

2006-638: EXAMINING THE UNDERLYING MOTIVATIONS OF ENGINEERING UNDERGRADUATES TO BEHAVE UNETHICALLY

Trevor Harding, Kettering University

Dr. Trevor S. Harding is Associate Professor of Industrial and Manufacturing Engineering at Kettering University where he teaches courses in engineering materials and manufacturing. Dr. Harding's research interests include wear phenomenon in orthopedic implants, ethical development in engineering undergraduates, and pedagogical innovations in environmental education. Currently, Trevor serves on the ERM Division Board of Directors and on the Kettering University Center for Excellence in Teaching and Learning Advisory Board.

Cynthia Finelli, University of Michigan

Dr. Cynthia J. Finelli is Managing Director of the Center for Research on Learning and Teaching North and Associate Research Scientist of Engineering Education at University of Michigan. Her current research interests include evaluating methods to improve teaching, exploring ethical decision-making in engineering, developing a tool for comprehensive assessment of team-member effectiveness, and assessing the effect of the first year experience on under-represented student retention. She serves on the Executive Board of the Educational Research and Methods Division (ERM) of ASEE and was the ERM Division Program Co-Chair for the 2003 Frontiers in Education Conference and the 2006 ASEE Annual Conference and Exposition.

Donald Carpenter, Lawrence Technological University

Dr. Donald D. Carpenter is an Assistant Professor of Civil Engineering. Dr. Carpenter also serves as Chair of the Educational Innovation Collaborative at LTU and Coordinator of the Civil Engineering Assessment Program. He is actively involved in ASEE and serves as Faculty Advisor for the ASCE Student Chapter at LTU. His research interests involve academic integrity, assessment tools, urban stream restoration, and watershed processes.

Matthew Mayhew, University of North Carolina-Wilmington

Dr. Matt J. Mayhew is Director of Student Life Assessment at the University of North Carolina Wilmington. He completed his Ph.D. in Higher Education with an emphasis on Research, Evaluation, and Assessment. His research interests include evaluation and assessment and student development, with particular focus on learning outcomes of postsecondary education, namely, moral reasoning, reflective judgment, spirituality, and intercultural sensitivity.

Examining the Underlying Motivations of Engineering Undergraduates to Behave Unethically

Abstract

The need for ethical behavior in engineering professional practice has been demonstrated repeatedly over the years, and most, if not all, academic institutions provide opportunities for engineering students to learn about ethics and professional responsibility. While there has been some investigation of the effectiveness of these academic efforts on student learning of ethics, little attention has been paid to students' ethical decision-making and behavior. The present study seeks to verify the use of a model of ethical decision-making to predict the tendency of engineering and humanities students to engage in cheating, an unethical behavior with which nearly all undergraduates are familiar.

The study surveyed 527 randomly selected engineering and humanities undergraduate students from three academic institutions. Comparison between engineering and humanities students showed that engineering students were statistically more likely to cheat on tests and homework than humanities students, even when controlling for the number of tests or assignments. Hierarchical regression analysis confirmed that the hypothesized model could explain a considerable portion of the variance in students' intention to cheat and in their actual behavior. The strongest predictor of behavior was an individual's *intention to cheat*, as predicted by the model. In turn, the strongest predictors of intention were an individual's attitude toward cheating, their sense of moral obligation to avoid cheating, and his/her perception of subjective norms pertaining to cheating. Past cheating was shown to be an important predictor variable for both intention and behavior.

Introduction

There is a growing emphasis in the United States on graduating engineering students who understand professional and ethical responsibility, as evidenced by *The Engineer of 2020* report produced by the National Academy of Engineering (NAE)¹. This report concludes that future engineers will need to “possess a working framework upon which **high ethical standards** and a strong sense of **professionalism** can be developed.” To date, most research on ethics education in engineering has focused on the effectiveness of various pedagogies as measured by in-class assessment of learning. While valuable, these efforts fail to recognize that the best measure of successful learning of ethical decision-making may be the extent to which an individual behaves ethically. The study described here details an effort by the authors to conduct an empirical study of the ethical decision-making of engineering undergraduates in comparison to that of humanities undergraduates. The paper will present the results of a self-report questionnaire administered to 527 engineering and humanities students, including a regression analysis of the data and an attempt to model the ethical decision-making process in these two populations.

