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Experimental Studies to Clarify the Knowledge-to-action Gap in Information Ethics

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Abstract: If learners cannot form an intention to take an appropriate action with reference to the knowledge of information ethics, it cannot be said that the learners have working knowledge of ethical principles. In the present study, the two experiments are conducted with high school students to examine if the knowledge-to-action gap can be confirmed by means of paper-and-pencil tests consisting of knowledge and intention tasks of information ethics. The knowledge task is to inquire about appropriate behavior regarding the correct knowledge, while the intention task is an inquiry whether the respondents consciously select the action or not. The experiments 1 and 2 indicated that participants take unethical behaviors even though they know appropriate behavior. In addition, the experiment 2 demonstrated that the participants estimated the number of classmates with unethical behavior is higher than the actual number. These results indicate the importance of education and teaching methods, which need to be carefully designed to reduce the gap between knowledge and action to comply with information ethics.

Keywords: knowledge-to-action gap, information ethics, theory of planed behavior

1. Introduction

Due to the rapid progress of information technology, there is a growing need of ethical maturity for individuals in information society. Ministry of Education, Japan (2009, p.37) defines information ethics as "thinking and attitudes that form the basis for appropriate conduct in information society" (Ministry of Education, Culture, Sports, Science and Technology, 2009, p.37). Thus, despite having knowledge of information ethics, if there is no intent to actualize that knowledge (behavioral intention) in practice, it cannot be said that working knowledge of ethical principles has been acquired. For examples, bad practices continue to abound in information moral behavior despite efforts for disseminating good practices by various organizations (Telecommunications Carriers Association, 2015b; The Japan Commercial Broadcasters Association, 2015; Information-technology Promotion Agency, Japan, 2015). A study of texting while walking reported 56.2% of respondents have experienced near run-ins with people smartphoning while walking. In another survey on password use, 93.1% of web service users answered yes to the question of password recycling. Such behavior is often called unsafe act (Haga, 2000, Reason, 1990), which is described as behavior that may harm the safety of the doer or others even when it is implemented unintentionally (Haga, 2000, p. 137). In this study, unsafe act against information ethics is referred to as unethical behavior.

The main objective of this study is to clarify the characteristics of unethical behavior, by quantifying inconsistencies between knowledge and behavioral intention, by using questionnaires created from descriptions in textbooks of information ethics for Japanese high schools. Students participated as respondents completed two types of questionnaires: one is to answer for ethical behavior to be regarded as correct knowledge (*knowledge task*), and another is to answer for actual behavior that will be taken by the respondents (*intention task*). Based on the results of the questionnaires, characteristics of unethical behavior are investigated considering how students estimated the behavior of their classmates. In the remainder of this paper, first we briefly review the studies of psychological processes underlying the relations between knowledge and behavior. Section 3 explains the results of surveys, where subject matters for information ethics are extracted and categorized from Japanese high school textbooks. Finally, in Sections 4 and 5, two psychological experiments are presented to make

sure there exist the knowledge-and-action gap, and then discuss findings from the experiments that reveal inconsistencies between knowledge and behavioral intention.

2. The psychological process from knowledge to behavior

Appropriate information moral behavior, namely, ethical behavior, is observed when a person forms intention not only to avoid unethical behavior, but also to take ethical behavior. In the theory of planned behavior proposed by Ajzen (1991), the behavior stage is preceded by an intention stage, which in turn is influenced by attitudes toward the particular behavior, subjective norm, and perceived behavioral control. Gollwitzer (1993, 1996) further divides intention into two types: goal intentions and implementation intentions. Goal intentions take the form of a wish or desire "I intend to do X!" (Gollwitzer, 1996, p.292) while implementation intentions are concrete plans to achieve particular goals when there is an established relationship between a behavior and the situation on which it is premised "I intend to do X when situation Y is encountered!" (Gollwitzer, 1996, p.292). In case of information moral behavior, an example of implementation intentions will be as follows: a person intends to create a new password when password registration is required for use of a website.

