Motivational Correlates of Language-Specific Grit and Achievement in EFL: A CHAID Analysis

Gülçin Mutlu

Abstract

The first purpose of this study was to examine the associations between students' motivational characteristics and their language-specific grit for learning English. Second, this study aimed to investigate how students' language-specific grit and motivational characteristics related to their achievement in English. While examining the presence of associations sought through both of the research questions, a particular overall purpose was to identify what specific variables included in the analyses had the strongest impact on group differentiation concerning the dependent variables of grit and achievement. The participants included 182 students enrolled in a tertiary English preparatory program in Turkey. Chi-squared automatic interaction detection (CHAID) algorithm as a data mining method was used to analyze the data. The results revealed that task value, self-efficacy and intrinsic motivation had significant impacts on differentiating the students with different levels of grit. Moreover, language-specific grit, test anxiety, self-efficacy and control beliefs significantly related to students' achievement.

Keywords: CHAID, CHAID algorithm, Motivation, Grit, Persistence, Perseverance

Gülçin Mutlu, Ph.D. is an Assistant Professor of Curriculum and Instruction at İzmir Democracy University in İzmir, Turkey. She can be reached at gulcin.mutlu@idu.edu.tr

The construct termed as *language-specific grit* in this study dates back to the construct of grit which was first operationalized by Duckworth, Peterson, Matthews and Kelly (2007) as a psychological general trait referring to one's capacity to further her or his efforts and interests for the activities taking a long time to complete. The presence of such a construct was a keen interest historically to several psychologists or researchers in the literature (e.g. Cox, 1926; Galton, 1892) a long time before Duckworth and others (2007). However, it had not been yet defined as a distinct measure of human psychology until the recent renewed interest about soft-skills and character strengths by Duckworth (2007) and others (Heckman & Rubinstein, 2001; Heckman, Stixrud, & Urzua , 2006; Lieras, 2008; Peterson & Seligman, 2004).

Duckworth et al. (2007), known with their proponent work on grit, conducted a series of studies particularly focusing on grit and the results from these studies consistently indicated that participants' grit scores were associated with various success outcomes. Following Duckworth (2007) and her associates, the links between success outcomes and grit have been firmly investigated and confirmed by several other researchers (Akos & Kretchmar, 2017; Changlek & Palanukulwong, 2015; Hagger & Hamilton, 2018; Muenks, Yang, & Wigfield, 2018; Reraki, Celik, & Sarıçam, 2015); but, these pieces of evidence emphasized a more general view of grit by conceptualizing it as a stable human trait and detracting its ability to change in line with the type of the task or activity in question. In this essence, Duckworth et al. (2007) and Duckworth and Quinn (2009) warned future researchers about the possibility that the measure of grit may be a domain-specific construct. Hence, there is a need for more evidence to connect success outcomes and grit when grit is treated as a task or domain-specific construct.

Though a particular line of research on grit examined how grit was associated with several success outcomes, some other variables were also investigated regarding their links to

grit (Duckworth et al, 2007; Changlek & Palanukulwong, 2015; Hagger & Hamilton, 2018; Muenks, Yang, & Wigfield, 2018; Reraki, Celik, & Sarıçam, 2015; Von Culin, Tsukayama, & Duckworth, 2014). As a proponent study, Duckworth et al. (2007), for instance, investigated how grit related to self-control, personality traits (i.e. Big Five traits of conscientiousness, extraversion, neuroticism, agreeableness, and openness to experience) and self-efficacy. Investigations into the links between several motivational variables and grit were also performed in subsequent studies (Changlek & Palanukulwong, 2015; Çelik & Sarıçam, 2016; Hagger & Hamilton, 2018; Muenks, Yang, & Wigfield, 2018; Reraki, Celik, & Sarıçam, 2015; Von Culin, et al., 2014). Thus, based on the attempts by several researchers above, it appears that variables other than success outcomes were also worthy of investigating to unpack the true nature of grit. It is also important to note here that in the above attempts, grit was treated as a general character strength and the participants were mostly adults who were in fact not enrolled in a particular study or a degree program.

Another investigation into the variables other than success outcomes was performed by Mutlu (2017; see also Mutlu & Yıldırım, 2019) who conducted a proponent study to date on grit in foreign language learning by investigating how language-specific grit for English related to students' learning environment perceptions, exposure to the target language and several demographics. However, this first attempt to examine the domain-specificity of the grit is not sufficient to understand the nature of this new construct. Therefore, there is more need to investigate how grit is related to success outcomes and other types of affective constructs, perhaps particularly to those known to predict achievement, such as self-efficacy or motivation. This need appears to be more obvious and crucial as to the domain-specific forms of grit since

variables like motivation and self-efficacy may show differentiated effects depending on the type of tasks or domains in question.