The measurement and study of ethical behavior is a challenging proposition, given the difficulty in developing valid measures that are both common and recent for the population of interest. To deal with this challenge, the authors have developed a research design that is focused on using

self-reports of undergraduate engineering student's engagement in academic dishonesty (also known as cheating) as a target for examination of their ethical decision-making and ethical behavior while in college. The authors do not examine cheating because they believe necessarily that more must be done to catch and punish students who cheat. Rather, they view cheating as a behavior that requires an ethical decision and one that is commonly encountered by students. Most importantly, this ethical decision is one that requires students to consider a behavior they know to be in violation of established policies, codes, and, in some cases, norms (in actuality, students were asked to respond about behaviors they personally defined as cheating). Thus, academic dishonesty represents an "authentic experience" by which ethical decision-making and behavior can be studied among this population.

There is ample evidence to suggest that engineering students self-report significantly higher rates of cheating than do students in most other disciplines (only business students report higher rates of cheating)^{2,3,4}. To understand why engineering students would cheat more often than their peers would, the authors have designed a study in which the ethical behavior and decision-making of undergraduate engineering students are compared to those of humanities students. Humanities students historically report lower levels of cheating than all other disciplines^{2,3,4}, presenting a population that is significantly different from engineering students in terms of cheating behavior.

In addition to the assumption that cheating serves as a valid proxy measure of ethical behavior, the authors assume that cheating is the result of rational choice that is under the volitional control of the individual. Such behavior can therefore be modeled so that one can predict the behavior in question, as well as the direct antecedents involved in establishing an individual's intention to engage in the behavior. In other words, the ethical decision-making of engineering students can be measured assuming that cheating is both a form of (un)ethical behavior and a rational choice made by the individual. When comparing the ethical decision-making of engineering and humanities students, the authors rely on a modified form of the Theory of Planned Behavior^{5,6} as a model of the decision-making process used by students when forming an intention to cheat. The purpose of this study, therefore, is to measure the predictive validity of the modified Theory of Planned Behavior as a model of cheating behavior and the intention to cheat.

Theory of Planned Behavior

To provide a theoretical foundation for this study, the authors chose a modified form of Ajzen's Theory of Planned Behavior (TPB)⁵. The modified model includes the explicit variables of the TPB (shown inside the dashed box in Figure 1), plus a variable describing past behavior and an additional moral component. The premise of the TPB is that individuals make rational decisions to engage in specific behaviors based on their own beliefs about the behaviors and their expectation of a positive outcome after having engaged in the behavior. According to the theory, an intention to perform a behavior is determined by three components: (1) attitude toward a behavior, (2) perceived social pressures to engage in or not engage in the behavior (subjective norm), and (3) perceived ease of performing the behavior (perceived behavioral control). In the aggregate, these components directly influence an individual's intention to complete a behavior, and intention in turn influences whether an individual ultimately engages in the behavior. To the extent that the individual's perception of behavioral control is in agreement with actual

behavioral control, Ajzen postulated that perceived behavioral control serves as a proxy for actual behavioral control, therefore having a direct influence on *both* intention and the actual behavior.