Furthermore, Koike, et al. (2003) propose an extended psychological process model that begins with a stage of knowledge (*i.e.*, knowing the subject) followed by the stages of interest, motivation, and behavioral intention, until an actual behavior is taken. Regardless of the progress of these qualitative models, there have not been any method for quantifying the knowledge-and-action gap. In contrast, focusing on the formation of the initial and final stages in the psychological process, Tanaka, et al. (2015b) proposed an experimental method to quantify inconsistencies between knowledge and behavioral intention, and demonstrated the validity of the method in disaster emergency situations. This experimental method is used in this study to investigate the relationship between knowledge and behavior in the case of information ethics.

3. Preliminary Study

In order to apply the experimental method (Tanaka, et al. 2015b) to the field of information ethics, it is necessary to collect individual unethical behaviors and categorize them for use in questionnaires. Through factor analysis of existing studies on awareness of information ethics, Arimitsu (2015) has identified three major themes: copyright (copyright infringement and illegal copy), personal information (invasion of privacy), and information abuse. Arimitsu (2015) pointed out that the awareness should be measured with regard to risk aversion as well. In addition to these four themes, we consider public manners in this study, which are frequently cited as social problem with personal digital assistant such as mobile devices. We then reviewed textbooks and supplementary materials used in the subject of Information in Japanese high school curriculum, and surveyed unethical behaviors given in these materials.

3.1 Materials surveyed

We surveyed 11 textbooks on the subject of Information. Six of them were textbooks officially approved in 2012, and five were supplementary booklets published in 2014 or later.

3.2 Survey Method

Descriptions of unethical behaviors are extracted from the textbooks and supplementary booklets, taking account of the above-mentioned themes: copyright, personal information, information abuse, risk aversion, and manners.

Table 1. Types of unethical behavior items classified under the four topics.

Unethical behavior types (behavior against information ethics)	Surveyed material		Extracted descriptions
	Textbooks	Supplementary booklets	
Ethics in Information Society			
Chainmail forwarding	5	5	14
Identification of individuals on SNS	4	4	10
Phones in priority seating areas	3	5	8
Digital theft	2	4	6
Texting while walking	2	4	6
Understanding and Observing with the Law			
Copyright infringement	6	5	26
Portrait right infringement	6	5	20
Fraudulent access	5	4	20
Illegal downloading	1	3	5
Information Security			
Renewing anti-virus software	6	4	13
Preventing data loss	4	3	9
Password recycling	4	3	8
Password storage	0	2	2
Wisdom for Safety			
Confirming the reliability of information	6	4	13
Paying false bills	5	4	15
Replying to unknown senders	2	5	10
Confirming use of personal data	1	5	16
Real-time posting	0	1	1

3.3 Results and Discussion

As the results of the survey, 202 unethical behavior descriptions are extracted, and grouped substantially into 18 types. Since the formation of behavioral intention depends on individual situations where ethical behaviors are desired (Leonard et al., 2004), it must be assumed that extraneous variables exist in each situation. To minimize the influence of interrelationships between these extraneous variables, we analyzed the materials as a single experimental factor (Kaiho, 1999). In addition, extracted items were categorized in terms of situation prerequisite for ethical behavior.

In the teachers' training handbook for information ethics (Ministry of Education, Culture, Sports, Science and Technology, 2010), teaching content is systematically organized into two themes: ethics and information society. The theme of ethics includes two topics: one is ethics in information society, and another is understanding and observing the law. The theme of information safety, on the other hand, includes the other two topics: information security and wisdom for safety. Based on this distinction of four topics, the extracted 18 unethical behavior types are further classified as shown in Table 1.

