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Knowledge and the Prediction of Behavior: The Role of Information Accuracy in the Theory of Planned Behavior

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The results of the present research question the common assumption that being well informed is a prerequisite for effective action to produce desired outcomes. In Study 1 ($N = 79$), environmental knowledge had no effect on energy conservation, and in Study 2 ($N = 79$), alcohol knowledge was unrelated to drinking behavior. Such disappointing correlations may result from an inappropriate focus on accuracy of information at the expense of its relevance to and support for the behavior. Study 3 ($N = 85$) obtained a positive correlation between knowledge and pro-Muslim behavior, but Study 4 ($N = 89$) confirmed the proposition that this correlation arose because responses on the knowledge test reflected underlying attitudes. Study 4 also showed that the correlation could become positive or negative by appropriate selection of questions for the knowledge test. The theory of planned behavior (Ajzen, 1991), with its focus on specific actions, predicted intentions and behavior in all four studies.

Only when well informed can we act effectively to produce desired outcomes. This article of faith is frequently invoked to explain a wide range of detrimental lifestyle behaviors. Uninformed or misinformed, people eat an unhealthy diet and don't exercise enough, engage in unsafe sex, abuse drugs and alcohol, fail to protect themselves from the harmful rays of the sun, and pollute the environment. Beyond detrimental lifestyles, when poorly informed, people fearfully avoid members of outgroups, investors succumb to "irrational exuberance," and a nation's leader embarks on misguided policies.

A well-informed citizenry is the essential backbone of a free society, and few would dispute the value of more and better information. Yet the possession of accurate information is no guarantor of wise judgments, nor is misinformation necessarily a precursor of bad decisions. It is an empirical question as to whether accurate information encourages people to act in their own or society's best interests, and whether lack of information has detrimental implications for effective action, that is, action that produces desired outcomes. This article examines the effects of accurate information or knowledge on people's attitudes and decisions.

One indication that there may be no simple relation between level of accurate information and behavior comes from research on the prevention of AIDS. Surveys indicate that in many at-risk populations, knowledge about AIDS, its causes, and transmission routes is quite high while adoption of safer sex practices in these populations remains low (e.g., Calsyn, Saxon, Freeman, & Whittaker, 1992; DiClemente, Forrest, & Mickler, 1990; see Helweg-Larsen & Collins, 1997). In their review of this literature, Helweg-Larsen and Collins further observed that "the many research efforts aimed specifically at examining the relation between knowledge about AIDS . . . and preventive behaviors suggests overwhelmingly that this relation is weak or nonexistent" (p. 23). Consistent with this conclusion, a meta-analysis of seven data sets dealing with general AIDS knowledge and intentions to use condoms (Sheeran & Taylor, 1999) found a relatively low mean weighted correlation of .21, and general AIDS knowledge has not been found to account for much variance in actual condom use behavior (e.g., Ananth & Koopman, 2003).

Dissociations between knowledge and behavior have been documented in other domains as well. For instance, weak or nonsignificant findings have been

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reported with respect to the relation between knowledge about colorectal cancer screening and actually getting a screening (Guerra, Dominguez, & Shea, 2005), knowledge about breast cancer and performing breast self-examinations (Schlueter, 1982), knowledge about organ and tissue donation and signing a donor card or registry (Feeley & Servoss, 2005), and knowledge about diabetes and compliance with a diabetes control regimen (Spirito, Ruggiero, Duckworth, & Low, 1993). Similarly, in two studies (Ievers-Landis et al., 2003; Silver Wallace, 2002), knowledge about osteoporosis among young women was found to be largely unrelated to exercising and calcium intake, two recommended preventive behaviors. According to Silver Wallace (2002), "knowledge has been consistently shown to be noninfluential in predicting behavior" (p. 170).

Of interest, these negative findings have made barely a dent in the conviction that accurate information is a critical determinant of self-protective behavior. Thus, while reporting that "HIV/AIDS knowledge was not significantly related to use of condoms" (p. 538), Ananth and Koopman (2003) recommended that "intervention efforts may benefit from dispelling misconceptions about AIDS" (p. 529). Indeed, many health professionals continue to believe that ignorance is the primary reason for the spread of HIV/AIDS (see Helweg-Larsen & Collins, 1997) and for other health-related problems.

In critical analyses of this literature and in their theoretical formulations, investigators typically conclude that knowledge, although necessary, is not sufficient to produce the desired behavior (see, e.g., DiClemente, 1989; Fisher & Fisher, 1992). It is usually argued that, in addition to having the required knowledge, people must also be motivated to perform the behavior in question. In Fisher and Fisher's (Fisher & Fisher, 1992; Fisher, Fisher, Williams, & Malloy, 1994) information-motivation-behavioral skills model, for example, knowledge and motivation jointly influence behavior, either directly or indirectly via their effects of behavioral skills. However, research with this model has shown that knowledge does not consistently influence behavior, and when it does, its effects on behavior tend to be relatively small and mediated by behavioral skills (e.g., Fisher et al., 1994; Misovich, Martinez, Fisher, Bryan, & Catapano, 2003).

KNOWLEDGE, INFORMATION, AND BELIEFS

In this article we take issue with the proposition that knowledge is a prerequisite for effective action. Indeed, relying on work with the theory of planned behavior (TPB; Ajzen, 1991), we propose that knowledge is neither sufficient nor necessary and try to show why knowledge, as typically conceptualized and assessed, fails to predict behavior. Knowledge tests consist of a series of factual assertions and participants are asked, for each assertion, whether they believe that it is true or false. *Degree of knowledge* is ascertained by counting the number of responses considered to be correct by some objective standard.

It is important to distinguish between knowledge, as just defined, and amount of information. For example, to assess amount of information, Wood (1982; Kallgren & Wood, 1986; Wood & Kallgren, 1988) asked participants to indicate how well informed they were with respect to a given topic or counted the number of belief statements participants could list in a short period. In the current research we were not interested in the *amount* of information people possess. Instead, we examined the role of knowledge, that is, the extent to which the information people have is accurate.

In the TPB, beliefs constitute the informational foundation that ultimately determines behavior. Note, however, that the theory deals neither with amount of information (i.e., with the number of beliefs people hold) nor with the accuracy of that information. Unlike knowledge, the beliefs in the TPB may be incorrect, they may reflect wishful thinking or be biased in other ways, and they may be unrepresentative of the information that is considered important in a given behavioral domain. Nevertheless, these beliefs are assumed to guide intentions and behavior. Specifically, beliefs about a behavior's likely consequences (behavioral beliefs) are assumed to determine *attitudes toward the behavior*, beliefs about the expectations and behaviors of others (normative beliefs) are assumed to determine *subjective norms*, and beliefs about potential facilitating or inhibiting factors (control beliefs) are assumed to determine *perceived behavioral control*. Attitudes, subjective norms, and perceptions of control in turn combine to produce intentions which, together with actual control, determine performance of the behavior. (For a discussion of the theory, see Ajzen, 2005.)

(IN)VALIDITY OF KNOWLEDGE TESTS

We now consider why scores on common knowledge tests often fail to predict behavior. First, and foremost, such tests may actually fail to assess knowledge. Faced with questions about cancer, AIDS, the environment, energy conservation, or the health care system—issues about which they may have only limited information—individuals may simply guess at the correct response. Such guesses, however, are unlikely to be random. As early as 1946, Newcomb demonstrated that when respondents are uncertain, their responses are consistent with their own attitudes toward the issue in question. In

other words, rather than assessing knowledge, responses to items on a knowledge test may often reflect the participant's attitude. In fact, Hammond's (1948; see also Blumenfeld, 1966; Weschler, 1950) error-choice method, a disguised attitude measurement technique, relies on the assumption that answers to factual questions are biased in such a way as to reveal the respondent's attitude (see Kidder & Campbell, 1970).

