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Examination of water saving behavior within framework of Theory of Planned Behavior

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Abstract: Education is seen as an effective strategy to improve water saving awareness and thus existing water sources are used carefully. In this study, water saving behaviors of secondary school students and the factors affecting these behaviors were examined within the framework of the Theory of Planned Behavior (TPB) [1, 2]. The study was realized with the participation of 497 students. As a result of the study, it was seen that the water saving intentions and behaviors of students were high. It was determined that TPB explained students' water saving behavioral intentions in 62%, and that their intentions were under the influence of subjective norm, perceived behavioral control and attitude, respectively. Behavioral explanation rate of behavioral intention and perceived behavioral control was calculated as 78%.

Keywords: Water Saving, Theory of Planned Behavior, Secondary School Students, Structural Equality Model

1. Introduction

Water resources play a critical role in the continuation of soil, biological variety and life on Earth. Water, a highly important natural resource, contributes to the development of economy, societies, and cultures in addition to ecosystems [19]. Access to available water supplies varies and is limited so much so that many countries face water shortage in certain periods [18]. Water shortage will be one of the most important global ecological problems of the 21st century [34-37]. The stress created by such factors as population growth, inappropriate field usage, and urbanization multiplies with global warming [10]. However, it has been predicted that population growth and economic developments will be more determinative than climate changes on the relationship between water demand and the amount of available water. Turkey, which is situated in the Middle East where water supply is limited, is among countries which suffer from water shortage [5]. 70% of the waters resources in Turkey are used in agriculture [13]. In regions where rain is irregular and little, draught affects agriculture negatively, and, in return, water demand increases [29]. Wrong water management policies, increase in population and global warming are among the principle reasons for the water shortage being experienced in Turkey [26]. It is necessary to develop effective strategies for the preservation of water supplies in Turkey, and necessary precautions should be taken. In this respect, it is highly important to instigate people to water saving. In order to do so, it is necessary to know the psychological factors affecting water saving behaviors. This study was realized based on the Theory of Planned Behavior (TPB) [1, 2], which is regarded as one of the most effective socio-psychological theories in explaining the relationship between attitude and behavior. Ever since the day of its inception, in addition to its applications in socio-psychology fields, TPB has been successfully applied to various topics covered in biology education such as health education and environmental education [e.g., 6-9, 24, 27, 28, 30, 39]. According to TBP, behavior, which is shaped by certain factors, presents itself in a planned way. First of all, an *intention* towards the behavior arises in the individual. The stronger the intention towards a behavior, the more likely it is for that behavior to manifest [16]. Behavioral intention is under the influence of 3 variables [2]: Attitude towards Behavior, Subjective Norms, and Perceived Behavioral Control. The relationship between these components can be formulized as follows:

Behavioral Intention = (Attitude towards Behavior x β_1) + (Subjective Norms x β_2) + (Perceived Behavioral Control x β_3)

(β_1- β_2- β_3: Regression coefficients)

Attitude towards Behavior denotes whether the individual who is going to perform a certain behavior considers the performance of that particular behavior good or bad. *Subjective norm* refers to the social pressure one perceives whether to perform that behavior or not. *Perceived Behavioral Control* refers to the idea how difficult or easy one finds the performance of a behavior. In cases where behavioral control is involuntary and when it can be detected objectively, this factor can have a direct influence on the behavior [2].

Effects of attitude, subjective norm and perceived behavioral control show difference in terms of individuals and the characteristic of the behavior. These factors are the main components forming the first part of the theory. The second part of the theory consists of *beliefs* dimension (behavior beliefs, normative beliefs, control beliefs) (Figure 1).