4. Experiment 1

Inconsistency between knowledge and behavioral intention occurs when people choose to engage in behavior against the correct knowledge they possess. In this study, such inconsistencies occurred

among respondents are revealed by comparing their answers to a questionnaire on appropriate behavior based on correct knowledge (*knowledge task*) and a questionnaire on actual intended behavior (*intention task*). In accordance with the method proposed by Tanaka, et al. (2015b, 2016), we conducted two experiments using a within-participants design to effectively reduce the impact of individual comprehension differences (Kaiho, 1999) and a between-participants design to effectively reduce any impact from inference of experimental aims based on the questions presented (Kato, 1999).

4.1 Participants

124 first year high school (10th grade) students participated. The responses from 111 students were analyzed after eliminating 13 incomplete responses.

4.2 Stimulus

For each of the 18 unethical behavior types (Table 1), we created descriptions of situation accompanied by a choice of ethical or unethical behavior responses. In the case of password recycling item, for example, the description of the situation will be "I use multiple websites that require setting up a password." The ethical behavior choice is described as "I use different passwords for each website" while the unethical behavior choice as "I use the same password for multiple websites."

4.3 Procedure

The questionnaires were distributed to three different classes during the course hours. Students were given an example and instructed to choose either an ethical or unethical behavior in response to the questionnaire on knowledge and intention tasks. Instructions for the knowledge task were: "Which behavior is appropriate in principle when using information technology?" and instructions for the intention task were: "Which behavior would you yourself choose?" Following the method by Tanaka, et al. (2015b, 2016), four types of task arrangements are employed: knowledge task alternating with intention task (KIKI), intention task alternating knowledge task (IKIK), all knowledge tasks followed by all intention tasks (KKII), and all intention tasks followed by all knowledge tasks (IIKK).

4.4 Results and Discussion

Table 2 shows the percentage of correct answers for knowledge and intention tasks by arrangement. Given the high percentage of correct answers for knowledge tasks we assumed a non-normal distribution and chose a non-parametric test. The Wilcoxon signed-rank test was applied to correct response rates for knowledge tasks and intention tasks per arrangement. For all of the arrangements (within-participants design), the correct answer rate for intention items was significantly lower than the correct answer rate for knowledge tasks (Table 2).

The correct answer rates for KKII knowledge tasks and IIKK intention tasks reflects responses when participants were unaware that the other opposing tasks existed, so they are useful in considering how inconsistency between knowledge and behavioral intention is related to between-participants design. When we applied the Mann–Whitney U test to the correct answer rate for KKII knowledge tasks and IIKK intention tasks, we found that the correct answer rate for intention tasks was significantly lower than that for knowledge tasks (Table 2). When we compare within-participants design and between-participants design, the correct answer rate for intention tasks was lower than that for knowledge tasks. These results show inconsistency between knowledge and behavioral intention.

Next, to control for the impact of interrelationships between extraneous variables, we examined inconsistency between knowledge and behavioral intention using topics that included four or five types of unethical behaviors as experimental factors. Since we found more inconsistency for all of the arrangements compared to the results described above, we combined the four arrangements into a single condition and tested as a within-participants design. We applied a Wilcoxon signed-rank test to the correct answer rates for knowledge tasks and intention tasks in each topic (Table 3). The results indicate that in all the topics of Ethics in Information Society, Understanding and Observing the Law, Information Security, and Intelligent Safety, the correct answer rate for intention tasks was significantly

Table 2. Correct answer rate for knowledge tasks and intention tasks by arrangement (Experiment 1).

Variable	n	Knowledge task M (SD)	95% CI	Intention task M (SD)	95% CI	U	z	p	r
Within-participant design (Wilcoxon signed-rank test)									
KIKI	29	.86 (.13)	[.81, .91]	.67 (.19)	[.59, .74]		-4.21	< .001 **	.83
IKIK	32	.86 (.15)	[.80, .91]	.59 (.18)	[.53, .66]		-4.38	< .001 **	.77
KKII	26	.89 (.11)	[.85, .93]	.62 (.22)	[.53, .71]		-4.11	< .001 **	.81
IIKK	24	.81 (.19)	[.73, .89]	.58 (.25)	[.48, .69]		-3.22	.001 **	.66
Between-participants design (Mann–Whitney U test)									
KKII-K vs. IIKK-I		.89 (.11)	[.85, .93]	.58 (.25)	[.48, .69]	91.50	-4.30	< .001 **	.61

Note. KKII-K = knowledge task in KKII; IIKK-I = intention task in IIKK. * p <.05, ** p <.01.