If responses to the factual questions on a knowledge test are indeed biased to be consistent with the participants' attitudes, then the obtained "knowledge" scores will correlate positively with attitudes when correct responses have positive implications for the issue under consideration. However, the same bias should produce a negative correlation with attitudes when correct responses have largely negative implications. When the knowledge questionnaire is balanced such that equal numbers of correct responses have positive and negative implications, there should be little correlation between attitudes and knowledge. It follows that if there is a correlation between attitudes and behavior, we would expect a positive correlation between knowledge and behavior when correct responses reflect a favorable attitude, a negative correlation between knowledge and behavior when they imply an unfavorable attitude, and no significant correlation when an equal number of correct responses have positive and negative implications. We report a direct test of this idea in the fourth and final study reported here in a later section.

A second problem related to knowledge tests is that the factual items they contain generally deal with broad concepts such as breast cancer, HIV/AIDS, or the environment, not with the specific behavior under consideration. Empirical research has shown that broad attitudes or other general dispositions are usually poor predictors of specific actions (Ajzen, 2005; Ajzen & Fishbein, 1977). The same is likely to be true for general knowledge. Thus, a measure of general knowledge in a given domain is unlikely to predict any particular behavior in that domain. Dispositional measures that are *compatible* with the behavioral criterion in terms of the action involved, the target at which the action is directed, and in terms of the context and time of behavioral performance tend to predict behavior much better than global dispositions (see Ajzen, 2005; Fishbein & Ajzen, 1974; Kraus, 1995).

A third issue related to use of knowledge tests to predict behavior has to do with the content of items on such tests. Judging factual items on knowledge tests to be either true or false often has no clear implications for behavior. Consider knowledge in relation to breast cancer. One of the items on the knowledge inventory used by Misovich et al. (2003) is the following: "It is normal for some women's breasts to feel lumpy or uneven." The behavioral criterion in this study was performance of breast self-examinations. It is not at all clear whether agreement with the statement that it is normal for some women's breasts to feel lumpy or uneven would encourage or discourage breast self-examinations.

What's more, agreements or disagreements with assertions on knowledge tests are not scored in terms of their support or lack of support for the behavior of interest. Instead, they are scored for their accuracy in relation to an objective criterion. A response scored as correct will therefore not necessarily indicate a cognition in support of the desired behavior. Consider, for example, the relation between knowledge about heroin and other illicit drugs and actual drug use. Many investigators would assume that heroin use should decline with accurate knowledge about this drug and its effects. Now, imagine that a heroin knowledge test includes the following assertions: "The street price of heroin has declined in the past few years" and "Heroin use results in hair loss." Agreement with the first assertion would seem to reflect a belief that encourages heroin use even though, being factually correct, it would be scored as revealing accurate knowledge about the topic. Conversely, agreement with the second assertion, even though incorrect, would be indicative of a belief that discourages heroin use. Clearly, then, there is no reason to expect a simple, direct relation between amount of heroin knowledge and avoidance of heroin.

The aforementioned considerations lead to the conclusion that we can expect a positive correlation between knowledge and behavior only if correct responses on the knowledge test consistently imply support for performance of the behavior and incorrect responses consistently imply lack of support. The present article reports the results of four studies that examined the relation between knowledge and behavior in three domains: knowledge about the environment and energy conservation behavior, knowledge about drinking alcohol and drinking behavior, and knowledge about Islam and Muslims and behavior directed at Islam and Muslims.

STUDY 1: ENERGY CONSERVATION

The first study assessed knowledge about the environment to predict a category of behavior—energy conservation. The discussion in the introduction suggests, however, that we cannot expect a strong association between knowledge about the environment in general and the specific behavioral category of energy conservation. Much better prediction of intentions to conserve energy, and actual energy conservation, should be provided by measures of the behavior-specific constructs in the theory of planned behavior (i.e., attitudes, subjective norms, and perceptions of control with respect to conserving energy).

Method

A total of 79 undergraduate college students (58.2% female) participated in the study for partial course credit. They ranged in age from 18 to 26, with a median age of 20. The study was described as an environmental knowledge survey. A self-contained questionnaire was administered in small groups of 5 to 12 participants. A pilot study with 30 students was conducted to develop the questionnaire which contained an environmental knowledge test followed by items to assess TPB constructs, and a scale to measure general attitudes toward environmental protection.

Environmental Knowledge Test

The 33-item environmental knowledge test contained items translated from a German version of an extensive environmental knowledge survey developed by Kaiser and Frick (2002; Frick, Kaiser, & Wilson, 2004) for use in Switzerland. Some of the items were reformulated to suit local circumstances. Among the items included were, "If the amount of carbon dioxide (CO_2) doubled, the average global temperature would increase by about 10° Fahrenheit," "Nuclear energy and fossil fuels are 2 types of renewable energy," "Using aerosol spray cans negatively affects the environment by adding to the problem of global warming," and "On average, recyclable beer bottles are recycled and reused 10 times." Participants rated each statement as *true* or *false* and then indicated their confidence on a 5-point scale: "How confident are you that your answer is correct?" Confidence ratings were provided on 5-point scales labeled *extremely confident, very confident, moderately confident, somewhat confident*, and *not at all confident*. A total knowledge score was computed by counting the number of correct responses without reference to the certainty rating which was used to compute an estimate of support for environmentally friendly behavior, described next.

Support for Proenvironmental Behavior

Responding to a given item on the knowledge test as true or false was judged on an intuitive basis to imply either support, or lack of support, for behavior friendly to the environment. Internal consistency analyses (i.e., item-total correlations) were used to confirm the intuitive classification. If responses to an item correlated positively with the total score, agreement with the item was considered to be supportive of environmental protection; if they correlated negatively with the total score, agreement with the item was considered to indicate lack of support for the environment. This classification was used in the small number of cases where it disagreed with our intuitive classification. Support for environmentally friendly behavior was indicated by acceptance of such items as, "If we were to stop all ozone depleting emissions, the ozone layer would be able to completely regenerate" and "Air conditioners in cars raise environmental concerns because they leak chlorofluorocarbon (CFC) into the air." Considering these statements to be false was scored as lack of support for proenvironmental behavior. A supportive response was given a score of +1 and a nonsupportive response a score of −1. These scores were then multiplied by the corresponding confidence rating (scored 1 to 5)[1] and the resulting products were averaged to produce an estimate of support for environmentally friendly behavior.[2] The environmental support scale had a .51 alpha reliability coefficient.[3]

Environmental Attitude Scale

A nine-item environmental attitude scale included the eight items from the abbreviated version of the New Ecological Paradigm scale (Cordano, Welcomer, & Scherer, 2003; see also Dunlap, Van Liere, Mertig, & Emmet Jones, 2000), and one additional item to address a salient contemporary concern—evidence for global warming. This additional item read as follows: "There is no scientific proof for global warming." Among the other items on the scale were, "The balance of nature is very delicate and easily upset," "If things continue on their present course, we will soon experience a major ecological catastrophe," and "Plants and animals exist primarily to be used by humans." Responses were provided on a 5-point scale with endpoints labeled either *strongly disagree* and *strongly agree* or *never* and *always*. Negative items were reverse scored, and the mean across the nine items constituted the attitude score ($\alpha = .77$).

TPB Measures

The behavior of interest was defined as "conserving energy this semester." Participants were told that this refers to regular performance of energy-saving behaviors including, but not limited to, turning off lights and computers when not in use, walking or using bikes/public transportation instead of an automobile, car pooling, and limiting the duration of hot showers or shampooing. The questionnaire contained 25 items designed to

[1]We also tried to score the confidence scale from 0 to 4, but the 1-to-5 scoring produced somewhat better results.

[2]Because the confidence scale was inadvertently omitted for one of the items, the estimate of support for environmentally friendly behavior is based on 32 items.

[3]The relatively low reliability of this scale is not unexpected because items were not selected for their support or opposition to protection of the environment but because, in previous research, they were considered to assess important knowledge about the environment.

assess the four major TPB constructs in relation to conserving energy this semester: attitude toward the behavior, subjective norm, perceived behavioral control, and intention. After eliminating one subjective norm item to increase internal consistency, 6 items were available to assess each of the theory's predictors. Responses to all items were provided on 5-point scales. The items assessing a given construct were interspersed among items assessing the other constructs.