There has been a particular surge of interest upon the variable of motivation in the literature as a close correlate of success. However, it is also seen that it has been difficult to define or conceptualize this construct, which results in an emergence of a number of different categorizations for motivation and motivational theories. Theory of the hierarchy of needs (Maslow, 1943), expectancy-value model of motivation (Eccles, 1983; Lawler & Porter, 1967; Pintrich, 1988, 1989), achievement motivation theory (McClelland, 1961) and goal-setting theory (Locke & Latham, 1990) have been the most popular ones in the literature. Supporters or researchers of the expectancy-value model (Chen, 2002; Eccles, 1983; Eccles & Wigfield, 2002; Feather, 1992; Pintrich & De Groot, 1990; Wigfield, 1994; Wigfield & Eccles, 1992, 2000) repeatedly reported that learners' expectancies for success in a task and the subjective values they attached to the success to the task directly predicted the degree of persistence (corresponding to the recent construct of grit today) and achievement they would possess. In essence, research into the expectancy-value model provided sufficient and strong evidence about the links between persistence (recently termed as grit) shown as a type of "achievement behaviors" (Wigfield, 1994, p. 51) and motivation (Eccles, Wigfield, Harold, & Blumenfeld, 1993; Eccles & Wigfield, 1995; Wigfield, Harold, Eccles, Blumenfeld, Aberbach, Freedman-Doan, & Yoon, 1992). Thus, in line with the expectancy-value perspective and given the task of learning English, it could be expected and hypothesized that those with high expectations of being successful in English who attach positive values to achievement in English are more likely to put more grit and effort for learning the language and become more successful.

As is seen in the above account, a number of variables were investigated regarding their relationships to students' grit by previous researchers. However, in their analyses, they made no classifications or specifications regarding students' different degrees of gritty behaviors or success outcomes. Hence, research into the characteristics possessed by gritty and less gritty students or high achievers or low achievers and into the differences between these two main distinct group categories (of achievement and grittiness) are worthy of investigation. Moreover, there is a scarcity of research that links language-specific form of grit to success and affective outcomes and future investigations into these probable links are needed. In line with the above hypotheses and gaps in the literature, this study aimed to answer the following research questions:

Research Question 1 (RQ1): To what degree do six motivational variables affect the differences in students' language-specific grit for learning English?

Research Question 2 (RQ2): To what degree do students' language-specific grit and six motivational variables affect the differences in students' achievement scores in English.

Methods

Participants

The data were collected from the English preparatory program students enrolled at a state university in Turkey (n = 182). The English preparatory class was a required course for the participant students. To start their main content departments, they were required to pass the English preparatory program successfully. These students were enrolled in the Faculty of Engineering (n = 87), Faculty of Aviation and Space Sciences (n = 49), and Faculty of Social Sciences and Humanities (n = 46). Eighty (44 %) of the students were females and 102 (56 %) of them were males. Almost 90 % of them were aged 20 years old or less. There were only 19

students aged over 20. The average mean of age was approximately 19 years old (M = 19.39; SD = 1.91).

When the motivational characteristics of the students were examined (Table 1), it was seen that the participants had the highest average mean on the control beliefs sub-scale (M = 5. 20; SD = 1.17) and the lowest mean score on test anxiety (M = 4.14; SD = 1.45). All of the mean scores for six motivational sub-scales corresponded to beyond-moderate degree of frequency (on a scale from 1 to 7-point Likert type). Given the students' levels of language-specific grit in English, they had a moderate level of language-specific grit on a scale from 1 to 5 (M = 3.28; SD = .67).

Table 1

Motivation and Persistence-related Characteristics of the Participants (N = 182)

Motivation/Persistence Characteristics	*M*	*SD*
Task value	4.84	1.16
Extrinsic motivation	5.03	1.21
Intrinsic motivation	4.98	1.21
Self-efficacy	4.86	1.18
Test anxiety	4.14	1.45
Control beliefs	5.20	1.17
Language-specific grit	3.28	0.67

Instruments

Language-Specific Grit Scale

Persistence Scale for Learning English (PS) developed by Mutlu (2017) as a one-dimensional instrument with a total of 18 items was utilized to measure language-specific grit in this study. This instrument based on the goal setting theory employed a five-point Likert-type

scale ranging from *not at all true of me* (1), *slightly true of me* (2), *moderately true of me* (3), *very true of me* (4) to *completely true of me* (5). The instrument revealed an alpha reliability of .94 in Mutlu's (2017) study. In this current study, language-specific grit (persistence) scale indicated an alpha reliability of .93.