Table 3. Correct answer rate for knowledge tasks and intention tasks by topic (Experiment 1).

Variable	Knowledge task M (SD) [95% CI]	Intention task M (SD) [95% CI]	z	p	r
Ethics in Information Society	.89 (.17) [.85, .92]	.63 (.27) [.58, .68]	-7.62	< .001 **	.72
Understanding and Observing with the Law	.91 (.18) [.87, .94]	.67 (.26) [.62, .72]	-6.36	< .001 **	.60
Information Security	.82 (.19) [.79, .86]	.62 (.24) [.57, .66]	-6.92	< .001 **	.66
Wisdom for Safety	.81 (.23) [.77, .85]	.55 (.31) [.49, .61]	-6.56	< .001 **	.62

Note. N = 111. * p <.05, ** p <.01.

lower than that for knowledge tasks, thus confirming inconsistency between knowledge and behavior (Table 3).

5. Experiment 2

Parents and peers are one of the factors involved in the formation of behavioral intention and social norms (Grube, et al. 1986; Burankrant & Page, 1988). Capalidi, et al. (2001) have proposed that an individual's anti-social tendencies are encouraged by relationships with peers who have anti-social tendencies. In a study of information moral behavior and college students, Chiang and Lee (2011) found that social norms are influenced not only by parents and family but also by friends and classmates, and that the influence of friends and classmates is actually greater than that of parents and family. In a survey on problem behavior among high school students, Yoshizawa and Yoshida (2010) reported that an individual's anti-social tendencies are influenced more by the anti-social tendencies of the peer group than by the anti-social tendencies of a single friend.

Information moral behavior often involves a high degree of anonymity on the Internet. If students decide to engage in certain behavior because they believe their friends and classmates will do the same, they are in effect projecting the information moral behavior of others. In Experiment 2, we asked students to predict the percentage of their classmates that they thought would choose unethical behavior to confirm whether students who choose unethical behavior project the same response among their classmates.

Table 4. Correct answer rate for knowledge tasks and intention tasks by arrangement (Experiment 2).

Variable	n	Knowledge task M (SD)	95% CI	Intention task M (SD)	95% CI	U	z	p	r
Within-participant design (Wilcoxon signed-rank test)									
KIKI	23	.95 (.09)	[.91, .98]	.62 (.16)	[.55, .69]		-4.20	< .001 **	.88
IKIK	22	.97 (.04)	[.95, .98]	.64 (.12)	[.58, .69]		-4.02	< .001 **	.86
KKII	26	.96 (.04)	[.95, .99]	.64 (.16)	[.57, .71]		-4.21	< .001 **	.83
IIKK	22	.98 (.06)	[.95, 1.00]	.60 (.14)	[.54, .66]		-4.11	< .001 **	.88
Between-participants design (Mann–Whitney U test)									
KKII-K vs. IIKK-I		.96 (.04)	[.95, .99]	.60 (.14)	[.54, .66]	3.00	-5.75	< .001 **	.81

Note. KKII-K = knowledge task in KKII; IIKK-I = intention task in IIKK. * p <.05, ** p <.01.

5.1 Participants

108 second year high school (11th grade) students participated. The responses from 90 students were analyzed after eliminating 18 incomplete responses.

5.2 Stimulus

The 18 unethical behavior types (Table 1) was used as in Experiment 1.