Attitude toward the behavior. Conserving energy this semester was rated on six bipolar adjective scales that ranged from *very unpleasant* to *very pleasant, strongly dislike* to *strongly like, very negative* to *very positive, extremely undesirable* to *extremely desirable, extremely unwise* to *extremely wise*, and *extremely bad* to *extremely good*. The mean score across the six items constituted our measures of attitude toward conserving energy this semester, with an alpha coefficient of .88.

Subjective norm. Four items were used to assess injunctive norms, whereas another two items assessed descriptive norms. The injunctive norm items asked about the perceived expectations of important others: "People whose opinions I care about approve of my conserving energy this semester," "People I care about encourage me to conserve energy this semester," "I feel social pressure to conserve energy this semester," and "People who are close to me would approve of my conserving energy this semester." Responses were provided on 5-point *strongly disagree* to *strongly agree* scales. The two descriptive norm items referred to the perceived behavior of others: "Most people like me are going to conserve energy this semester" (*extremely unlikely–extremely likely*) and "Most people who are important to me currently conserve energy" (*strongly disagree– strongly agree*). The injunctive and descriptive norm items were combined to produce an overall subjective norm measure ($\alpha = .83$).

Perceived behavioral control. The following six items provided a measure of perceived behavior control. "If I wanted to, I could easily conserve energy this semester" (*strongly disagree–strongly agree*), "Whether I conserve energy this semester is entirely up to me" (*strongly disagree–strongly agree*), "For me to conserve energy this semester is" (*completely impossible–definitely possible*), "Conserving energy this semester is" (*definitely beyond my control–definitely under my control*), "It will be difficult for me to conserve energy this semester" (*strongly disagree–strongly agree*), and "I should have no trouble conserving energy this semester" (*strongly disagree–strongly agree*). The coefficient alpha for this scale was .73.

Intention. The following six items were used to assess intentions. "I am planning to conserve energy this semester (*strongly disagree–strongly agree*), "I am likely to conserve energy this semester" (*strongly disagree–strongly agree*), "I intend to conserve energy this semester" (*definitely not–definitely yes*), "I will probably conserve energy this semester" (*definitely will not–definitely will*), "I have decided to conserve energy this semester" (*strongly disagree–strongly agree*), and "I expect I will conserve energy this semester (*strongly disagree–strongly agree*). The intention scale had an alpha coefficient of .97.

Energy-saving behavior. Finally, participants were asked to report, on 5-point scales (from *never* to *always*), how frequently they engage in seven specific behaviors related to the environment and energy use and to rate their overall energy conservation behavior on two additional 5-point scales. After eliminating one behavior to increase internal consistency, the following specific behaviors were used to construct an environmental behavior index: "I walk, ride a bicycle, or take public transportation to work or school," "I wait until I have a full load before doing my laundry," "When shopping, I ask for paper bags rather than plastic ones," "I regularly read at least one environmental journal/magazine (hard-copy or online)," "I make sure to recycle regularly (e.g., glass bottles, paper, and plastic)," and "I make a genuine effort to turn off electricity and appliances when not in use." The mean score was used as a measure of environmental behavior, with an alpha coefficient of .68.

The two general energy conservation items were formulated as follows: "Generally speaking, do you make an effort to conserve energy in your daily living?" (*never–always*) and "Thinking back over the past few weeks, how much energy have you been conserving?" (*none at all–a great deal*). The internal reliability for the scale composed of these two items was .77.

Because the scores for the specific and general behavior measures were highly correlated ($r = .67$, $p < .01$), all eight items were combined to produce an overall behavior score, with a coefficient alpha of .77. This overall measure of energy conservation behavior was used in the analyses reported below. It represents a self-report of current and past energy-saving behavior.

Results

Environmental Knowledge and Support for the Environment

As can be seen in Table 1, on average the participants answered a little more than 19 questions correctly, for a 58% hit rate. Although significantly different from the 50% chance level of 16.5 correct responses,

TABLE 1
Means, Standard Deviations, and Correlations Among Main Variables: Study 1—Conserving Energy

	M	*SD*	*KNOW*	*SUP*	*ENV*	*ATT*	*SN*	*PBC*	*INT*
Knowledge (KNOW)	19.31	2.48	—						
Support for environment (SUP)	0.71	0.77	−.07	—					
Environmental attitude (ENV)	3.97	0.56	.14	−.02	—				
Attitude toward saving energy (ATT)	4.02	0.76	−.12	.30	.29	—			
Subjective norm (SN)	3.00	0.82	−.12	.19	.29	.65	—		
Perceived behavioral control (PBC)	4.30	0.62	−.03	.15	.15	.56	.42	—	
Intention to save energy (INT)	3.67	1.00	−.04	.26	.12	.79	.65	.63	—
Energy-saving behavior	3.04	0.67	.05	.23	.33	.57	.57	.47	.62

Note. $N = 79$. $r > .18$ significant at $p < .05$; $r > .28$ significant at $p < .01$.

$t(78) = 9.98$, $p < .01$, this indicates relatively little accurate information about the environment, at least as assessed by the items on our knowledge test. The environmental knowledge score also failed to correlate significantly with support for environmentally friendly behavior as implied by responses on the knowledge test,[4] with general proenvironment attitudes, with any of the TPB variables, or with self-reported environmental behavior (see Table 1).

In contrast, the environment support implied by responses to the items on the knowledge test did correlate significantly with attitudes toward saving energy, with intentions to save energy, and with reported energy saving behavior. These results suggest that the accuracy of factual information (i.e., knowledge) regarding the environment was largely irrelevant for determining environmentally friendly intentions and behavior. What mattered more was the extent to which the participants' responses to the knowledge items tended to be supportive or nonsupportive of environmentally friendly behavior, regardless of whether these responses were correct or incorrect. Of course, even the estimate of support for proenvironmental behavior—as expressed on the knowledge test—was a relatively poor predictor. It had a correlation of only .26 with intentions to save energy and a correlation of .23 with reported energy conservation. These correlations were similar in magnitude to the correlations obtained for general environmental attitudes (see Table 1).

Predicting Energy Saving Intentions and Behavior: TPB

Much better prediction of energy-saving intentions and behavior was afforded by the TPB. As shown in Table 1, the best single predictor of intentions to save energy was the attitude toward this behavior ($r = .79$, $p < .01$), and the best single predictor of current or past energy-saving behavior was the intention to do so ($r = .62$, $p < .01$). The results of hierarchical multiple regression analyses are shown in Table 2. In the prediction of energy-saving intentions, all three components of the model made significant contributions, accounting for 69% of the variance. Adding the number of correct answers on the knowledge test to the model on the second step of the analysis failed to account for any additional variance in intentions. Perceived control over energy saving influenced performance of this behavior only indirectly by its effect on intentions. Once intentions were formed, they were the sole significant predictor of behavior and perceived control failed to make a significant additional contribution. As can be seen in Table 2, intentions and perceived behavioral control accounted for 40% of the variance in reported energy-saving behavior.[5] Once again, addition of knowledge on the second step of the hierarchical regression analysis failed to produce a significant increase in the proportion of explained variance.

Because support for environmentally friendly behavior implied by responses to the knowledge test was found to correlate significantly with energy-saving intentions and behavior, additional hierarchical regressions were performed in which support was included as another predictor on the second step of the analyses. As can be seen in Table 2, neither in the prediction of intentions nor in the prediction of behavior did the addition of support for environmentally friendly behavior produce a significant increase in the proportion of explained variance suggesting that the effect of support was mediated by the TPB variables.

[4]The relatively low correlation ($r = .30$) between attitudes toward the environment and support for the environment (as implied by responses to the knowledge items) may be attributable to the fact that items on the knowledge test were not designed to assess attitudes and that the support scores that were derived had relatively low internal consistency (reliability).