Student Background Form

A background information form was designed to elicit information concerning students' ages, genders, faculty majors and final grade scores on the preparatory program. To elicit the data about students' final grades, students were orally asked for their consents for the researcher to elicit their final grades from their class teachers and they were requested to write their names on the forms.

Motivated Strategies for Learning Questionnaire (MSLQ)

The motivation section of the MSLQ had 31 items to be responded on a 7-point Likert scale, from 1 (*not at all true for me*) to 7 (*very true for me*) was utilized in this study. This instrument was originally developed by Pintrich, Smith, Garcia and McKeachie (1991). The Turkish adaptation of the MSLQ (see Büyüköztürk, Akgün, Demirel, & Özkahveci, 2004) was used in this study. Büyüköztürk et al. (2004) reported Cronbach reliability scores ranging between .52 and .86 for the subscales of the motivation section in the Turkish version.

The theoretical framework behind the motivation section of the MSLQ is based on an adapted version of the general expectancy-value model of motivation (Eccles, 1983; Eccles & Wigfiled, 2002; Wigfield, 1994). In accordance with the tenets of expectancy-value model of motivation, goals, different value beliefs and emotional reactions were theoretically represented by three main motivational components which were further categorized into six different sub-scales. The three main components were *expectancy*, *value* and *affect*. In line with the meanings

of these three dimensions, there were six sub-scales of the instrument named as *self-efficacy* and *control beliefs for learning* as sub-sections expectancy, *intrinsic goal orientation*, *extrinsic goal orientation* and *task value* as sub-sections of value and lastly *test anxiety* as a sub-section of affect. Table 2 depicts these sub-scales and their definitions. An alpha reliability of .89 was also found on the whole scale over 31 items in the current study. The subscales of self-efficacy, control beliefs for learning, intrinsic goal orientation, extrinsic goal orientation, task value and test anxiety respectively showed alpha reliability scores of .90, .73, .77, .67, .81 and .79 in this study.

Table 2

Description of Motivation Section of the MSQL

Dimension	*Description*	*Main Component*	*N of items*
Self-efficacy	The extent to which one believes her/his ability to achieve a task	E	8
Control Beliefs for Learning	The extent to which one believes in the influence of efforts to manage a task	E	4
Intrinsic Goal Orientation	The extent to which one has internal reasons (i.e. mastery or curiosity) to be engaged in a task	V	4
Extrinsic Goal Orientation	The extent to which one has external factors (i.e. rewards, competition or grades) to be engaged in a task	V	4
Task Value	The extent to which a task is perceived to be interesting, useful and important	V	6
Test Anxiety	The extent to which one is concerned about having exams.	A	5

Note. E= Expectancy, V= Value and A= Affect; The descriptions were derived based on Pintrich, et al., 1991.

Data Analysis

Decision tree as a data mining method was utilized for data analysis. CHAID (Chi-Squared Automatic Interaction Detector) algorithm was employed for decision tree development. The developer of the CHAID, Kass (1980, p. 119) briefly explained the working system of the

CHAID by saying that it "partitions the data into mutually exclusive, exhaustive, subsets that best describe the dependent variable. The subsets are constructed by using small groups of predictors." Thus, it was believed that such type of an analysis would be suitable for this study aiming to examine the effects of motivational predictors in differentiating and classifying the learners in terms of their language-specific grit and achievement scores by means of detecting the most significant predictors describing them.

Prior to the development of classification trees via CHAID, the type and category of the variables were checked and the dependent and independent variables in continuous forms were transformed into categorical ones by using the Visual Binning option on SPSS. It is possible to have either continuous or categorical variables on CHAID. However, each form (category) of the study variables was tested with CHAID and the use of categorical variables other than continuous ones resulted in better tree development. Thus, the researcher followed with the (transformed) nominal variables for decision tree development. Table 3 shows these variables and their structure as they were used in the analyses. The alpha level was determined as .05 for the analyses in this study.

