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Investigating the Effect of Certain Socio-demographic Factors on University Students' Level of Reflective Thinking by Using Regression Tree

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ABSTRACT This research aims to investigate the effect of certain socio-demographic factors upon the reflective thinking of university students. The data set comprised 2,247 university students. In this research, a "Reflective Thinking Questionnaire" was used to determine the reflective thinking levels of university students. According to the findings of this research, the area where they attended primary school, satisfaction with their department, attitude toward taking notes in class, willingness to ask the lecturer to explain details about the topic, current GPA, classes taken, and the number of books read to date were found to be meaningful predictors in the model. The level of parents' education was not found to be meaningful in the research.

INTRODUCTION

Reflective thinking is a term connected to pragmatic philosophy and progressivism that is often used in teacher education and is continuously being developed, especially over the past century. According to Ünver (2003), reflective thinking is a problem-solving process. It is a thought process aimed at revealing the current situation of methods and levels of teaching, learning, and problem-solving by using the factors of a person's education, personal values, and beliefs. In *How We Think*, a book written by Dewey (1933), many models were described about thinking that attempted to explain how one thinks through concepts such as stream of consciousness, imagination, and belief. One of these models is *reflective thinking* (Rodgers 2002). According to van Manen (1977), reflection is an experience and divides behaviors into two periods. While some reflections are toward behaviors that may happen in the future (*pre-event* behaviors), others dwell upon past experiences (*remembered* or *retrograde* behaviors). In each reflection type, it is far more telling to understand the existing meaning and importance in an experience rather than the experience itself. In other words, reflective thinking is a process where any experience is remembered, thought of, and evaluated in relation to a clear goal. According to Yilmaz and Keser (2016), reflective thinking activities enable a person to improve their individual responsibility, and it enables students to be aware of their cognitive processes. During the process of reflective thinking, students decide whether or not to habitually try and improve their reflective thinking (Sargent 2015).

Several studies have proved that a significant positive correlation exists between reflective thinking and learning skills, that educators in particular suggest this thinking style to improve students' speaking and writing abilities, and that emotional intelligence and other learning activities can be improved by using reflective thinking (Khalid et al. 2015; Afshar and Rahimi 2016; Wielgus 2015; Yilmaz and Keser 2016).

Dalgiç (2011) explained reflective thinking as a detailed thought process aimed at improving defects and errors, as it aims to make sense of the past, current, and future actions by becoming aware of behaviors and experiences and by observing and analyzing events one senses in the environment.

According to King and Kitchener (1994), reflective thinking is a process that produces theories and proposals for solving complex, poorly defined problems through constant evaluation of existing assumptions, beliefs, and information. King and Kitchener (1994) explained this process through seven steps comprising three main stages as outlined next.

Pre-reflective Thinking

In this stage, there is no need for evidence to reach a result as knowledge is distinguished concretely.

First level: Knowledge is certain and absolute, as it is determined from observation and tradition.

Second Level: Individual group authorities around them as either good or bad and starts to consider different truths as good or bad.

Third Level: Truth is currently uncertain, and it will be determined at a future time.

Quasi-reflective Thinking

In this level, multidimensional situations and problems are observed. The individual has started to question the information, but it is not understood how to use the evidence to achieve results.

Fourth Level: Knowledge is ambiguous and not intrinsic to the person. If the evidence is ambiguous, instead of applying it to a problem to be solved, new evidence is found.

Fifth Level: The individual understands knowledge and evidence in a complex and multidimensional manner, and can analyze knowledge with an element of uncertainty.

Reflective Thinking

Connections between different knowledge are meaningfully constructed. Knowledge is open to reassessment when a problem cannot be solved.

Sixth Level: The individual correlates more complex connections and understands more complex structures. To enable this, they need to structure knowledge themselves.

Seventh Level: This construction process continues and it can be extended through the reevaluation of knowledge or obtained connections. Nothing is stable, and all knowledge, including the knowledge that people structure themselves, is open to reconsideration.

As for Bartlett (1990), the process of reflective thinking comprises five stages that is, analyzing, informing, comparing knowledge, evaluating, and implementing. Based on Dewey's ideas, VanSickle (1985) explained the reflective thought process in four steps that is, identifying the problem, gathering and organizing the data, comparing the data with others' assumptions, and determining the results clearly.

This research aims to investigate the effect of certain factors on the reflective thinking of university students by using regression tree analysis. The variables suitable for reflective thinking were meticulously considered, and their effects on reflective thinking were examined.