[5]Strictly speaking, the TPB posits that perceived behavioral control moderates the effect of intentions on behavior. However, addition of the Control × Intention term to the prediction equation failed to account for additional variance in behavior in any of the three studies reported here.

TABLE 2
Hierarchical Regression Analyses for the Prediction of Intentions and Behavior: Study 1

	Step 1		Step 2		
Predictors	β	R^2	β	R^2	ΔR^2
Intention to save energy					
Attitude	.51**		.52**		
Subjective norm	.21*		.22*		
Perceived behavioral control	.25**	.69**	.25**		
Knowledge			.05		
Support			.03	.69**	.00
Energy-saving behavior					
Intention	.54**		.52**		
Perceived behavioral control	.14	.40**	.14		
Knowledge			.07		
Support			.07	.41**	.01

Note. $N = 78$.
*$p < .05$. **$p < .01$.

Discussion

The results of the first study showed that knowledge about the environment was virtually unrelated to general attitudes regarding the environment, and it had no influence on attitudes, subjective norms, or perceptions of control with respect to engaging in energy-saving behaviors. Consequently, it also had no effect on intentions to engage in such behaviors or on reported actions of an environmentally friendly nature. Nevertheless, support for environmentally friendly behavior as implied by endorsement of statements on the environmental knowledge inventory did have a significant, albeit rather low correlation ($r = .23$, $p < .05$) with attitudes toward engaging in energy-saving behaviors, and this effect carried over to intentions and self-reported behavior. However, as would be expected in the context of the TPB, the effect of implied support was fully mediated by the theory's components, and the addition of support to the regression equation failed to account for any additional variance in intentions or behavior.

STUDY 2: DRINKING ALCOHOL

The first study had to do with knowledge about a broad domain—the environment—not knowledge related to any particular intention or behavior. Like general attitudes or personality traits, such broad measures of knowledge would not be expected to be good predictors of particular behaviors. The second study, therefore, assessed more narrowly defined knowledge, that is, knowledge about alcohol and drinking. Usually, the assumption would be made that the more accurate people's information about alcohol and drinking, the more negative their attitudes toward drinking should be and, therefore, the lower should be their intentions to drink and the less alcohol they should consume. In contrast, we predicted that knowledge (i.e., accurate information) about alcohol and drinking will lower intentions to drink only to the extent that accurate beliefs about drinking have negative implications for performance of this behavior.

Method

The methods and procedures were similar to those employed in the first study. A total of 91 undergraduate college students (82% female) participated in the study for partial course credit. They ranged in age from 18 to 33, with a median age of 20. The study was described as a survey of attitudes toward alcohol and alcohol use. Formative research was conducted with students from the same population ($N = 32$) to construct questionnaire measures of alcohol knowledge, general attitudes toward alcohol, and TPB variables. Participants in the main study completed the self-contained questionnaire in small groups of 5 to 12 students.

Alcohol Knowledge Test

The first part of the questionnaire contained a 31-item alcohol knowledge inventory. The items on this test were modeled after knowledge questions commonly found in the informational literature on alcohol abuse. Examples are "Nearly 18 million adult Americans abuse alcohol or are alcoholics," "Alcohol intoxication produces hearing and vision problems," "The leading cause of death among Americans 15–24 years old is due to alcohol-related automobile accidents," and "One ounce of beer has the same amount of alcohol as one ounce of wine." In addition, the knowledge test also included five questions of relevance to the local student population, such as, "According to the University of Massachusetts Alcohol Policy, students are allowed to use alcohol containers as decorations within their residence hall room as long as the containers are not filled with alcohol" and "One consequence for violating the campus alcohol policy by drinking or possessing alcohol includes housing probation for one year." Participants responded by checking either the *true* or *false* option for each item, followed immediately by the same 5-point confidence scale used in the first study. Knowledge scores were computed by counting the number of correct responses to the 31 knowledge items.

Support for Drinking

The true or false responses, together with the confidence ratings, were used to derive a support for drinking

score by the method described in the first study. As in the first study, initial classification of items as supportive or nonsupportive of drinking was tested by examining item-total correlations. The support for alcohol scale had a reliability coefficient alpha of .55 (see footnote 3).

Alcohol Attitude Scale

A 20-item scale to assess attitudes toward alcohol and alcoholics was modeled after the measure developed by Strassburger and Strassburger (1965). Based on our pilot work, many of the items were reformulated to suit current times and our student population (e.g., "Some people may need to drink in order to feel gay" was reformulated as "Some people need to drink in order to be outgoing and sociable"). A few items were replaced altogether. Thus, the item "A drunk makes me feel disgusted" was omitted and replaced by "You can't trust people who are heavy drinkers." Each item was followed by a 5-point *strongly disagree* to *strongly agree* response scale. Negative items were reverse scored, and the mean across all 20 items constituted the attitude score. This scale had an internal consistency coefficient alpha of .70.

TPB Measures

The behavior of interest was defined as drinking alcohol this semester. A set of 22 items were formulated to assess the four major constructs in the TPB: attitude, subjective norm, perceived behavioral control, and intention with respect to drinking alcohol this semester. These items were very similar to those used in the first study. Preliminary analyses led to the elimination of 2 items that reduced internal consistency, one assessing subjective norms and the other perceived behavioral control. The final measure included 5 items each assessing attitudes, subjective norms, and intentions, and 4 items for perceived behavioral control. Reliability coefficients alpha were .92 for attitudes, .85 for subjective norms, .71 for perceived control, and .98 for intentions.

Alcohol Drinking Behavior

A series of eight questions assessed the participants' current drinking behavior. After item analysis, four of these questions with high internal consistency were retained as a measure of behavior. The first behavioral item asked participants to rate how often they drink alcohol on a 7-point scale with endpoints labeled *never* and *virtually every day*. The second question was a quantitative measure: "How many drinks do you typically consume on one occasion (e.g., at a party or when you are hanging out with friends)?" A drink was defined as a 12-ounce can or bottle of beer, a 4-ounce glass of wine, a 12-ounce bottle or can of wine cooler, or a shot of liquor straight or in a mixed drink. Participants entered the number of drinks in a blank space. Next they were asked, "How would you describe yourself in terms of your current use of alcohol?" *Abstainer, infrequent drinker, light drinker, moderate drinker, heavy drinker, chronic alcohol abuser*. They were asked to check one of the alternatives. Finally, they indicated on how many occasions they had had one or more drinks in the past 30 days, with response alternatives of *none, 1 to 2 occasions, 3 to 5 occasions, 6 to 9 occasions, 10 to 15 occasions*, and *more than 15 occasions*. The reliability coefficient alpha for the measure of behavior was .79.

Results

Alcohol Knowledge and Support for Drinking

Table 3 presents descriptive data and correlations among the major variables assessed in the study. On average, the participants provided correct answers to about 24 of the 31 alcohol knowledge items (77% correct). Interestingly, the knowledge score had a strong negative correlation ($r = -.57$) with support for drinking. This finding shows that having correct information about drinking and its effects tends to undermine support for drinking, at least as reflected in the implications of responses to the knowledge test. However, as can be seen in Table 3, knowledge did not correlate significantly

TABLE 3
Means, Standard Deviations, and Correlations Among Main Variables: Study 2—Drinking Alcohol

	M	*SD*	*KNOW*	*SUP*	*ALC*	*ATT*	*SN*	*PBC*	*INT*
Knowledge (KNOW)	23.98	2.54	—						
Support for drinking (SUP)	−1.02	0.46	−.07	—					
Alcohol attitude (ALC)	2.85	0.43	−.16	.21	—				
Attitude toward drinking (ATT)	3.60	0.92	−.08	.03	.48	—			
Subjective norm (SN)	3.66	0.95	−.09	−.02	.53	.61	—		
Perceived behavioral control (PBC)	4.48	0.72	.02	−.05	.56	.72	.65	—	
Intention to drink (INT)	4.29	1.10	−.06	.01	.50	.89	.69	.84	—
Drinking behavior	3.06	0.46	−.02	.02	.59	.74	.59	.67	.76

Note. $N = 91$. $r > .17$ significant at $p < .05$; $r > .27$ significant at $p < .01$.