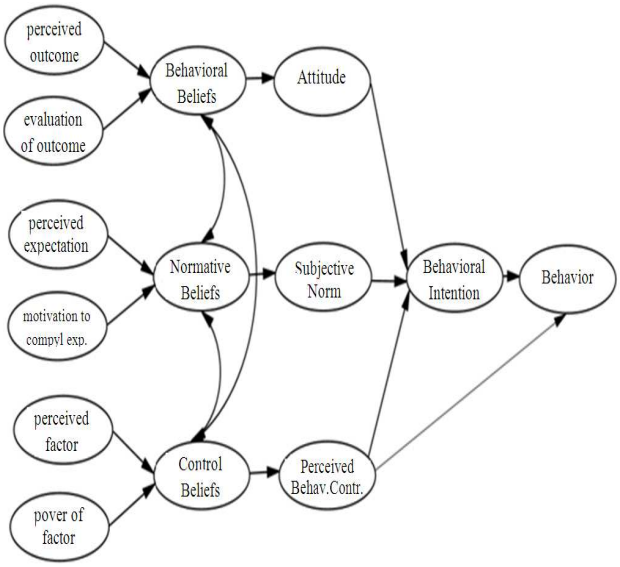

Figure 1. *The Theory of Planned Behavior (adapted from Ajzen 2005)*

Belief dimensions indicate that TBP is also a "Expectation-Value Theory" [16]. According to this theory, each variable in the belief dimensions consists of 2 sub-components which can be called expectation and value, and they are evaluated through the multiplication of the given answers [4, 17]. *Behavior beliefs,* which are predictors of Attitude, are determined according to an individual's predictions about the results of a behavior and how s/he evaluates these results. *Normative beliefs,* which are the predictors of Subjective Norm, are the combination of the expectations of people whom one deems significant and one's desire to meet these expectations. *Control beliefs,* which are predictors of Perceived Behavioral Control (PBC), are determined according to one's prediction of whether such competency situations facilitate or complicate the behavior and according to their predictions of their internal (such as skill and knowledge) and external (such as money and time) competency levels. *Beliefs,* which form the cognitive and affective basis of PBC, attitude, and subjective norm, play a central role in TPB. At the basis of beliefs is the influence of such variables as emotions, character traits, intelligence, value, age, sex, education, knowledge, experience, income level, race [2].

2. Method

2.1. Research Sample

Research sample consists of 497 students between the ages 14 and 20 enrolled at secondary schools in Erzincan, Istanbul, and Sanliurfa in 2011-2012 academic year. 23.5% (n=117) of the sample is female, and 76.5% (n=380) is male students. 21% of students (n=106) are in Erzincan, 29% (n=142) are in Istanbul, and 50% are in Sanliurfa.

2.2. Data Analysis

In this study, a *Water Saving Behavior Questionnaire* [15], developed in accordance with Theory of Planned Behavior [2] was used. The questionnaire consists of an introduction section with demographic questions, and this is followed by five scales all of which are graded in the style of five point likert scale, namely, *Behavior Scale* (2 items), *Behavior Intention Scale* (3 items), *Attitude towards Behavior Scale* (4 items), *Subjective Norm Scale* (3 items), and *Perceived Behavioral Control Scale* (3 items), and their sub-components: *Behavior Beliefs Scale* (11 items), *Normative Beliefs Scale* (9 items), and *Control Beliefs Scale* (4 items). Theory of Planned Behavior is also an *Expectations-Value Theory* [16], in other words, for each dimension, first the perception of existing expectations and then the importance of these expectations for the individual are questioned. Taking this into consideration, before moving onto analysis, data to be used in the study were obtained by multiplying the numbers corresponding to the answers given to items in the beliefs section of the model. For example, the "*if I save on water, I would save on money"* item in the behavior belief dimension determined opinions on the result of the behavior and then the "*How important is it for you to save money?"* item determined the importance of results. In the analysis section, value obtained from the multiplication of the answers given to these items was treated as a single item. Data was examined by developing a Structural Equality Model (SEM). In the SEM analysis, AMOS18 was used. Schermelleh – Engel, Moosbrugger, and Müller [38] determined Chi-Square Goodness of Fit (X^2/df) being smaller than 3, Root Mean Square Error Approximation (RMSEA) being smaller than .08, Standardized Root Mean Square Residual (SRMR) being smaller than .10; Goodness of Fit Index (GFI) and Comparative Fit Index (CFI) being bigger than .90 as the acceptable competence criteria in the appropriateness tests of the model. Moreover, the fact that Tucker-Lewis Index (TLI) was also bigger than .90 was taken into consideration [40]. In this study, appropriateness of these values was checked when forming the model. After SEM was constructed, the following criteria developed by

Ajzen and Fishbein [3] were taken into consideration when evaluating the coefficients: 0.0-0.3 weak, 0.3-0.5 average, and 0.5 and over high regression coefficients.