5.3 Procedure

We distributed questionnaires during the class period to three different classes. We first asked students to respond to the same questionnaire as in Experiment 1. Students were not informed that they would later be asked to complete a second questionnaire predicting behavior of their classmates. Approximately one month after the first questionnaire, participants were given the second questionnaire during the class and asked to predict the percentage (in 10% increments) of classmates who would choose ethical/unethical behavior. In the questionnaire form, ethical/unethical behavior items were listed on either the left or right end of the scale. The behavior listed on the right was described as the behavior taken when the behavior listed on the left was not taken. Ethical and unethical behaviors were alternated to mitigate any order effect and items were prefaced with the question: "What percentage of your classmates do you think will engage in this behavior?"

5.4 Results and Discussion

5.4.1 Inconsistency between knowledge and behavioral intention

Table 4 shows correct answer rates for knowledge and intention tasks under each of the arrangements. As in Experiment 1, we applied a Wilcoxon signed-rank test to the correct answer rates for knowledge and intention tasks under each of the arrangements. For all of the arrangements, the correct answer rate for intention tasks was significantly lower than that for knowledge tasks (Table 4). When we applied the Mann-Whitney U-test to correct answer rates for KKII knowledge tasks and IIKK intention tasks, we found that the correct answer rate for intention tasks was significantly lower than that for knowledge tasks (Table 4). In regard to within-participants and between-participants experimental design, intention tasks had a lower correct answer rate as compared to knowledge tasks.

To investigate inconsistency between knowledge and behavioral intentions by topic as in Experiment 1, we combined the four arrangements into one. The Wilcoxon signed-rank test was applied to the correct answer rates for knowledge and intention tasks for each of the arrangements (Table 5). In all the topics, the correct answer rate for intention tasks was lower than that for knowledge tasks, thus confirming inconsistency between knowledge and behavior (Table 5). These results were consistent

Table 5. Correct answer rate for knowledge tasks and intention tasks by topic (Experiment 2).

Variable	Knowledge task	Intention task				
	M (*SD*) [95% CI]	*M* (*SD*) [95% CI]	*z*		*p*	*r*
Ethics in Information Society	.96 (.10) [.94, .98]	.59 (.23) [.54, .64]	-7.72	<	.001 **	.73
Understanding and Observing with the Law	.98 (.07) [.96, .99]	.63 (.27) [.57, .68]	-7.35	<	.001 **	.70
Information Security	.94 (.10) [.92, .97]	.69 (.18) [.65, .73]	-7.10	<	.001 **	.67
Wisdom for Safety	.97 (.10) [.95, .99]	.59 (.30) [.53, .66]	-7.21	<	.001 **	.69

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

Table 6. Percentage of unethical behavior predicted by intention item.

Variable	EBIT	UBIT				
	M (*SD*) [95% CI]	*M* (*SD*) [95% CI]	*t*		*p*	*r*
Ethics in Information Society	.35 (.20) [.31, .40]	.69 (.21) [.64, .73]	10.67	<	.001 **	.64
Understanding and Observing with the Law	.39 (.20) ** .47 [.35, .44]	.62 (.24) [.56, .67]	6.27	<	.001	
Information Security	.39 (.18) [.35, .43]	.65 (.22) [.60, .70]	8.52	<	.001 **	.57
Wisdom for Safety	.45 (.15) [.42, .48]	.58 (.18) [.54, .62]	4.72	<	.001 **	.38

Note. N = 90; EBIT = ethical behavior in intention task; UBIT = unethical behavior in intention task. * p <.05, ** p <.01.

with the results in Experiment 1 and support our finding of inconsistency between knowledge and behavioral intention.

5.4.2 Prediction of percentage choosing unethical behavior

To determine if a student's choice of unethical behavior is related to his or her prediction that classmates will also engage in unethical behavior, we compared ethical and unethical behavior responses under intention tasks with predictions of classmate behavior (Table 6). T-test results from the predicted percentages per intention item indicate that for all topics, a significantly higher percentage of students who selected unethical behavior had predicted that classmates would engage in unethical behavior (Table 6).