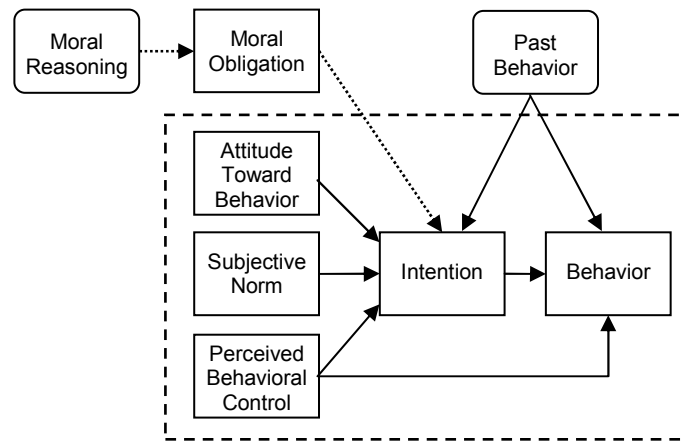


Figure 1: Modified version of Ajzen’s Theory of Planned Behavior⁵ including moral components and past behavior (Ajzen’s original model is shown inside the dashed box).

Support for the TPB as a predictive model of *cheating* comes from Whitley^{7,8} who conducted a meta-analysis of 107 studies of academic dishonesty. Among other findings, Whitley reported that: (1) students with favorable attitudes of cheating are more likely to cheat than students with unfavorable attitudes (attitude toward behavior); (2) students who perceive that social norms permit cheating do so to a greater extent than other students (subjective norm); and (3) students who perceive themselves as more effective cheaters are more likely to cheat (perceived behavioral control). Further support for the TPB as a predictive model for cheating comes from Beck and Ajzen⁹ who showed that the model successfully predicted most of the systematic variance in student decisions to cheat.

Despite substantial support for the TPB as a means of predicting behavior, research continues to examine additional variables that might enhance the predictive capabilities of the theory in certain circumstances¹⁰. For example, Armitage and Conner¹¹ showed that correlations between moral norms and other constructs of the TPB were large, and they argued that moral norms might play an important role in the theory. Inclusion of an additional moral component in the current study is important for several reasons. First, the decision to cheat is clearly an ethical one, and a moral component may be critical in such decisions. Second, it has been shown that college has a particularly influential effect on gains in moral reasoning scores¹², such that there may be significant differences in this component according to college level. Third, opportunities to participate in discussions of differing moral perspectives are not often provided in an undergraduate engineering program, so there may be differences in the relative influence of a moral component by discipline. For these reasons, the authors have included a moral component to the TPB that may be defined as either moral obligation (described by Ajzen⁵ as “personal feelings of ... responsibility to perform, or refuse to perform, a certain behavior”), moral reasoning (described by Kohlberg¹³ as the process by which an individual determines whether a behavior is morally right or wrong), or both.

Finally, the modified form of the TPB also includes a measure of past behavior-- cheating in high school (an experience common to all study participants). Past behavior is hypothesized to influence both the intention to engage in cheating and the extent to which an individual actually cheats.

Sample Descriptives

A total of 527 respondents from three institutions participated in this study. Of this number, 223 attended a large Doctoral Research Extensive public institution (School A), 208 attended a small private Baccalaureate Specialty institution (School B), and 96 attended a mid-sized private Masters I institution (School C). Students from two disciplines were included in the sample for comparative purposes: engineering and humanities. Engineering students made up 78.5% of the sample, with humanities students accounting for the remainder. Unlike the engineering students, humanities students were recruited from School A only.

The sample consisted of 32.5% females. However, among the engineering students included in the sample, women constituted only 21.2% – a number similar to the 2004 national average for female enrollment in bachelor’s engineering programs¹⁴. Among the humanities students, 73.5% were females. The average age of respondents was 20.0 years ($\sigma = 2.81$), with 96% of the sample being 23 years of age or less. Slightly more than half (57.5%) of the sample consisted of freshmen and 38.1% seniors. The recruitment of only freshmen and seniors was an intentional effort to survey students at the very beginning and end of a baccalaureate experience to assess the effect of a traditional 4 year program on the study outcome variables.

Caucasians made up the largest portion of the sample (84.4%) with 9.9% identifying themselves as Asian/Pacific Islander, 5.3% African American/Black, 4.0% Hispanic/Latino, and 1.6% Native American/American Indian. International students accounted for 6.3% of the sample; however, the majority of these students was enrolled in engineering programs and was ethnically Asian/Pacific Islander.