3. Findings

In Figure 2 can be seen the structural equality model formed to explain students' water saving behaviors. The fact that values calculated for this model are within the determined range (X^2/sd=2.49, RMSEA=.05, SRMR=.06, GFI=.90; CFI=.91, TLI=.90) is proof that the model results competently with the data.

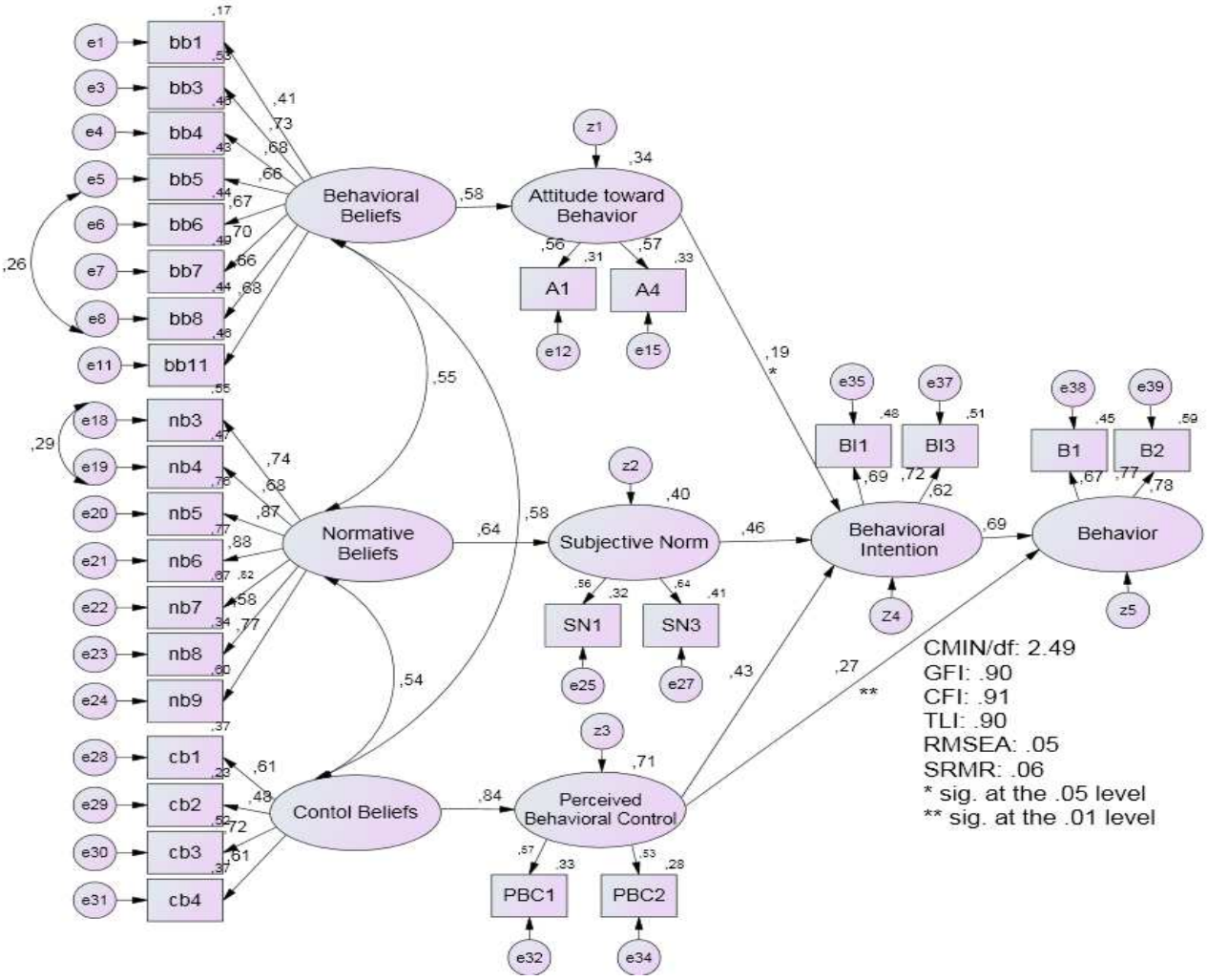

Figure 2. *Structural Equality Model Explaining Students' Water Saving Behaviors (Standardized Solution Values)*

