was to determine if signs would make smokers more likely to comply with the college policy regarding outdoor smoking.

Methods.

For this study, two campus buildings were also chosen. Prior to deciding which buildings to involve in the study, all campus buildings were systematically observed over five days to determine which ones had entrances where people seemed to congregate and smoke. The two buildings that were chosen were the campus center (student union) and the technology center.

The signs used in this study were brightly colored straightforward signs that simply stated that college policy required that individuals smoking cigarettes must do so 20 or more feet away from building entrances. The signs were printed, enlarged, and laminated.

Prior to baseline data collection, unobtrusive marks were placed precisely 20 feet from the entrances to the two buildings. Permission was obtained to post the signs, and facilities personnel were advised not to remove the signs.

Data collection protocol described 27 baseline data collection times over the span of one week. Most of the collection times coincided with intervals between class times. Data collectors sat on benches at building entrances where they had a clear view of the entire entrance area. They used tally sheets concealed among books and papers to mark the numbers of smokers inside and outside the 20 foot markings. The simple pre-printed tally sheets identified the observer, the date and time of observation, the building name, and two columns (inside 20 feet, outside 20 feet) where the students simply entered hash marks representing individuals who complied or did not comply with the policy.

After collection of the baseline data, signs were posted at the entrances of the buildings. The signs were monitored daily to make sure they remained posted. After signs were posted, data were again collected during the same 27 time periods.

Results.

At baseline data collection, 272 smokers were observed in front of the two buildings. Seventy four (27.2%) of

Table 1

Stair and Elevator Use by Gender and by Building

			Library			
	n		Elevator		Stairs	
	Males	Females	Males	Females	Males	Females
Baseline (n=620)	243	377	32 (13.2%)	48 (12.7%)	211 (86.8%)	329 (87.3%)
Signs posted (n=795)	304	491	18 (5.9%)	45 (9.2%)	286 (94.1%)	446 (90.8%)
Signs removed (n=730)	310	420	27 (8.7%)	50 (11.9%)	283 (91.2%)	370 (88.1%)
			Dormitory			
	n		Elevator		Stairs	
	Males	Females	Males	Females	Males	Females
Baseline (n = 717)	319	398	175 (54.9%)	213 (53.5%)	144 (45.1%)	185 (46.5%)
Signs posted (n = 631)	269	362	129 (47.9%)	164 (45.3%)	140 (52.1%)	198 (54.6%)
Signs removed (n = 598)	244	354	136 (55.7%)	135 (38.1%)	108 (44.3%)	219 (61.2%)

Table 2

Numbers of Individuals Complying with Outdoor Smoking Policy at Two Buildings

	Campus Center		Technology Center	
	n	Compliers	n	Compliers
Baseline	70	23 (32.9%)	202	51 (25.25%)
Signs posted	36	11 (30.1%)	109	34 (31.2%)

individuals complied with the policy and smoked their cigarettes at least 20 feet from the building entrance. When data were collected with the signs in place, 145 smokers were observed during the data collection periods, with 45 (31.03%) individuals smoking at least 20 feet from the building entrances. Chi square analyses showed this increase to be not significant. Table 2 shows the building data details.

Study 3 – Gym Germs

Background.

The recent emergence of community acquired methicillin resistant staphylococcus aureus (MRSA) skin infections among otherwise healthy people, including athletes, is a cause for concern and for vigilance in prevention and control (CDC, 2003). Cohen (2005) includes sharing of equipment along with direct physical contact and sharing clothing as possible means of the transmission of MRSA in individuals who participate in athletic activities.

Hygiene is the first line of defense against the spread of many communicable diseases, and although List (2005) recommends that athletes avoid sharing equipment, he indicates that when equipment sharing is unavoidable, the next best option is cleaning equipment after each use. The purpose of this study was to determine if signs urging fitness center patrons to clean exercise equipment after use would increase the frequency of cleaning.

Methods.