Finally, when asked about paying for their college education, 22.3% indicated that scholarships covered most or all of their expenses. Additionally, 23.1% of participants reported participating in fraternity or sorority activities at least 1 hour per week, while 71.5% of respondents reported participating in clubs, student teams, professional societies, and or community service organizations at least 1 hour per week.

Methods

For the present study, the authors designed a two-part instrument that includes the Perceptions and Attitudes toward Cheating among Engineering Students (PACES-2) Survey and the Defining Issues Test (DIT-2). The PACES-2 Survey consists of demographic questions, as well as items to assess the variables of the modified TPB.

The first of these variables is the dependent outcome variable – self-reported college cheating behavior. It is worth noting that at no time does the survey define cheating for the respondent; the authors allowed the individual respondent to define “cheating” for themselves. As such, the

instrument is measuring the extent to which the respondent acknowledges engaging in a behavior even they consider to be cheating.

Another challenge in measuring cheating behavior lies in the differences in approaches to assessment between engineering and humanities. One explanation for higher reported rates of cheating among engineering students is that these students have more frequent opportunities to cheat than humanities students do. In addition, past research by the authors has established that context (i.e. type of cheating) plays a significant role in determining both the frequency of cheating and students' attitudes toward it.¹⁵ Since engineering programs often rely more heavily on tests and homework for assessment, context must be considered when measuring cheating behavior between dissimilar groups of students.

To account for differences in opportunity and the influence of context, cheating behavior was measured on the PACES-2 survey instrument in the form of a frequency for two different contexts: test cheating and homework cheating. Using a five-point Likert scale, respondents were asked to indicate, "*During the previous academic term in college, how frequently did you cheat on in-class tests or exams?*" For homework cheating, respondents were asked, "*During the previous academic term in college, how frequently did you cheat on homework assignments?*" Responses to these items included:

- Never (1),
- A few of the times I took a test or exam/worked on a homework assignment (2),
- About half the times I took a test or exam/worked on a homework assignment (3),
- Almost every time I took a test or exam/worked on a homework assignment (4), and
- Every time I took a test or exam/worked on a homework assignment (5).

Other TPB variables measured by the PACES-2 instrument include attitude toward behavior (via a series of semantic differential scales), subjective norm, perceived behavioral control, intention, and self-reported college cheating behavior. Except as indicated, all items used a Likert scale format. The survey also included questions to address moral obligation and frequency of high school cheating (i.e., past behavior). Similar to the behavioral items described previously, all TPB related items were posed in two separate contexts: test cheating and homework cheating. The Balanced Inventory of Desirable Responding (BIDR) instrument is included verbatim at the end of the PACES-2 Survey to control for social desirability bias¹⁶.

The second part of the instrument, the DIT-2, is a multiple-choice test that was originally developed by Rest^{17,18,19}. The DIT-2 is based on Kohlberg's Theory of Moral Development¹³ and provides a measure of an individual's moral reasoning from a social justice perspective. Respondents were asked to identify concepts important in resolving each of five dilemmas representing modern social problems. Moral reasoning aptitude is assessed via an average moral reasoning score (N2 score).

The two-part survey instrument underwent an initial phase of pilot testing at School A to develop reliable, internally-consistent scales from the PACES-2 Survey and to identify shortcomings in study protocols. This pilot testing was followed by a second test-retest phase to establish the temporal stability of the questionnaire items. The final phase of the study involved the full administration of the PACES-2 and DIT-2 survey instruments to the study populations. A total

of 1600 randomly selected students from the three institutions were recruited to participate in the study. A number of approaches were used to increase response rate as described elsewhere²⁰. Response rates varied by institution with 27.9% for School A, 52.0% for School B, and 24.0% for School C. All instruments and methods described here were reviewed and approved by a behavioral sciences internal review board.