In the model shown in Figure 2, water saving behavior was tried to be predicted through intention; moreover, how PBC directly influences behavior was also examined. As can be seen in the model, regression equations obtained as a result of analysis are as follows:

Behavioral Intention = (A x .19) + (SN x .46) + (PBC x .43)

Behavior = (Behavioral Intention x .69) + (PBC x .27)

Based on these regression equations, it is possible to comment on the amount of relationship between behavior, behavior intention, attitude, subjective norm, perceived behavioral control variables. Based on the coefficients in the equation, it can be said that behavior intention together with PBC explains behavior in 78%. Variant percentage (R^2) of behavior intention, which is a dependent variable, explained by attitude, subjective norm and PBC independent variables was .62. In other words, Theory of Planned Behavior explains students' water saving intentions in 62%. Difference in subjective norm singlehandedly explains the differentiation in behavior intention in 21% ($.46^2$), difference in PBC in 18% ($.43^2$), and difference in attitude variable in 4% ($.19^2$). When these ratios were examined through the criteria for regression coefficients suggested by Ajzen and Fishbein (1980), it was seen that subjective norm and PBC have highly significant influence on behavior intention, and that attitude's influence is weak. Variant percentages (R^2) explained through beliefs dimensions of attitude, subjective norm and PBC, which constitute the second part of the theory, are 34% ($.58^2$), 40% ($.64^2$), and 71% ($.84^2$), respectively. When

the correlation values of beliefs dimensions are examined among themselves, it was seen that there are average, positive meaningful relations among these structures (r_1=.55, r_2=.58, r_3=.54) [11].

Students' water saving intentions was represented by 2 items in the model: *BI1: I will try to save water in the following months, BI3: I will put some effort to save water in the following months.* Average of these items is 4.04, in other words, their intention in this respect is rather high. According to TPB, the fact that students' intentions are high can be interpreted as their water saving behavior being high as well. Hence, the average of items concerning students' water saving behaviors also shows parallelism with their intentions, and it is rather high. Average of items that measure behavior – *I do my best in saving water (B1)* and *I save water (B2)* – is 4.02, in other words, students save water to a great extent.

Students' attitudes towards water saving were represented with 2 items (A1: Saving water is beneficial, A4: Saving water is important), and these items were scaled from "*I completely agree"* to "*I completely disagree"* in 5 point likert type. Average of these two items is 4.81. In the behavior beliefs, which are the predictors of attitude, what students thought would be the outcome when they save water and the importance of these results for them were interrogated. According to this, reasons behind students' attitude towards water saving, in other words, items predicting their behavior beliefs can be listed as follows:

If I save water:

bb3: I contribute to energy saving *x* this gain of theirs is important for me (.73),

bb7: I contribute to the lessening of water shortage *x* this gain of theirs is important for me (.70),

bb4: I would be protecting natural water supplies *x* this gain of theirs is important for me (.68),

bb11: I would contribute to the lessening of the effects of draught *x* this gain of theirs is important for me (.68),

bb6: I would be protecting the environment *x* this gain of theirs is important for me (.41).

In the model were 2 items for students' subjective norms on water saving scaled in five point likert type (SN1: *People/institutions whose opinion I value expect me to save water,* SN3: *People/institutions that are important to me want me to save water)*. Average of these two items is 4.13. This can be interpreted as students' perceiving a high expectation about water saving. In the normative beliefs section, people or institutions whose expectations student give importance to are sequenced according to factor weight value as follows:

nb6: Voluntary Environmental Institutions expect me to save water *x* the expectation of the principle is important for me (.88),

nb5: Ministry of Energy and Natural Resources expects me to save water *x* the expectation of the principle is important for me (.87),

nb7: Ministry of Environment and Urbanization expects me to save water *x* the expectation of the principle is important for me (.82),

nb9: Ministry of Forestry and Water expects me to save water *x* the expectation of the principle is important for me (.77),

nb3: Ministry of Health expects me to save water *x* the expectation of the principle is important for me (.74),

nb4: Teachers expect me to save water *x* the expectation of the principle is important for me (.68),

nb8: My neighbors expect me to save water *x* the expectation of the principle is important for me (.58).