Table 3

The Variables and Their Structure as used in CHAID Analyses

Variable Name	*Values (Modalities)**	*Profile of the Sample f (%)*	*Measurement Scale*
Task Value	<= 27	72 (39,6 %) **	CV→OV
	28 - 32	51 (28 %)	
	33 +	59 (32.4 %)	
Test Anxiety	<= 17	61 (33.5 %)	CV→OV
	18 - 24	62 (34.1 %) **	
	25 +	59 (32.4 %)	
Self-efficacy	<= 35,00	62 (34.1 %) **	CV→OV
	36 - 44	62 (34.1 %) **	
	45 +	58 (31.9 %)	
Control Beliefs for Learning	<= 19	68 (37.4 %) **	CV→OV
	20 - 23	56 (30.8 %)	
	24 +	58 (31.9 %)	
Intrinsic Goal Orientation	<= 18	71 (39 %) **	CV→OV
	19 - 22	51 (28 %)	
	23 +	60 (33 %)	
Extrinsic Goal Orientation	<= 18	63 (34.6 %)	CV→OV
	19 - 23	67 (36.8 %) **	
	24 +	52 (28.6 %)	
Language-specific Grit	<= 54	64 (35.2 %) **	CV→OV
	55 - 65	64 (35.2 %) **	
	66+	54 (29.7 %)	
Final Achievement Score in Prep Program	<= 72	64 (35.2 %) **	CV→OV
	73 - 79	61 (33.5 %)	
	80+	57 (31.3 %)	

Note. CV→OV= transformed from continuous variable into categorical (ordinal) variable; *based on the calculation of the total score on each sub-scale; ** shows majority of the participants in relation to MSQL sub-scales, language-specific grit and achievement variables.

Results

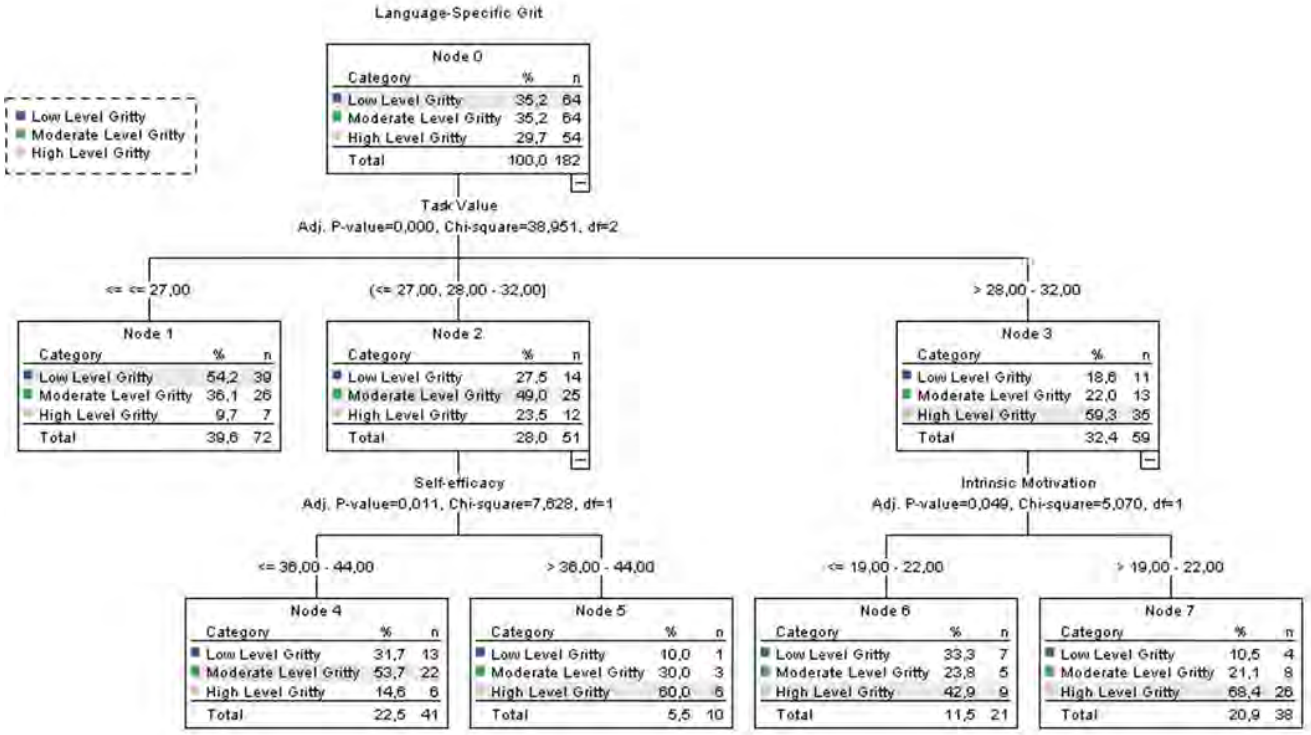
RQ1: Classification of Students' Level of Language-specific Grit in learning English based on Six Motivational Variables