Behavioral Measures

College Cheating

Table 1 presents average Likert scores for college cheating frequency items. Perhaps most importantly, the data suggests that the average study participant reported cheating on less than “a few assignments or tests in the last academic term.” Further, 71.3% of respondents reported having never cheated on a test during the past academic term, and 45.5% reported having never cheated on a homework assignment in the past academic term.

Table 1: Differences in self-reported frequencies of college cheating

Discipline	College (Present Behavior)		
	<i>Test Cheating</i>	<i>HW Cheating</i>	<i>Difference</i>
Engineering	1.35	1.72	0.37***
Humanities	1.19	1.36	0.17**
Difference	0.16**	0.36***	

p<0.01, * p<0.001

Engineering students reported cheating on tests at a significantly higher frequency than humanities students, suggesting that even when accounting for number of opportunities, engineering students still report cheating on tests more frequently. 32.5% of engineering students admitted to cheating on tests at least a few of the times they took tests during the previous term compared to only 18.3% for humanities students. For the homework contexts, Table 1 again shows that engineering students reported cheating at a significantly higher frequency than humanities students. In this context, 59.7% of engineering students reported cheating on homework at least a few of the times they worked on an assignment compared to only 36% for humanities students. Table 1 also supports the observation that context affects frequency of cheating (not just absolute number of incidents) as shown by the higher frequencies reported for homework cheating independent of discipline (p<0.01).

Past Behavior

As a measure of past behavior, the PACES-2 survey included items identical to those described above for measuring participants’ self-reported frequency of cheating during an average term in high school. Table 2 shows average Likert scores for both test and homework cheating during high school. Unlike the case of college cheating, the frequencies of cheating for engineering and humanities students are not significantly different. Based on this data one might conclude that in terms of their cheating behavior, engineering and humanities students are not all that different prior to entering college. When considering this finding alongside the differences in college cheating noted above, it becomes apparent that the differences seen in cheating frequencies

between engineering and humanities students occur after arriving at college, not before, suggesting an influence of college discipline.

Table 2: Differences in self-reported frequencies of high school cheating

Discipline	High School (Past Behavior)		
	<i>Test Cheating</i>	<i>HW Cheating</i>	<i>Difference</i>
Engineering	1.60	1.89	0.29***
Humanities	1.70	1.97	0.27***
Difference	-0.10	-0.08	

p<0.01, * p<0.001

However, it would be incorrect to say that engineering students cheat more frequently when they arrive at college. To the contrary, comparing the data in Table 1 and 2 indicates that both engineering and humanities students report cheating *less* frequently in college than in high school. The difference between engineering and humanities students seems to be a result of the humanities students curtailing their cheating more so than the engineering students. All differences between high school and college cheating were significant at the p<0.001 level.

TPB Scales

The PACES-2 instrument included a number of items for each of the Theory of Planned Behavior variables shown in Figure 1 (i.e., intention, attitude toward behavior, subjective norm, and perceived behavioral control). Several items were also included on the instrument for the additional variable moral obligation. Using confirmatory factor analysis these items were grouped together to form scales that could be used in a regression analysis. This analysis showed that for all scales the variance explained by a single component model was greater than 50% providing reasonable support for a single factor model of this variable. In addition, Cronbach’s alpha was used to establish the internal reliability of each scale (the extent to which a set of items on a test measure the underlying factor or latent variable). All scales (except Perceived Behavioral Control for the test cheating context) had reliability scores above 0.75 indicating sufficient internal consistency.

Further analysis of the scales indicated very high correlations ($r>0.58$) between moral obligation, attitude toward behavior, and subjective norm for both the test and homework contexts indicating potential problems with multicollinearity (a situation in which predictor variables which are presumed to be independent are actually highly correlated suggesting they measure similar phenomenon). As such, the authors decided to reduce these via a second-order factor analysis to a single factor that incorporated measures of attitude, moral obligation, and subjective norm. Regardless of context, 77% of the variance in these measures was explained by the single factor, with a Cronbach’s alpha of 0.85, providing reassurance that a single factor model was valid and reliable.