Students perceived behavior controls concerning water saving was also measured by 2 items: *PBC1: It is easy for me to save water, PBC2: My circumstances are appropriate for water saving.* Average of these two items is 4.01, in other words, students' perceived behavioral control is rather high. Control beliefs forming the basis of their perceived behavioral controls are as follows:

cb3: people around me take my warnings concerning water saving into consideration *x* this would make my water saving easier (.72),

cb4: I have the means to make use of water saving techniques (such as drip irrigation) were I to water the plants/field/garden *x* this would make my water saving easier (.61),

cb1: I know how to save water *x* this would make my water saving easier (.61),

cb2: my family's financial means are sufficient to buy water saving goods (such as washing machine or dish washer) *x* this would make my water saving easier (.48).

5. Conclusion

According to research findings, Theory of Planned Behavior (TPB) [2] explains secondary school students' water saving behavior intentions in 62%, and their behaviors in 78%. TPB component that affects students' water saving intentions and thus their behaviors the most is *subjective norm.* This indicates that students' water saving behavior is shaped primarily by the expectations of people or institutions that they deem important. In other words, students save water more when they think there is such an expectation of them, and their water saving behavior is affected negatively when they think there is no such expectation. The second variable that affects their water saving behaviors is the perceived behavioral control. The fact that they have sufficient opportunity and information about water saving is a factor that would increase their water saving behavior. Moreover, in addition to its indirect influence on students' behavior, the direct influence of perceived behavioral control over their behavior is also noteworthy (β=.27), in other words, appropriateness of the circumstances for water saving can directly influence behavior. Although students have a positive attitude towards water saving, its effect on their water saving behavior is rather weak, in other words, it is difficult to comment whether students would present such behavior taking into consideration their attitude towards water

saving. The fact that students have a positive attitude does not mean that s/he would save water; likewise, the fact that they have a negative attitude does not mean that s/he would not save water. In studies focusing on water saving within the framework of TPB, the effects of TPB components over behavior presented different results. For example, in the study where Harland, Staats, and Wilke [21] examine environment-friendly behavior, subjective norm did not have an effect on turning off the tap while brushing teeth, in the study where Nancarrow, Leviston, Porter, and Tucker [32] examined the effect of TPB components and some other variables on waste water usage, it was seen that subjective norm is the most effective TPB component. According to the findings of Clark and Finley's [14] research in Bulgaria, Attitude is the most effective TPB component on water saving behavioral intention, and this is followed by PBC and subjective norm, respectively. Difference in the results of these studies may refer to the premise that water saving behavior, as is true for many other behaviors, changes according to individuals' demographic characteristics such as age and gender, and society's cultural and socio-economic differences. As a matter of fact, in the conclusion of the study, it was determined that subjective norm is the most important factor in students' water saving behavior. There is a collectivist culture in Turkey [22, 20], and interaction between social groups is highly important [25]. Hofstede [23] states that in collectivist cultures behavior of individuals is primarily under the influence of external factors. Thus, the effect of subjective norm, which denotes social pressure, over students' behavior can be explained by the collectivist nature of Turkish culture. Similar studies [12, 31, 33] also indicate that compared to individualist cultures, subjective norm is more effective in collectivist cultures in the manifestation of a behavior. When the values in the structural equality model were examined, it was obvious that having students develop a positive attitude is not enough to have them exhibit such behavior. In this respect, when the fact that subjective norm is the most influential factor is taken into consideration, students' water saving behavior will manifest more if one creates the perception that there is such an expectation. Ad campaigns can be organized to this end, incentive applications can be planned in schools, seminars may be held by collaborating with people/institutions that students deem important, spokespeople may be invited to schools. If the fact that perceived behavioral control is second in influencing behavior is taken into consideration, it is thought that students' water saving behavior would increase when they are made conscious as of water saving and when they are provided with opportunities (e.g. sensory taps, pressurized showers, water saving house wares etc) to do so. At this point, it is thought that behavior can be made more by means of increasing students' perceived behavioral control with practical applications and project assignments and with emphasizing the knowledge and skills for students to acquire on water saving.

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