CHAID analysis was conducted by using the student language-specific grit as the dependent variable and six motivational variables, self-efficacy, control beliefs for learning, task

value, extrinsic motivation, intrinsic motivation, test anxiety as independent variables. As shown in Figure 1, the most significant independent motivational variable was task value, $X^2 = 38.951$, df = 2, p = 0.000, which meant that this variable had the strongest impact to differentiate and classify students into three groups concerning their language-specific grit levels.

Figure 1

CHAID Decision Tree Model for Language-Specific Grit Based on Motivational Variables



Most of the participants (n = 72) were placed in node 1 that corresponded to a low degree of task value for learning English. The remaining 51 students belonged to node 2 and 59 students to node 3. Given the percentage distributions of the three categories of language-specific grit, high task value group (node 3) was composed of a significantly higher percentages of high-level gritty learners (59.3 %) when respectively compared to moderate (node 2; 23.5 %) and low (node

1; 9.7 %) groups. Likewise, there were more moderate level gritty learners in the moderate level task value group (node 2; 49 %) and more low-level gritty learners within the low-level task value group (node 1; 54.2 %).

When the second level of the tree was examined, self-efficacy and intrinsic motivation were found to be statistically significant. The variable of self-efficacy classified node 2 into two groups, $X^2 = 7.628$, df = 1, p = 0.011. Those with a moderate degree of self-efficacy belonged to node 4 and those with a high-level self-efficacy composed node 5. Moderate degree self-efficacy group was dominated by those students with a moderate degree of language-specific grit for English (node 4; % 53.7) followed by low level gritty students (31.7 %). Similarly, in the high degree self-efficacy group, most students (60 %) appeared to have a high level of language-specific grit while there was only one student with a low degree of language-specific grit. The variable of intrinsic motivation significantly split node 3 into two groups (node 6 and node 7), $X^2 = 5.070$, df = 1, p = 0.049. Both groups were dominated by those students with a high degree of language-specific grit (42.9 % for node 6 and 68.4 % for node 7). However, there were more low-level gritty learners in node 6, the group with moderately intrinsically motivated students compared to node 7 of highly motivated students.

The results from the tree development through CHAID algorithm also enabled the researcher to form some rules in the form of "if-then" structure. Thus, given node 7, the results revealed that if a student possessed a high level of task value and intrinsic motivation for learning, then it could be stated with 0.684 probability that this student was going to be a high-level gritty learner of English. Moreover, if this student had a high degree of task value again but a moderate degree of intrinsic motivation, it was with 0.429 probability that this student would still be a high-level gritty learner of English.

Given the overall accuracy of the model in classifying the sample of this study, it was seen that 56 % of the participants were accurately classified. The classification accuracy results here implied that 102 respondents out of 182 were classified accurately in the observed sample (Table 4). The risk that the participants would be inaccurately classified in relation to their language-specific grit levels was found to be 44 % in this sample. However, when a test sample is used for cross-validation purposes, this risk is higher with 48%.

Table 4

Classification Matrix

	Predicted			
Observed	<= 54.00	55.00 - 65.00	66.00+	% Correct
<= 54,00	39	13	12	60.9 %
55.00 - 65.00	26	22	16	34.4 %
66.00 +	7	6	41	75.9 %
Overall %	39.6 %	22.5 %	37.9 %	**56.0 %**