TABLE 4
Hierarchical Regression Analyses for the Prediction of Intentions and Behavior: Study 2

	Step 1		Step 2		
Predictors	β	R^2	β	R^2	ΔR^2
Intention to drink					
Attitude	.55**		.55**		
Subjective norm	.13*		.12*		
Perceived behavioral control	.36**	.87**	.36**		
Knowledge			−.02	.87**	.00
Drinking behavior					
Intention	.66**		.67**		
Perceived behavioral control	.12	.58**	.11		
Knowledge			.03	.58**	.00

Note. $N = 90$.
*$p < .05$. **$p < .01$.

with the general alcohol attitude scale ($r = .16$) or with any of the TPB variables. Not surprisingly, therefore, it also did not predict reported drinking behavior ($r = -.02$).

Predicting Drinking Intentions and Behavior: TPB

Hierarchical multiple regression analyses were performed to examine the degree to which the TPB could predict drinking intentions and behavior. As can be seen in Table 4, intentions to drink alcohol were predicted with a high degree of accuracy. Inspection of the regression coefficients shows that each of the three predictors made a significant contribution although attitudes and perceptions of control appeared to be more important than subjective norms. The model accounted for 87% of the variance in intentions. The addition of knowledge on the second step of the analysis had no significant effect and did not explain any additional variance.

A very similar pattern of results was obtained for the prediction of self-reported drinking behavior. Intentions and perceptions of behavioral control accounted for 58% of the variance in drinking behavior, but only intentions made a significant contribution to the prediction. This finding suggests that perceived behavioral control exerted its effect on behavior indirectly by, as previously noted, influencing intentions to drink alcohol. Adding alcohol-related knowledge to the equation failed to improve prediction of behavior.

Discussion

The second study showed that knowledge related to alcohol and its effects does not seem to discourage intentions to drink alcohol or influence reported alcohol consumption. This conclusion emerged despite the fact that the knowledge test dealt with issues closely related to, and thus to some degree compatible with, the behavioral criterion. Even when answers to the knowledge questions were scored in terms of their apparent support or lack of support for drinking alcohol, the resulting scores predicted neither attitudes toward drinking nor drinking intentions or behavior. The critical issue, from our perspective, has to do with the contents of the knowledge test. According to the TPB, decisions regarding alcohol use are based on readily accessible behavioral, normative, and control beliefs regarding this behavior. We would argue that the knowledge test, even though assessing what is commonly considered to be important information about drinking, failed to reflect the participants' own beliefs about drinking, beliefs that actually guided their decisions.

Some evidence in support of this supposition comes from research that directly assessed beliefs about drinking in the context of the TPB. For example, Armitage, Conner, Loach, and Willetts (1999) elicited accessible behavioral, normative, and control beliefs about drinking and about cannabis use in a pilot study and then used the most frequently listed beliefs in the main study to explain intentions to use these substances and their actual use. We focus here only on the behavioral and control beliefs regarding alcohol use. Among the likely outcomes of alcohol consumption (behavioral beliefs) mentioned by the participants were the beliefs that drinking makes me more sociable, will result in my becoming dependent on it, and will result in my getting into trouble with authority. Because beliefs of this kind do not represent objectively verifiable factual information about drinking, such "items of information" are not included in tests that assess knowledge about drinking. Similarly, among the control factors mentioned most frequently were the beliefs that I have opportunities to drink and that drinking alcohol costs too much money. Again, for obvious reasons, these kinds of issues did not appear on the alcohol knowledge test. In a sense, then, a typical alcohol knowledge test—even when specifically dealing with the behavior of interest—may simply assess the wrong kinds of beliefs, beliefs that are not readily accessible when considering alcohol use and that do not underlie the motivation to perform this behavior.

STUDY 3: ATTENDING A MOSQUE SERVICE

In the first two studies, knowledge had virtually no effects on intentions or behavior in relation to conserving energy and drinking alcohol. Even though endorsement of factual statements on knowledge tests can, in

principle, be used to infer support for a behavior of interest, only in the second study was there a significant relation between knowledge (i.e., accuracy of responses on the alcohol knowledge test) and inferred support for drinking. Even there, however, the measure of support for drinking did not predict drinking intentions or behavior, and neither did the measure of knowledge. We have proposed that the kind of information called for on knowledge tests often has little to do with the salient information that actually guides people's intentions and actions. Our third study provides evidence that knowledge can be correlated with behavior-relevant attitudes and with behavior.

The third study dealt with information about Muslims and Islam and its effect on willingness to attend a Muslim worship service. We expected that, in this socially sensitive domain, attitudes toward Islam and Muslims may well have a strong biasing effect on responses to factual questions, thereby creating a correlation between attitudes and knowledge. Knowledge would then be expected to correlate with the behavior of interest (willingness to attend a worship service) to the extent that the attitude measure itself is predictive of the behavior. Of course, the domain of knowledge in question is very broad, whereas the behavior is quite specific, and we would therefore expect the correlation between knowledge and behavior to be modest at best. In contrast, we hypothesized that the behavior-specific TPB variables afford good prediction of intentions to attend a Muslim worship service and that accurate information about Islam and Muslims, if it has an effect, exerts its effect indirectly by influencing attitudes toward the behavior, subjective norms, or perceptions of behavioral control.

Method

The methods and procedures employed in the first two studies served as a model for the third study. The self-contained questionnaire was developed in formative research with a sample of 31 undergraduate college students. A sample of 85 students from the same population participated in the main study in exchange for partial course credit. The study was described as a survey of knowledge about Muslims and Islam. The questionnaire contained a knowledge test, a scale to assess general attitudes toward Muslim and Islam, and measures of the theory of planned behavior constructs. The participants, who completed the questionnaire in small groups of 5 to 12, were 76% female and ranged in age from 18 to 31 with a median age of 20. Fifty-two (61%) described themselves as Christian, 12 (14%) as Jewish, 5 (6%) as agnostic, 4 (5%) as atheist, and 12 (14%) as "other." One Muslim participant was excluded from the analyses.

Islam Knowledge Test

Items of factual information about Muslims and Islam were constructed as part of the formative research. The information used came from a variety of sources, including books about Islam and Muslims and various Internet sites. After eliminating or reformulating items that were ambiguous or posed other difficulties in the formative research, the final knowledge test contained 29 items. Examples are "Islam, like Christianity and Judaism, traces its roots back to the Patriarch Abraham," "Converting non-Muslims through force is one of the five pillars of Islam," "The majority of Muslims live in the Arabian Peninsula," "Giving charitably is mandated by Islam," and "Muslims started the first crusade by attacking Jerusalem." Response alternatives were *true* or *false*, and a total knowledge score was computed by counting the number of correct responses. As in the first two studies, each true/false judgment was followed by a 5-point confidence scale.

Support for Islam and Muslims

As in the previous two studies, the true/false responses, in combination with the confidence rating, were used to construct a support for Islam/Muslims scale. Again, item-total correlations were used to test the initial intuitive categorization of all items as supportive or nonsupportive of Islam or Muslims. The alpha reliability coefficient for the support scale was .75 (see footnote 3).

It should be noted that correct responses to 20 of the 29 items on our knowledge test were found to imply a favorable attitude toward Islam and Muslims. This was due to the fact that any unbiased sampling of facts about Islam and Muslims will contain more positive than negative information. Moreover, the factual items for the test were culled primarily from Muslim sources that, naturally, tend to present the positive sides or Islam.

Muslim Prejudice Scale

Bushman and Bonacci's (2004) 11-item scale to assess prejudice against ethnic groups was adapted to assess attitudes toward Muslims. Among the items were the following: "Muslims have moral standards that they apply in their dealings with each other, but with non-Muslims, they are unscrupulous, ruthless, and undependable," "It is wrong for Muslims and non-Muslims to intermarry," and "You just can't trust a group of young Muslim men together because they are probably up to criminal or delinquent activity." Responses were provided on 5-point *strongly agree* to *strongly disagree* scales, and the mean response served

as the measure of attitude toward Muslims. The scale had a .90 alpha reliability coefficient.