METHODOLOGY

Material

The data set comprised 2,247 university students. To determine the reflective thinking levels of university students in this research, a Reflective Thinking Questionnaire was used, as developed by Kember et al. (2000), and it was adapted to Turkish and analyzed in terms of validity and reliability by Basol and Evin-Gencel (2013). This scale comprises 16 items. Items in the instrument are of the five-point Likert type, ranging from Strongly Disagree (1) to Strongly Agree (5). The possible scores for this scale range between 16 and 80. A high score shows an individual to have a high reflective thinking level, whereas a low score shows an individual to have a low reflective thinking level. This instrument comprises four factors that is, habitual action, understanding, reflection and critical reflection. According to the findings from the Principal Component Analysis, the instrument's total variance was ascertained to be 53.03 percent, and the subscales' variance totals were 23.64 percent for reflection, 13.19 percent for critical reflection, 9.37 percent for understanding, and 6.82 percent for habitual action.

The reliability of the instrument was calculated by the researchers using the test-retest reliability, Cronbach's alpha internal consistency coefficient, and split-half reliability. The results are shown in Table 1.

As seen in Table 1, the test-retest reliability coefficient was 0.74, Cronbach's alpha internal consistency coefficient was 0.77, and the split-half correlation coefficient was 0.77. As the coefficients were higher than 0.70 (the minimum requirement for acceptability) the instrument can be said to be reliable.

The dependent variable of the scale was a student's total score, and the model investigated such factors as faculty, gender, class, whether they had attended nursery school, the area

Table 1: Reliability coefficients of the questionnaire to measure the level of reflective thinking

	Test-retest reliability (with 2-week intervals)	*Test-retest reliability (with 2-month intervals)*	*Internal consistency co efficient*	*Spearman Brownsplit-half reliability*
Habitual action	0.66*	0.64*	0.54	0.46
Understanding	0.68*	0.63*	0.69	0.71
Reflection	0.72*	0.70*	0.72	0.69
Critical reflection	0.73*	0.70*	0.68	0.68
Total reflection score	0.74*	0.73*	0.77*	0.77*

where they went to primary school, mother's education level, father's education level, satisfaction with their department, how often they read a newspaper, the estimated number of books they had read, how often they have consulted decisions they have made, how often they have discussed a film they have watched or book they have read (or similar event) with the people around them, their attitude toward taking notes in class, whether or not they have previously participated in a research study, their willingness to ask the lecturer to explain details about a topic, and their current GPA. This study's model was analyzed using the regression tree.

Data Analysis

Regression Tree

The regression tree analysis is one of the main techniques used in data mining. This technique is used to predict cases or objects that belong to classes from a continuous dependent variable based on the measurement of predictor variables. The regression tree model results provided clear information on the importance of significant factors. In this analysis, an algorithm divides data into two sets to have records in a more homogeneous subset. The two subsets are then split again until the homogeneity criterion or some other time-based stopping criterion is satisfied. The final aim of splitting is to reveal the right variable associated with the right threshold to maximize the homogeneity of the subgroups or branches (Basti et al. 2015). Essentially, a regression or classification tree consists of three steps. The steps are *growing, pruning*, and *obtaining the optimal tree* by calculating misclassifications and complexity costs (Bradford et al. 1998; Bramer 2002; Espesito et al. 1997).

RESULTS AND DISCUSSION

Descriptive statistics with regard to the total scores gathered from the instrument applied to determine the levels of university students' reflective thinking are shown in Table 2. With reference to the findings in Table 2, the mean score from the scores of the 2,247 individuals who participated in the research was 54.23, and the standard deviation for these scores was 9.08. The resulting mean revealed the participants had a middle level of reflective thinking.

Table 2: Descriptive statistics for the dependent variable (reflective thinking score)

Sample	*Min.*	*Max.*	*Mean*	*Std. error*	*Std. dev.*
2.247	16	80	54.23	0.19	9.08

Descriptive statistics pertaining to the independent variables that were inspected for their effect on reflective thinking are summarized in Table 3. After relating descriptive statistics to the dependent and independent variables, the model was analyzed with the regression tree. In this analysis, the effects of the independent variables on the dependent variable were gathered onto a tree structure in accordance with their level of importance. The risk estimate value (percentage of estimation error) in the regression tree was calculated as 0.190 with a standard deviation of 0.030. In other words, the accuracy of classification was eighty-one percent. The levels of importance of the independent variables' effects on the dependent variable are shown in Table 4.