Regression Analysis

Cheating Behavior

Multiple regression analyses were performed to determine how the constructs worked together to predict college cheating behavior. Because the dependent behavior variables (college cheating frequency) failed normality tests, these variables were converted to dichotomous variables using a median split. Standardized regression coefficients are shown in Table 3. Regression diagnostics confirmed that the assumptions of normality, linearity and homogeneity were met for the model. In general, the various regression models explained levels of variance (R^2) in the outcome variable that were similar to those reported in the literature on the Theory of Planned Behavior^{9,10}, supporting the use of the TPB as a model of cheating behavior. Further, percentage of variance explained was similar for both homework and test cheating contexts, though the variance explained by the model was slightly higher for test cheating.

Table 3: Regression analysis of study variables on college cheating behavior

Direct effects on:	Standardized Regression Coefficients (β)	
	Frequency of Cheating on Tests $R^2 = 0.39$	Frequency of Cheating on Homework $R^2 = 0.27$
<i>Behavior</i>		
Demographics		
Education level (Freshman)	-.014	-.004
Investment Scholarship	-.083*	.010
Fraternity membership (No)	.054	.058
Club membership (No)	-.031	.058
International student (No)	.028	.003
Gender (Male)	.123**	.046
Discipline (Engineering)¥	-.123**	-.093*
Past Behavior	.209***	.128**
Perceived Behavioral Control	.056	-.033
Intention	.479***	.440***

* $p < .05$, ** $p < .01$, *** $p < .001$

¥ A negative regression coefficient indicates that engineering students would cheat more frequently than humanities

As predicted by the Theory of Planned Behavior, an individual's intention to engage in cheating had the greatest influence on their self-reported college cheating behavior. The values of the regression coefficient for intention were similar for both test and homework cheating, suggesting that the importance of this variable on behavior may be independent of context. However, perceived behavioral control failed to predict behavior, suggesting that participants' perceived ease of cheating has no bearing on their actual cheating.

Not surprisingly, the second strongest predictor of cheating behavior is past behavior (high school cheating), with students who reported cheating more frequently in high school also reporting a higher frequency of cheating in college. However, past behavior seems to have a slightly greater influence on test cheating than on homework cheating.

Among the demographic variables, discipline (engineering or humanities) had a significant, though not strong, influence on the participants self-reported cheating for both test and homework contexts with engineering students being more likely to cheat. In the case of test

cheating, gender seems to play a significant role with increased test cheating reported among female students. Gender does not, however, play a significant role in explaining the variance in homework cheating. This distinction may in part explain the mixed results reported in the literature on the influence of gender on cheating rates^{21,22,23,24,25,26,27}. Finally, test cheating behavior was slightly higher for those students who reported paying for all or most of their college expenses through scholarships, suggesting that students who are on scholarship feel more pressure to do well on tests to remain eligible for their scholarships.

Intention

The modified Theory of Planned Behavior further states that intention will be predicted by perceived behavioral control as well as those variables included in the second-order factor (attitude, subjective norm, and moral obligation). Table 4 provides regression coefficients for a hierarchical linear regression analysis of the TPB variables, moral obligation, past behavior, and demographics on intention. The variance in intention explained by the model was around 58% for both the test and homework contexts, indicating substantial support for the TPB as a model of how individuals develop an intention to cheat.