TPB Measures

The study's behavioral focus was on attending a short mosque service. Participants were given the following instructions.

> As part of an attempt to bridge relationships between different ethnic groups on campus, a local nearby mosque is opening its doors to students interested in attending a brief mosque service. There would also be people available to answer questions at the end of the service. Transportation would be provided. In order to help us determine the interest level of UMASS students, please think about your interest level and answer the following questions by circling your choice.

The participants then responded to a series of 20 TPB items designed to assess their attitudes, subjective norms, perceptions of behavioral control, and intentions with respect to attending the mosque service. Five items, very similar to those used in the first two studies, assessed each of the four constructs. The reliabilities of these measures were .87 for attitudes, .81 for subjective norms, .63 for perceived behavioral control, and .95 for intentions.

Behavior. To assess interest in attending a brief mosque service, a form was attached to the questionnaire on which participants could sign up for a mosque service by listing their names and e-mail addresses. They were told that this information would be passed on to the committee that is organizing visits to the mosque. The behavior was coded as +1 for participants who completed the form and handed it in and coded 0 for participants who did not. During the debriefing, participants were informed that there was actually no organized effort to encourage attending a mosque service, but they were given information about opportunities to do so if they were interested.

The questionnaire assessed 16 additional behaviors with respect to Muslims. Among other things, participants were asked to indicate how often they discussed matters pertaining to Muslims or Islam with their friends or family; whether they had ever taken a class on Islam, read a book about Islam, or attended a lecture about Islam; how often they read newspaper articles or watched TV news stories about Muslims; and how often, alone or in a group, they have had lunch with a Muslim student. The total set of 16 behaviors had an alpha reliability coefficient of .72.

Results

Knowledge About and Support for Islam and Muslims

As assessed by our instrument, participants in the study exhibited a relatively low level of knowledge about Islam and Muslims. On average, the number of correct responses on the 29-item test was 17.47, representing a 60% hit rate (see Table 5). Still, the average knowledge score was significantly higher than the 14.5 score expected by chance, $t(84) = 8.66$, $p < .01$. Moreover, in contrast to the first two studies, the degree to which participants had accurate information (or less inaccurate information) correlated with the other measures obtained in this study. First, as can be seen in Table 5, there was a negative correlation ($r = -.39$, $p < .01$) between knowledge regarding Islam and Muslims and prejudice toward Muslims. This finding is consistent with our expectation that responses to the factual items on the knowledge test may have been biased by the participants' attitudes toward Muslims. The more favorable their attitudes (i.e., the lower their prejudice), the more the participants tended to provide responses with positive implications for Islam and Muslims. In fact, knowledge had a .80 correlation with support for Islam and Muslims, as implied by responses on the knowledge test.

TABLE 5
Means, Standard Deviations, and Correlations Among Main Variables: Study 3—Mosque Service

	M	*SD*	*KNOW*	*SUP*	*MUS*	*ATT*	*SN*	*PBC*	*INT*
Knowledge (KNOW)	17.47	3.16	—						
Support for Muslims (SUP)	−0.54	0.67	.80	—					
Muslim prejudice (MUS)	2.18	0.81	−.39	−.48	—				
Attitude toward attending (ATT)	3.11	0.77	.47	.39	−.43	—			
Subjective norm (SN)	2.49	0.84	.35	.34	−.44	.63	—		
Perceived behavioral control (PBC)	3.76	0.75	.35	.34	−.48	.50	.50	—	
Intention to attend (INT)	1.96	0.97	.45	.45	−.29	.67	.50	.32	—
Willing to attend mosque service	0.15	0.36	.31	.31	−.14	.37	.13	.29	.50

Note. $N = 85$. $r > .18$ significant at $p < .05$; $r > .27$ significant at $p < .01$.

However, as we saw earlier, for the majority of items, responses with positive implications for Islam and Muslims were also the correct responses, thereby producing the observed negative correlation between knowledge scores and the measure of prejudice.

Knowledge exhibited correlations of moderate magnitude ($r = .35$–$.47$) with attitudes, subjective norms, perceived control, and intentions in regard to attending a mosque service, and had a point-biserial correlation of .31 (all $ps < .01$) with signing up for attending a mosque service. The same correlation ($r = .31$) obtained between support for Muslims as inferred from responses to items on the knowledge test and the dichotomous behavior measure. This contrasts with a very low and nonsignificant correlation ($r = -.14$) between general prejudice toward Muslims and interest in attending the mosque service. It should be noted that only 13 of the 85 participants (15%) expressed such an interest, a floor effect that limits the predictive validity of any potential antecedent variable.

Signing up for a mosque service did not correlate significantly ($r = .14$) with the index of 16 behaviors related to Muslims and Islam, but knowledge, support for Muslims and Islam, and prejudice toward Muslims did. The respective correlations were .35, .46, and -.28, all significant at $p < .01$. Thus, the three dispositional measures that dealt generally with Islam and Muslims had moderate predictive validity in relation to a broad measure of behavior, a finding consistent with the pattern of attitude-behavior correlations observed in the literature (see Ajzen & Fishbein, 1977). In contrast, the TPB measures, which addressed the specific behavior of attending a mosque service, were poor predictors of the general behavior index. The correlations with the behavior index ranged from .11 (*ns*) for subjective norm to .25 for intention ($p < .05$).

Predicting Mosque Attendance Intentions and Behavior: TPB

The moderate though significant effect of knowledge on mosque attendance intentions and behavior permit a test of the hypothesis that these effects are mediated by the proximal antecedents specified in the TPB. Note, first, that the best single predictor of intentions to attend a mosque service was the attitude toward this behavior ($r = .67$, $p < .01$), and that the best single predictor of signing up for a mosque service was the intention to do so ($r = .50$, $p < .01$). A hierarchical regression analysis showed that the TPB accounted for 46% of the variance in intentions. Only attitude toward attending a mosque service had a significant regression coefficient in this analysis (see Table 6). Even though the proportion of variance accounted for increased from 46% to 48%, neither the addition of knowledge about nor the addition of support for Islam and Muslims made a significant contribution to the prediction of intentions once the TPB constructs were taken into consideration. Further analyses revealed that only attitudes toward the behavior mediated the effects of knowledge and support on intentions. This would be expected in light of the finding that only attitudes made a significant contribution to the prediction of intentions.

TABLE 6
Hierarchical Regression Analyses for the Prediction of Intentions and Behavior: Study 3

	Step 1		*Step 2*		
Predictors	β	R^2	β	R^2	ΔR^2
Intention to attend mosque service					
Attitude	.61**		.55**		
Subjective norm	.14		.12		
Perceived behavioral control	−.05	.46*	−.09		
Knowledge			.02		
Support			.21	.48*	.02
Signing up for mosque service (logistic regression)					
Intention	1.35*		1.25*		
Perceived behavioral control	.91	.40*	.82		
Knowledge			.09		
Support			−.04	.41*	.01

Note. $N = 85$.
*$p < .01$.

Because of the dichotomous nature of the behavioral criterion, a logistic regression analysis was performed for the prediction of signing up for a mosque service. As can be seen in Table 6, intention and perceived behavioral control accounted for 40% of the variance in this behavioral criterion (Nagelkerle R^2), but only intention made a significant contribution to the prediction. This corresponds to an 87% rate of correct prediction. When knowledge about and support for Islam and Muslims were added to the prediction equation, neither made a significant contribution. The proportion of explained variance increased to 41%, a nonsignificant increase, and the percentage of correct prediction remained at 87%.