The most important independent variable was willingness to ask the lecturer to explain every detail about the topic, with an importance value of 1.151. Table 4 shows that the predictor of attitude toward taking notes in class had an important effect on the dependent variable as a splitter, with an importance level of 0.608. The independent variable, satisfaction with the department, had an important effect similar to attitude toward taking notes in class. The importance of

Table 3: The descriptive statistics of predictors

Predictors	*Categories*	*Frequency*	*%*
Faculties	Faculty of Education	954	42.5
	Faculty of Theology	241	10.7
	Faculty of Science and Arts	695	30.9
	Faculty of Economic and Administrative Sciences	276	12.3
	Health College	81	3.6
	Missing value	0	0
	Total	2,247	100
Gender	Female	1,190	53.0
	Male	1,049	46.7
	Missing value	8	0.4
	Total	2,247	100
Current GPA	Unsuccessful	282	12.6
	Moderate success	972	43.3
	Successful	617	27.5
	Missing value	376	16.7
	Total	2,247	100
Class	Freshman	609	27.1
	Sophomore	700	31.2
	Junior	610	27.1
	Senior	328	14.6
	Missing value	0	0
	Total	2,247	100
Did They Attend Nursery School?	Yes	227	10.1
	No	2,015	89.7
	Missing value	5	0.2
	Total	2,247	100
The Area Where They Studied Primary School	Village	471	21.0
	Town	130	5.8
	Borough	737	32.8
	City	906	40.3
	Missing value	3	0.1
	Total	2,247	100
Mother's Education Level	Did not graduate	1,279	56.9
	Primary school graduate	701	31.2
	Secondary school graduate	123	5.5
	High school graduate	106	4.7
	Undergraduate	27	1.2
	Graduate	7	0.3
	Missing value	4	0.2
	Total	2,247	100
Father's Education Level	Did not graduate	417	18.6
	Primary school graduate	930	41.4
	Secondary school graduate	301	13.4
	High school graduate	382	17.0
	Undergraduate	190	8.5
	Graduate	18	0.8
	Missing value	9	0.4
	Total	2,247	100
How Often Do They Read The Newspaper	Everyday	449	20.0
	A few times per week	1,412	62.8
	I do not read newspapers	365	16.2
	Missing value	21	0.9
	Total	2,247	100
Estimated Number Of Books They Have Read	1–25	377	16.8
	25–50	389	17.3
	50–75	372	16.6
	75–100	307	13.7
	More than 100	755	33.6
	Missing value	47	2.1
	Total	2,247	100

Table 3: Contd...

Predictors	*Categories*	*Frequency*	*%*
Satisfaction level with their department	Yes	1,019	45.3
	Partial	925	41.2
	No	295	13.1
	Missing value	8	0.4
	Total	2,247	100
How often do they consult a decision that they have made	Always	293	13.0
	Usually	955	42.5
	Sometimes	923	41.1
	Never	67	3.0
	Missing value	9	0.4
	Total	2,247	100
How often do they discuss a film they have watched or book they have read (or similar event) with the people around them	Always	238	10.6
	Usually	747	33.2
	Sometimes	1,158	51.5
	Never	88	3.9
	Missing value	16	0.7
	Total	2,247	100
Their attitude toward taking notes in class	Yes	1,592	70.9
	No	642	28.6
	Missing value	13	0.6
	Total	2,247	100
Whether or not they have previously participated in a research study	Yes	1,327	59.1
	No	891	39.7
	Missing value	29	1.3
	Total	2,247	100
Willingness to ask the lecturer to explain every detail about a topic	Yes	1,678	74.7
	No	557	24.8
	Missing value	12	0.5
	Total	2,247	100

Table 4: Importance of the independent variables

Independent variable	*Importance*	*Normalized importance*
Willingness to ask the lecturer to explain every detail about the topic	1.151	100%
Attitude toward taking notes in class	0.608	68.6%
Satisfaction with the department	0.558	52.8%
Area where they studied primary school	0.472	45.4%
Estimated number of books read up to now	0.364	22.9%
Current GPA	0.355	21.8%
Field of study	0.292	18.7%

the other independent variables can be interpreted by examining Table 4. In the literature, writing has been stated as having an important place in the transition from teacher-centered learning to student-centered learning, and the writing activities that learners perform take them from a passive situation to an active one (Golombek 2015; Kirnik 2010).