An interpretation based on deviancy training would suggest that the intent to engage in unethical behavior is influenced by predictions of the behavior of others. To determine how accurate these predictions were, we compared the percentage of unethical behavior chosen in the intention tasks with the percentage of unethical behavior chosen in the classmate prediction questionnaire (Table 7). T-tests on the two percentages revealed that for all topics, the percentage of predicted unethical behavior was significantly higher than the percentage of unethical behavior chosen (Table 7). These results indicate the possibility that participants did not accurately predict the behavior of their classmates and in fact overestimated the percentage of classmates who would choose unethical behavior.

Table 7. Unethical behavior response rate in intention tasks and predicted unethical behavior.

Variable	UBIT	UBGT				
	M (*SD*) [95% CI]	*M* (*SD*) [95% CI]	*t*	*p*		*r*
Ethics in Information Society	.41 (.23) [.36, .46]	.48 (.12) [.45, .50]	-2.69	.008	**	.28
Understanding and Observing with the Law	.37 (.27) ** .35 [.32, .43]	.48 (.14) [.45, .51]	-3.46	.001		
Information Security	.31 (.18) [.27, .35]	.48 (.12) [.46, .51]	-8.37	< .001	**	.66
Wisdom for Safety	.41 (.30) [.34, .47]	.50 (.12) [.48, .52]	-3.47	.001	**	.35

Note. N = 90; UBIT = unethical behavior in intention task; UBGT = unethical behavior in guess task. * p <.05, ** p <.01.

6. General Discussion

The results from Experiments 1 and 2 indicate that inconsistency between knowledge and behavioral intention occurs when people intend to take action toward unethical behavior despite having knowledge of information ethics. When we compare our results from Experiment 1 with a study by Tanaka, et al. (2015a) where the same questionnaire items were given to first year university students, the correct answer rate was higher among the first year university students compared to the first year high school students for both knowledge tasks (0.93 under the lowest condition for the university students) and intention tasks (0.67 for the university students). These results seem to demonstrate the effectiveness of information ethics education and learning and the practice of information moral behavior during high school. In addition, the results indicate the significance of continuing the education for information ethics at the university level even if university students have higher skills in information technology.

Experiment 2 demonstrated how students' intention to engage in unethical behavior was influenced by their beliefs regarding their classmates' engagement in the same unethical behavior. Although we presume this tendency comes from the deviancy training defined by Capalidi, et al. (2001), the reason for the observed interrelationship is not clear yet merely from the results of this study, and further investigation will be required.

Moreover, there is a need for the development of teaching methods and materials that will foster attitudes that lead to the actualization of knowledge related to information ethics (Tamada & Matsuda, 2004; Sugawara, et al., 2012). Among various models of information ethics education in practice, Tamada and Matsuda (2000, 2004) have raised three important kinds of knowledge: knowledge of circumstances related to information technology, knowledge of moral standards, and knowledge of how to combine these two kinds of knowledge and compare them against different value standards to make appropriate judgements. Based on this framework, Tamada and Matsuda (2004) advocate a teaching method in which students learn how to clarify goals and conditions, consider problem factors and alternative solutions, realize the need for self-learning, and ask for advice regarding the questions of legal issues (violation of the law), inconvenience to others (harm to others), damage to self (harm to self) and technological issues (information technology). They emphasize it is crucial to develop thinking abilities so that these kinds of determinations can be helped by an awareness of the mental processes that might lead to unethical behavior. Learners must engage in activities that help them realize differences between behaviors in the realm of learning and training versus the behaviors they take in real-life situations. The experimental method employed in this study can be the one that may be suitable for actualizing the mental processes behind the unethical behavior. Taking account of the feature of the experimental methods to quantify inconsistency between knowledge and behavioral intention, our next step is to construct an educational program to promote appropriate behavioral intention through self-awareness of the inconsistency between knowledge and behavior.

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