The "Gym Germ" study took place in the college's fitness center. The center is a 9000 square foot facility, used by students, faculty, and staff. Equipment consists of 113 stations – 48 cardio/aerobic machines, and 65 resistance stations. Ample containers of spray cleanser and towels are available in various prominent locations throughout the facility.

The two signs developed for this study included one with pictures of amusing yet unpleasant looking germs and text that urged patrons to clean the equipment and "get the gym germs before they get you". The other sign was a simple graphic of the common bright red octagonal stop sign, with text that read "Stop Gym Germs" and a request to wipe down all equipment and machines after use. The signs were presented to a group of individuals representative of fitness center patrons; these individuals provided feedback that resulted in slight modifications in the signs.

The signs were printed, enlarged, and laminated. Only the director of the fitness center was aware of the study. None of the staff or student workers were aware that observations would be made of the facility's patrons.

Data were to be collected during nine different one-hour intervals over the course of one week. Data collectors were trained to identify up to 25 individuals that they could track over each time period. The data collectors stayed on treadmills or elliptical machines and used tally sheets to record numbers of individuals cleaning the equipment, types of equipment being used, and gender of those being observed. The tally sheets included space to jot down descriptions or comments that helped in tracking the identified individuals. As with the other studies, the tally sheets were pre-printed with the name of the observer, and the date and time of observation. These sheets were arranged in columns and rows. The first column had the numbers 1 to 25 listed in the rows; the other columns were "gender," "cardio machine," "weight machine," "free weights," "wipes," and "does not wipe." The observers merely put marks in the appropriate cells. After one week of baseline data collection, ten posters/signs were posted in the fitness facility; they were monitored daily to insure that they stayed up. One week after the signs were posted, data were again collected during the exact same nine data collection periods. The signs remained in place for two months; they were then removed, and data were once again collected at the same nine collection days and times.

Results.

During the baseline data collection period, 188 individuals were observed in the fitness facility. At this time, 69 (36.7%) wiped the machines/equipment after use. When the signs were in place, 226 fitness center patrons were observed, and 159 (66.37%) of them cleaned the equipment, a significant increase ($\chi^2 = 38.087$, $p < .0001$). After the signs had been removed, 204 individuals were observed during the data collection times; 119 (58.33%) were observed wiping down the machines/equipment. Females were more likely to clean the equipment than males ($\chi^2 = 88.9$, $p < .0001$) and aerobic equipment was more likely to be cleaned than

Table 3

Individuals Wiping Exercise Equipment, by Gender and Equipment Type

	Males		Females	
	n	#s wiping equipment	n	#s wiping equipment
Baseline	79	11 (13.9%)	109	58 (53.2%)
Signs posted	85	37 (43.5%)	141	113 (80.1%)
Signs removed	91	34 (37.4%)	113	85 (75.2%)
	Aerobic Equipment		Resistance Equipment	
	n	#s wiping equipment	n	#s wiping equipment
Baseline	98	47 (48.0%)	90	22 (24.4%)
Signs posted	136	106 (77.0%)	90	44 (48.9%)
Signs removed	119	83 (69.7%)	84	35 (41.7%)

resistance equipment ($\chi^2 = 49.83$, $p < .0001$). A more detailed breakdown of the data can be seen in Table 3.

Discussion

The Studies

In two of the studies, the data suggest that signs can be effective in bringing about behavior change. The stair study results are consistent with other studies showing that more people will use stairs rather than elevators when they are reminded with simple and inexpensive signs or posters (Colemen & Gonzalez, 2001; Kerr, Eves, & Carroll, 2001; Kerr, Yore, Ham, & Dietz, 2004). The results of the "Gym Germ" study are also very encouraging. The notable increase in the number of individuals engaging in the simple hygienic behavior of wiping equipment may possibly translate into a reduction in transmission of a variety of pathogens. In both the stair and gym studies, the desired behavior remained higher than baseline even after the signs were removed, indicating a possible sustainability of behavior change. The results of the smoking study were somewhat disappointing. Not only were there more smokers within the 20 feet of one of the building entrances when the signs were in place, the smokers were also observed ripping down the signs on several occasions.