When examining the tree structure in Figure 1, the average of students' total scores from the instrument (N=2247, $\bar{X}$= 54.23) indicated that they had a medium level of reflective thinking. The dominant variable that affected the students' reflective thinking levels was willingness to ask the lecturer to explain every detail about a topic. Students who answered "yes" for this variable had a higher reflective thinking level ($\bar{X}$= 54.83) than those who answered "no" for this variable ($\bar{X}$= 52.39).

The most effective variable on the level of reflective thinking for students who had said that they asked the lecturer to explain every detail was their attitude toward taking notes in class. According to this, the reflective thinking level of students who took notes in class ($\bar{X}$= 55.32) was found to be meaningfully higher than those who did not ($\bar{X}$= 53.28).

The most effective variable on the reflective thinking levels of students who took notes in class was the area where they had completed primary school. This variable affected the dependent variable in two categories (village and

town/borough/city), as those who had lived in a town, borough, or city showed similar characteristics. With regard to this, the reflective thinking levels of the students who had lived in a town, borough, or city while studying in primary school ($\overline{X}$= 55.77) was meaningfully higher than those who had lived in a village ($\overline{X}$= 53.49). According to Dursun (2006), Sekerci (2000) and Down (2015), problems exist in village schools from the perspective of learning strategy such as integrating different class levels into one class, the limited time for counseling and social activities, the lack of materials that can connect classes to everyday life for students, planning and preparing exam questions, the limited time for assessment, and evaluation practices.

The dominant variable that affected the reflective thinking levels of students who had lived in a rural area during primary school was their satisfaction with their department. According to this, the reflective thinking levels of students who were satisfied with their current department ($\overline{X}$= 55.38) was meaningfully higher than those who were not satisfied or were only partially satisfied with their department ($\overline{X}$= 50.85). Several studies have stated that in education and training environments, affective dimensions, especially with the concepts of class atmosphere, motivation, requisition, and interest, have an impact on individuals (Duman 2009; Gonzalez and Zarco 2015; Choi et al. 2015).

The most effective variable on the reflective thinking levels of students who were satisfied with their department was the estimated number of books they had read till date. In accordance with this, the reflective thinking level of students who had read more than 70 books ($\overline{X}$= 57.90) was meaningfully higher than those who had read 50-70 or fewer books ($\overline{X}$= 55.38). Unlike the results of this research, Kirnik's study (2010) concluded that a meaningful correlation between the improvement of students' reflective thinking levels and the number of books they had read did not exist.

As understood from Figure 1, the most effective predictor of the reflective thinking level of students who did not like taking notes in class was their current GPA. Accordingly, successful and moderately successful students showed similar characteristics and had meaningful differences from the unsuccessful students. The reflective thinking level of successful students ($\overline{X}$= 53.78) was meaningfully higher than those who were unsuccessful ($\overline{X}$= 50.84). Kim (2005) stated in his study that students whose reflective thinking levels were high had performed better in terms of learning than those whose reflective thinking levels were low.

The most effective factor on the reflective thinking level of students who were successful or moderately successful was their current class level. The reflective thinking level of freshman students ($\overline{X}$= 56.37) was meaningfully higher than sophomores, juniors, and seniors ($\overline{X}$= 53.03). Similar to the results of this study, Kaya (2009) ascertained a meaningful difference between class level and thinking ability in his study, obtaining the result in his paired comparison that students in lower grades were more successful in terms of their thinking abilities.

CONCLUSION

The variable with the greatest effect on university students' reflective thinking level was their willingness to ask the lecturer to explain every detail about a topic. Accordingly, students who asked the lecturer to explain every detail had higher reflective thinking levels than those who did not. The variable with the greatest effect on the level of reflective thinking for those who asked lecturers to explain was their attitude toward taking notes in class. According to this, the reflective thinking levels of students who took notes in class were found to be meaningfully higher than those who did not.