Table 4: Regression analysis of study variables on college cheating intention

Direct effects on:	Standardized Regression Coefficients (β)	
	Frequency of Cheating on Tests	Frequency of Cheating on Homework
<i>Intention</i>	$R^2 = 0.59$	$R^2 = 0.58$
Demographics		
Education level (Freshman)	-.035	-.069*
Investment Scholarship	.014	.008
Fraternity membership (No)	.076*	.072*
Club membership (No)	.009	.032
International student (No)	-.033	.037
Gender (Male)	-.018	-.044
Discipline (Engineering)	-.054	-.068
Past Behavior	.192***	.166***
Perceived Behavioral Control	-.018	.024
Second order factor	.643***	.629***
Moral Reasoning	-.061‡	-.037
<i>Second order factor (Moral Obligation, Attitude, Subjective Norms)</i>	$R^2 = 0.05$	$R^2 = 0.05$
Moral Reasoning	-.223***	-.182***

‡ $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$

As predicted by the TPB, the second-order factor was the strongest predictor of an individual's intention to cheat. Further, the strength of the regression coefficient was similar for both test and homework cheating, suggesting that the combined effect of attitude, subjective norm, and moral obligation on cheating behavior may be independent of context. Similar to the regression of cheating behavior, however, perceived behavioral control failed to regress onto intention for either context.

Among other variables, past behavior was a significant predictor of intention, with respondents who reported more frequent high school cheating also having a stronger intention to cheat in the near future. Membership in a fraternity or sorority was a weak predictor of intention for both test and homework cheating. Interestingly, membership in a fraternity/sorority did not influence actual cheating behavior. This suggests that while fraternity and/or sorority members may be slightly more likely to intend to cheat, they are no more likely to actually do so. Also, freshmen were slightly more likely to intend to cheat on homework than were the seniors included in this study, though this did not affect their actual behavior.

Influence of Moral Reasoning

The model hypothesized by the authors (shown in Figure 1), indicates that moral reasoning should act as an antecedent variable of moral obligation. Based on the data presented in Table 3, moral reasoning explains about 5% of the variability in the factor including subjective norms, moral obligation, and attitudes toward behavior. This leaves 95% of the variability in this factor unexplained, perhaps suggesting the need for future researchers to include constructs not operationalized in our model (i.e., attitudinal beliefs and expectancies and normative beliefs and expectancies).

The negative correlation between moral reasoning and the second-order factor suggests that respondents with higher measured moral reasoning scores tended to have lower second-order factor scores. Thus we might conclude that students who are more likely to base their understandings of fairness on conceptions of justice that serve societal needs are significantly more likely to feel some sense of moral obligation to avoid cheating, less positive attitudes toward cheating, and be more aware of subjective norms against cheating. Because of the multicollinearity problems associated with these TPB variables, a direct relationship between moral reasoning and moral obligation cannot be established. However, the fact that moral reasoning is correlated with the second-order factor suggests that further examination is warranted.

Conclusions

This study has attempted to examine the use of a modified form of the Theory of Planned Behavior as a model of the decision-making process used by engineering students when they consider engaging in an unethical behavior, specifically cheating. The results of this study confirmed the use of the Theory of Planned Behavior as a model of the decision to engage in cheating based on the variance in both behavior and intention explained by the model. Furthermore, the input variables of moral obligation, attitude toward the behavior, and subjective norm were shown to play an important role in establishing an individual's intention to engage in cheating. However, due to problems with multicollinearity, the specific role of each of these variables in the decision-making process could not be established. Together these results support further research on the use of the Theory of Planned Behavior as a predictive and explanatory model of ethical decision-making among engineering undergraduates.

Another important finding of this research was that past behavior (measured as high school cheating frequency) was an important predictor of both actual cheating behavior and the

development of an intention to do so. This finding supports previous work that showed that past cheating was related to unethical behavior later in life.

Finally, the results confirmed previously observed differences in the rates of cheating between engineering students and those from other disciplines. The unique contribution of this study was to show that this difference is independent of the number of opportunities to cheat experienced by an individual student. Furthermore, the difference in rates of cheating between engineering and humanities students was shown to exist only in college, not in high school. Together these results indicate that the explanation for higher rates of cheating among engineering students may lie in curricular or cultural differences between engineering and other disciplines, rather than in differences in opportunities to cheat or in the nature of students entering these disciplines.

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