Stair climbing, wiping equipment, and complying with policies are different types of behaviors. While individuals can see a benefit to themselves by walking up the stairs and wiping down the gym equipment, complying with a policy to stay 20 feet from a building while smoking has no individual benefit. Also, the college's policy is not enforced, so along with no benefit to policy compliance, there is no detriment or disadvantage to policy non-compliance. Brehm's (1966) reactance theory offers a possible explanation for the slight increase in non-compliance with the policy at one of the sites. Reactance theory explains how people react to losses of freedom, and posits that a behavior that is threatened with elimination results in the increased attractiveness of the threatened behavior. The increased attractiveness of the behavior motivates people to restore their freedom of behavior. So if the smokers felt that their freedom to smoke in front of the building was threatened by the signs, they resisted by not only disregarding policy but also by tearing down the signs.

The three studies reported here have many limitations and delimitations. The studies took place at one institution and findings cannot be generalized to other college or university settings. Clearly, it is difficult to gauge if factors other than the signs may have been responsible for the behavior changes. Another limitation was the inability to determine if different sets of individuals were present during the different data collection times. Many students, however, maintain regular schedules for class attendance, meal times, and exercise activities. Hopefully, this minimized limitations somewhat. The use of a limited number of buildings on campus and the collection of data on weekdays only may also limit the results of these studies.

Although multiple observers were present at the data collection points, they were assigned to observe different areas of the fitness center and different doors, stairways, and elevators in their assigned buildings. The limited number of student data collectors made it impossible to assign multiple observers to the same door, elevator, stairway, or gym section. The resultant inability to assess the reliability of the observations poses another threat to results of the studies. More students and more time could have resulted in more rigorous methods and more credible results.

Signs are a simple and inexpensive intervention that may have a role in public health education campaigns. More

studies on larger scales, however, need to be conducted to evaluate the effectiveness of signs on health related behaviors as well as the populations that are most impacted by signs and posters. In addition, research examining how signs influence behavior and the impact of signs on long term behavior change would be beneficial.

The Process

Engaging undergraduate students in research studies as part of health education classes has clear benefits. Two basic assumptions of experiential learning theory are that persons learn best when they are personally involved in the learning experience and that knowledge has to be discovered by oneself if it is to have significance (Kolb, 1984; Kolb & Fry, 1975). The research studies reported here provided students with opportunities for hands-on involvement and discovery. The students learned important research skills and they learned about cooperation and collaboration. Students learned that health education interventions can make a difference and they developed confidence in their own abilities.

The process was, however, not without problems. Dividing individual tasks equitably was problematic – laminating posters does not carry the same weight as preparing an IRB application. An attempt to address this was made by describing each task and what it entailed, grouping and combining certain tasks, and creating a sign-up system wherein students volunteered for tasks. In most cases, students were able to get their first or second choices. Because everything had to be accomplished within the time frame of one semester, accomplishing tasks in a timely manner was essential. A quick turn around time by the Institutional Review Board was helpful as was the ease with which students were able to get appropriate permissions for sign postings. Some students, however, did not get their assignments done on time, and that only served to hold other students up and delay their abilities to do their respective assignments. A few interpersonal squabbles arose; these provided learning opportunities about the realities of working with groups or teams. Because so many individuals were involved in the studies, more classroom time than anticipated had to be devoted to coordination, communication, and making sure that all students were on the same page. After the first study, this problem was addressed by appointing two students, who were taking the course for honors credit, as project coordinators. These two students coordinated the activities and assignments of the other students, and were able to accomplish many of the day-to-day organizational tasks outside of class.

Overall, the benefits of the process far outweighed the barriers and problems. The positive and congratulatory feedback that the students received at the undergraduate research symposia and the local conferences where they presented the studies served to validate their efforts and enhanced their identification with and their pride in their chosen field of health education.

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