In the light of analysis, the results gathered from the data set showed that the next two variables that affected students' reflective thinking levels were the area where they studied primary school and their current GPA. The variable that most affected the reflective thinking levels of students after those who took notes in class was where they had gone to primary school, and the reflective thinking levels of students who had been educated in a rural area (village) were determined to be lower than those who had been educated in a municipality, town, or province. Within the study, the most effective variable upon the reflective thinking level of students who had been educated in a rural area (village) during primary school was identified as their satisfaction with their current department. Accordingly, the reflective thinking level of students who were pleased with their department was

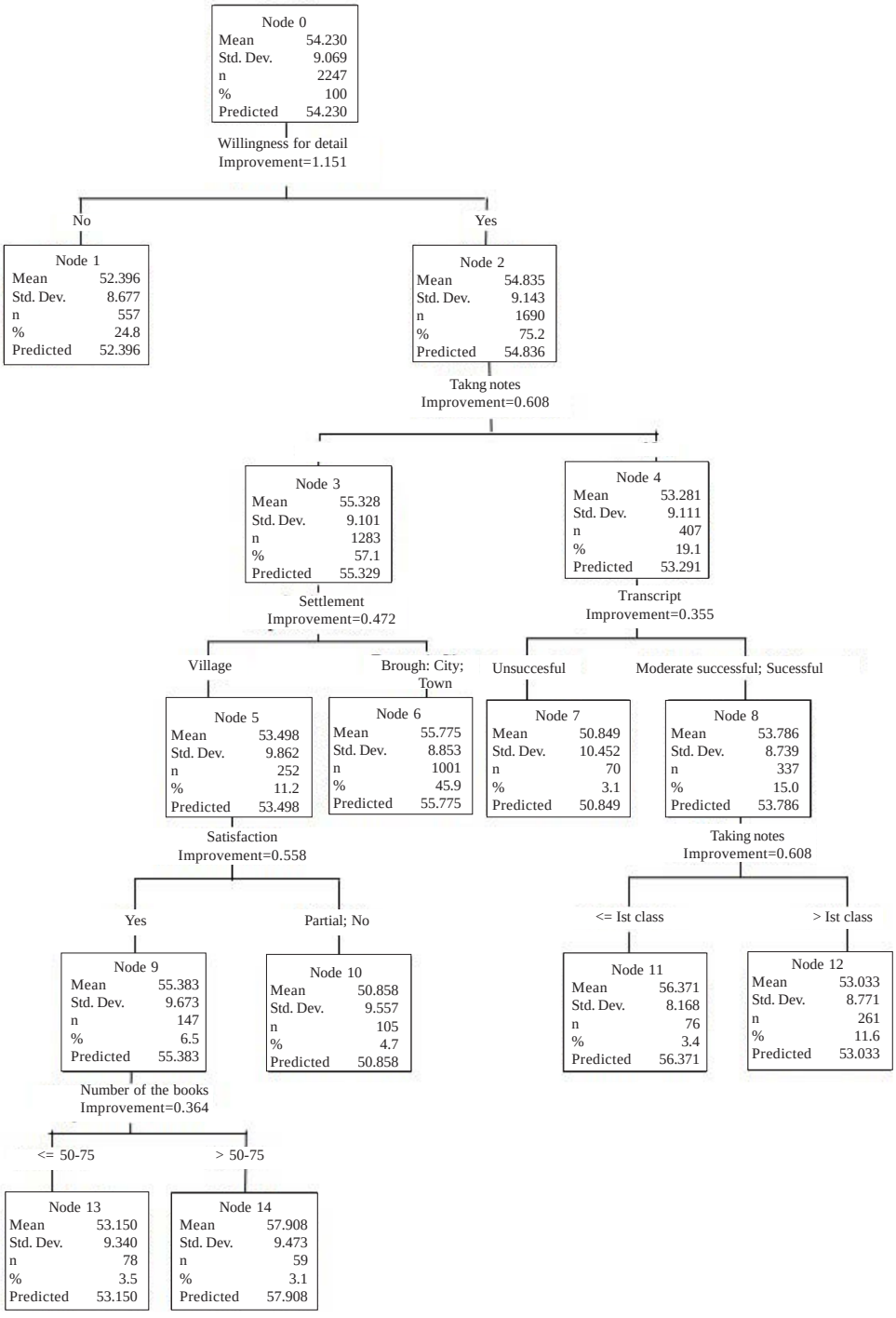

Fig. 1. The effective predictors upon the reflective thinking
Source: Author

higher than those who were only partially satisfied or who were unsatisfied with their departments.

RECOMMENDATIONS

In light of the findings from this study, educationists and politicians should be aware of the factors that affect reflective thinking, particularly due to how crucial it is to the learning process. In this way, curriculum should be determined according to the concept of reflective thinking.

All things considered, the regression tree analysis performed well in terms of its predictive ability to enable a model to reveal, robustly and without bias, effective predictors of reflective thinking. As a result, the researchers would like to encourage researchers to use data mining techniques such as the regression tree analysis to reveal the relationships between a dependent variable and its predictors.

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