Discussion

The third study showed strong correspondence between knowledge about and support for Muslims and Islam. That is, when responses to items on the knowledge test were coded for factual accuracy, they correlated strongly with the extent to which acceptance of that information implied support for Islam and Muslims. This finding may be explained by the possible biasing effect of prejudice on endorsement of questions with largely positive implications for Islam and Muslims. Consistent with this argument, knowledge scores also

correlated negatively with prejudice toward Muslims: the less prejudice they expressed the higher the knowledge scores of our participants and the more willing they were to engage behaviorally with Muslims, as assessed by a 16-item behavioral index. In addition, knowledge also correlated significantly with the particular behavior of interest in the present study: attending a mosque service. However, because the knowledge test dealt with Islam and Muslims in general, not with any particular behavior directed at Muslims, and because of a possible floor effect, the correlations with intentions to attend a mosque service and with actually signing up for a mosque service were of only moderate magnitude. Further, when considered in the context of the TPB, the effect of knowledge on intentions was indirect, mediated largely by attitudes toward attending a mosque service; the effect of knowledge on behavior was also indirect, mediated largely by intention. Knowledge did not moderate the effect of intentions on behavior.

STUDY 4: VOTING TO SUPPORT MUSLIM STUDENT ACTIVITIES

The correlations observed in the third study between knowledge about Islam and Muslims on one hand and, on the other, attitudes toward Muslims and support for Islam and Muslims as reflected in answers to the knowledge test were, arguably, fortuitous. They were likely the result of the fact that correct responses on the knowledge test had, for the most part, positive implications for Islam and Muslims. In the fourth study we tested this idea by systematically manipulating the evaluative implications of correct responses on a test of knowledge about Islam and Muslims. As discussed in the introduction, we expect a positive correlation between knowledge and behavior when correct responses to items on the knowledge test imply support for Islam and Muslims, a negative correlation when correct responses imply opposition to Islam and Muslims, and no significant correlation when an equal number of correct responses have positive and negative implications.

Method

The methods and procedures closely followed those of the third study. Participants were 89 undergraduate college students (69% female) who received partial course credit for their participation. They had a mean age of 20 and completed the self-contained questionnaire in small groups of 5 to 10 students. Fifty-two (58%) indicated that they were Christian, 8 (9%) were Jewish, 25 (28%) chose atheist/agnostic or other, and 2 (2.2%) did not state their religion.

This study differed from the previous study in two important respects. First, the participants completed one of three forms of the knowledge test, each consisting of 40 questions. In the positive form, 32 of the knowledge questions (80%) were selected such that a correct response implied support for Islam and Muslims. Examples are ''Islam teaches that there is no compulsion in religion'' (the correct response is true, with a positive implication) and ''Historically, Muslims have spread Islam though military force'' (false, positive). For the remaining 8 questions the correct answers had negative implications. In the second form, 80% of the questions were selected for correct responses to have negative implications, for example, ''In strict Islamic tradition, theft is punished by cutting off a hand'' (true, negative) and ''Most predominantly Muslim countries are democracies'' (false, negative). For the remaining questions, correct answers had positive implications. In the neutral form, the questions were balanced such that correct responses had positive implications for Islam and Muslims for 50% of the items and negative implications for the other 50%. Thirty-two participants completed the positive form, 25 the negative form, and 32 the neutral form. As in the previous studies, the participants first indicated whether they thought each statement was true or false, followed by a 5-point confidence rating.

The second difference between this and the previous study had to do with the behavioral criterion. Because relatively few participants in Study 3 had indicated an interest in attending a Muslim worship service, we chose as our criterion a different behavior. After completing the knowledge test, the participants were informed that, to encourage diversity on the campus, a proposal has been brought before the university administration to increase funding for Muslim student activities. To obtain student input, the administration was said to consider holding a referendum and the participants were told that, later on, they would have an opportunity to vote their support or opposition to the proposal.

Consistent with this, the TPB constructs were assessed with respect to voting in favor of the proposal to increase funding for Muslim student activities. The questionnaire contained the same items used in the previous study to assess attitudes toward the behavior, subjective norms, perceptions of behavioral control, and intentions. One subjective norm item was eliminated to increase internal consistency. Coefficients alpha were .83 for attitudes, .68 for subjective norms, .69 for perceived control, and .95 for intentions.

As in the previous studies, we computed knowledge scores by counting the number of correct answers as well as scores indicating support for Islam and Muslims, as reflected in the responses to the knowledge questions (see the Methods section of Study 3).

In the final part of the questionnaire, participants were asked to vote for or against increasing funding

for Muslim student activities at the university. This vote constituted our measure of behavior.

Results

Although significantly higher than chance, $t(86) = 15.92$, $p < .01$, for the total sample, the mean number of correct responses on the 40-item knowledge test was 26.54, representing a 66% hit rate. The knowledge scores did not differ appreciably from each other in the three variations of the test. The mean number of correct answers was 26.81 in the positive form, 26.24 in the negative form, and 26.50 in the neutral form.

Predicting Voting Intentions and Behavior: TPB

The TPB afforded accurate prediction of intentions and behavior. In the total sample of participants, the TPB explained 69% of the variance in intentions to vote in favor of the proposal to increase financial support for Muslim student activities. Of interest, these intentions were controlled almost exclusively by subjective norms that had a standardized regression coefficient of .80 ($p < .001$). Neither attitudes toward the behavior ($\beta = .06$) nor perceived behavioral control ($\beta = .09$) made significant contributions to the prediction. Such findings are not inconsistent with the TPB, because in the TPB the relative importance of the three predictors of intentions can vary, and it is not impossible for only one predictor to account for most or all of the variance in intentions. Very similar results were obtained when regression analyses were performed separately for participants in the three conditions of the experiment. The proportion of explained variance in intentions was .69 in the positive condition, .67 in the negative condition, and .71 in the neutral condition (all $p < .001$), and only the regression coefficients of subjective norms were statistically significant.

A logistic regression for the prediction of the binary voting criterion from intentions and perceived behavioral control resulted in a Nagelkerle R^2 of .79 in the total sample of participants, with a 93% hit rate. Only intentions made a significant contribution to the prediction, with an unstandardized regression coefficient of 3.78 ($p < .001$). Very similar results were obtained in the positive condition (Nagelkerle $R^2 = .83$; 94% hit rate), in the negative condition (Nagelkerle $R^2 = .70$; 92% hit rate), and in the neutral condition (Nagelkerle $R^2 = .84$; 93% hit rate). In each case, only intentions contributed significantly to the prediction.

Prejudice, Knowledge, Support for Muslims, and Voting Behavior

The results displayed in Table 7 show that, when data were collapsed across the three conditions of the experiment, knowledge did not correlate significantly with support for Islam and Muslims, nor did it correlate significantly with voting intentions or behavior. Knowledge did have a significant, albeit low correlation of .22 ($p < .05$) with attitudes toward Muslims.

TABLE 7
Correlations of Knowledge With Attitudes Toward Muslims, Support, Voting Intentions, and Behavior: Study 4

Correlations of Knowledge With . . .	*Total Sample*[a]	*Knowledge Form*		
		Positive[a]	*Negative*[b]	*Neutral*[c]
Attitudes	.22*	$.65_{a}$**	$-.47_{b}$**	$.28_{a}$
Support	.14	$.71_{a}$**	$-.78_{b}$**	$.15_{c}$
Voting intentions	.19	$.48_{a}$**	$-.25_{b}$	$.21_{a,b}$
Voting behavior	.10	$.45_{a}$**	$-.45_{b}$**	$.14_{b}$

Note. Correlations with different subscripts within rows differ significantly from each other at $p < .05$.
[a] $N = 89$. [b] $n = 32$. [c] $n = 25$. [d] $n = 32$.
*$p < .05$. **$p < .01$.

Of greater interest are the comparisons between experimental conditions. As expected, when knowledge was assessed by means of the positive form, it showed significant positive correlations with attitudes toward Muslims, with support for Islam and Muslims, with voting intentions, and with voting behavior. In marked contrast, when knowledge was assessed by means of the negative form, all correlations were negative and, except in the case of intentions, statistically significant. In the neutral condition, the correlations were low and none reached statistical significance.

Between-condition comparisons showed that the critical differences in correlations were statistically significant. Thus, the positive .65 correlation between knowledge and attitudes in the positive condition was significantly greater ($z = 3.50$, $p < .001$) than the negative $-.47$ correlation in the negative condition. There was also a significant difference between the negative and the neutral condition ($z = 2.11$, $p < .05$); the difference between positive and neutral conditions was not significant (see Table 7). Similarly, the correlations between knowledge and support for Islam and Muslims, as implied by responses to the knowledge questionnaire, differed significantly across conditions ($z = 6.93$, $p < .001$, for the comparison of positive and negative conditions; $z = 2.46$, $p < .05$, for positive vs. neutral conditions; and $z = 4.29$, $p < .001$, for negative vs. neutral conditions).

The knowledge–intention correlations differed significantly in the comparison between positive and negative conditions. When the positive form was used, knowledge showed a positive correlation of .48 with

intentions, compared to a negative correlations of −.25 in the negative condition ($z = 2.79$, $p < .01$). Finally, and perhaps of greatest interest, knowledge correlated positively ($r = .45$) with actual voting behavior when the positive form was used to assess knowledge, but it had an equally strong negative correlation with behavior ($r = -.45$) when the negative knowledge form was used. The difference between these two correlations is highly significant ($z = 3.50$, $p < .001$). There was also a significant difference between negative and neutral conditions ($z = 2.11$, $p < .05$); the difference between positive and neutral conditions was not significant.

To test the hypothesis that the knowledge–behavior correlations in the positive and negative conditions were largely due to the effect of attitudes toward Muslims on both knowledge and behavior, we computed partial correlations between knowledge and behavior while controlling for attitudes. The results confirmed this hypothesis. In the positive condition, attitudes toward Muslims correlated .65 with knowledge about Muslims and Islam (see Table 7), and it had a correlation of .62 with behavior. Controlling for attitudes toward Muslims reduced the .45 knowledge–behavior correlation to .09 (*ns*). In the negative condition, attitudes correlated −.47 with knowledge and −.55 with behavior. When attitudes were controlled, the knowledge-behavior correlation was reduced from −.45 to −.13 (*ns*). (In the neutral condition, the correlation between knowledge and behavior remained nonsignificant, going from .14 to .03.)

Discussion

The fourth study clearly demonstrated the problematic nature of the relation between accurate information and behavior. When responses to factual questions on a knowledge test have no evaluative implications, the test may in fact assess little more than the degree to which respondents have accurate information in the domain of interest. However, in many cases answers to factual questions have favorable or unfavorable implications for the topic under consideration, and responses to the questions, rather than reflecting factual knowledge, may be viewed as an indirect expression of an underlying attitude. When the knowledge test is balanced such that correct answers have an approximately equal number of positive and negative implications, the resulting measure may have little to do with accurate information, but it will not be biased in either a positive or negative direction. However, when correct responses have predominantly positive or predominantly negative implications for the topic under consideration, we will observe a positive or a negative correlation, respectively, between attitudes and knowledge. As a result, we will also obtain either a positive or a negative correlation between knowledge and behavior.

Consistent with these arguments, in Study 4 there was a positive correlation between knowledge and behavior with respect to Muslims when the positive form of the knowledge test was used, and this correlation virtually disappeared after attitudes toward Muslims were statistically controlled. Conversely, there was a negative correlation between knowledge and behavior when the negative form of the knowledge test was used, and this correlation was also reduced to nonsignificance by controlling for attitudes toward Muslims.

GENERAL DISCUSSION AND CONCLUSIONS

It stands to reason that the information individuals have in a certain behavioral domain is of central importance for the decisions they make. More problematic is the proposition that appropriate or desirable behavioral decisions require that this information be accurate. The frequently observed lack of correlation between knowledge and behavior effective to produce desired outcomes has led many investigators to conclude that knowledge is a necessary but not a sufficient condition (DiClemente, 1989; Fisher & Fisher, 1992). However, from the perspective of the TPB, information accuracy is neither necessary nor sufficient; indeed, it can be irrelevant to decision making. Instead, what determines intentions and actions is subjectively held information (i.e., beliefs) that links a behavior of interest to positive or negative outcomes, to the normative expectations of important referent individuals or groups, and to control factors that can facilitate or inhibit performance of the behavior. Whether that information is accurate or inaccurate is immaterial. To be sure, the TPB leaves open the possibility that the extent to which people's information is accurate will, on occasion, correspond to the behavioral, normative, or control beliefs they hold. However, this will often not be the case, because items on a knowledge test rarely deal with the particular behavior of interest and, even when they do, they often have no clear implications for behavioral performance. Furthermore, knowledge tests may reflect attitudes rather than assess accurate information.

The results of the four studies reported in this article are consistent with these arguments. The knowledge test in the first study had to do with general information about the environment, rather than with the particular behavior of interest (conserving energy), and participants' knowledge scores were indeed not predictive of their support for conserving energy. In fact, even support for the environment implied by acceptance of the information on the knowledge test was unrelated to the accuracy of people's responses. The knowledge test in the second study did deal with the specific behavior of interest, namely, drinking alcohol. Even though at

least one study (de Nooijer, Lechner, & de Vries, 2003) has found a significant correlation between behavior-focused knowledge and behavior, the items on most knowledge tests—even if dealing with the behavior of interest–are largely factual in nature, having no clear implications for behavior, and are thus unlikely to correspond to the behavioral, normative, or control beliefs that actually guide people's behavior. This was also the case in our knowledge test. Consequently, alcohol knowledge predicted neither intentions to drink nor reports of actual drinking behavior.

That knowledge can sometimes be predictive of attitudes and behavior was shown in the third study. Here, knowledge about Islam and Muslims corresponded to acceptance of items that supported a pro-Muslim position. As a result, knowledge correlated positively with attitudes toward Muslims, it predicted the general pattern of behavior in relation to Muslims and, to a lesser extent, the specific behavior of signing up for a mosque service. In the fourth study we were able to show that the direction of the correlation between knowledge and behavior can be systematically manipulated. By selecting factual questions in such a way that correct answers implied either predominantly favorable attitudes or predominantly unfavorable attitudes toward Muslims, we were able to produce a positive knowledge–behavior correlation or a negative knowledge–behavior correlation, respectively.

In contrast to relying on general knowledge to explain intentions and behavior, the TPB focuses on the proximal antecedents of the behavior in question. Relying on this approach, it was possible to achieve a high degree of predictive accuracy in all four studies. Attitudes, subjective norms, and perceptions of control were found to predict intentions to drink alcohol, to conserve energy, to attend a mosque service, and to vote support for Muslim student activities; these intentions were generally good predictors of the corresponding behavior. Also consistent with the theory, when knowledge did correlate positively with intentions and behavior in Study 3, these relations were mediated by attitudes in the case of intentions and by intentions in the case of behavior.

The implications of the current research are far-reaching and call into question current behavioral intervention strategies. Many educational campaigns, especially in the health domain, are focused on imparting accurate factual information of a general nature. It is expected that once people have a good understanding of the issues, they will engage in socially or personally desirable behavior. Unfortunately, more often than not, this approach results in failure, and people continue to take unnecessary risks or engage in socially undesirable behavior. The present research helps explain why the focus on knowledge is misplaced and suggests an alternative approach that is more likely to be effective. Instead of trying to make sure that people have accurate information, we need to find out what information they actually possess and how this information affects intentions and actions, irrespective of whether the information is accurate or not. Furthermore, we need to be concerned not about general knowledge in a behavioral domain but rather with information or knowledge that guides the behavior of interest (i.e., with beliefs about the behavior). Once we have identified the behavioral, normative, and control beliefs that are readily accessible for individuals in the population of interest, we can provide them with information to challenge beliefs that are contrary to the desired behavior, with information that strengthens their existing supportive beliefs, or with information that leads to the formation of new beliefs supportive of the desired behavior.

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