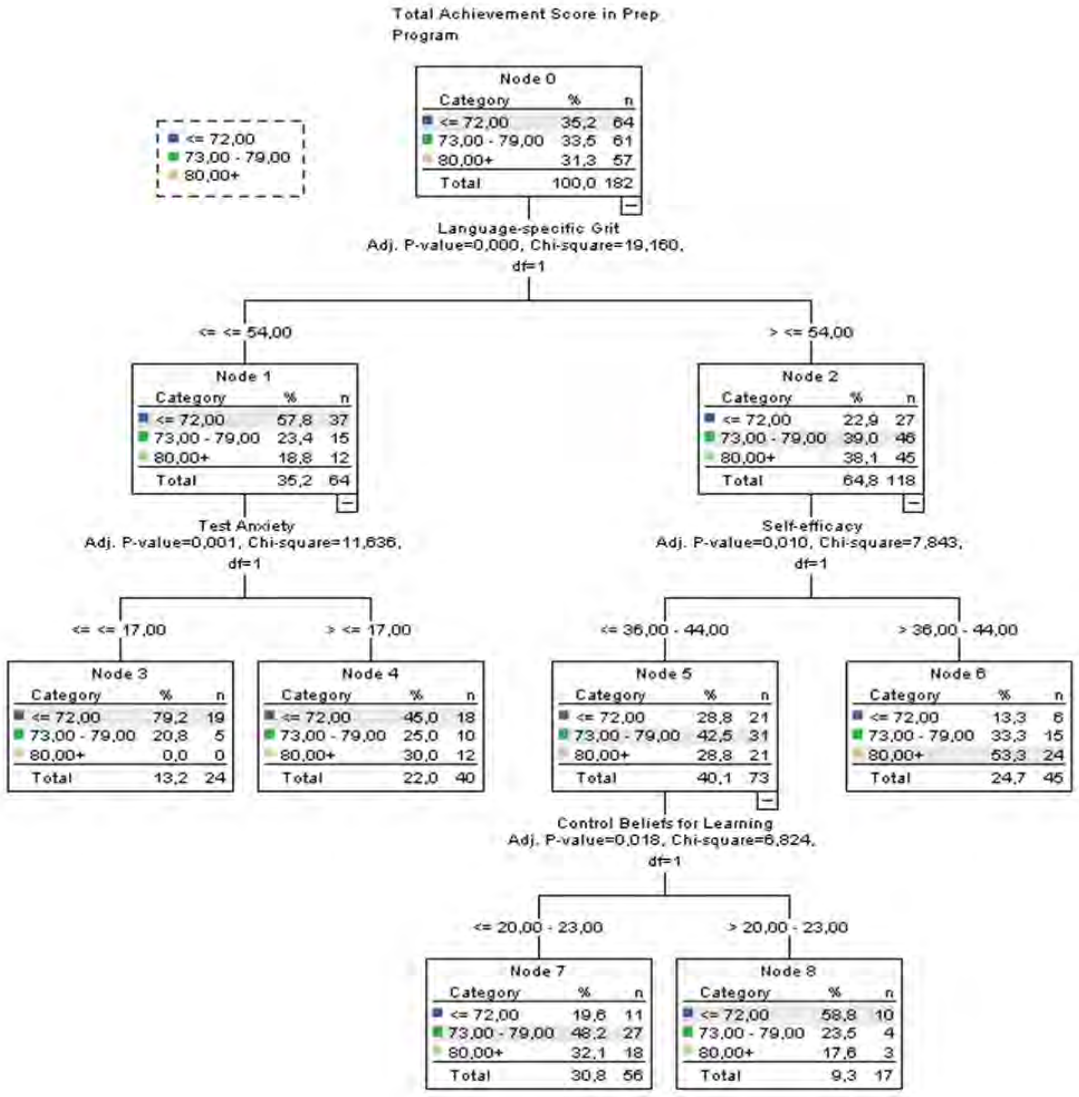
Note. Dependent Variable = Language-specific Grit Scores, Resubstitution = 44 %, Cross-validation = 48 %.

RQ2: Classification of Students' Achievement based on Language-specific Grit in Learning English and Six Motivational Variables

CHAID analysis was conducted by using the students' achievement scores in the preparatory program as the dependent variable and six motivational variables and language-specific grit for learning English as independent variables. Figure 2 shows that the most significant and strong independent variable having the ability to classify students into three different groups of achievement was language-specific grit, $X^2 = 19.160$, df = 1, p = 0.000. The variable of language-specific grit split the sample of the study into two groups as node 1 ($n = 64$) and node 2 *(*$n = 118$). High gritty group (node 2) possessed a significantly higher percentage of top successful students (38.1 %) compared to low gritty group (node 1; 18.8 %). Furthermore, node 2 included a significantly lower percentage of bottom achievers (22.9 %) in comparison to node 1 (57.8 %).

Figure 2

CHAID Decision Tree Model for Achievement Based on Language-Specific Grit and Motivational Variables



When the second level of the tree was examined, self-efficacy and text anxiety were identified as statistically significant variables. The variable of self-efficacy significantly split node 2 into two groups (node 5 and node 6), $X^2 = 7.843$, df = 1, p = 0.010. The group including

the students with a high degree of self-efficacy in learning (node 6) appeared to be dominated by the students (n = 24; 53.3 %) having a score 80 points and over as an achievement grade and only 13.3 % (n = 6) of these students scored 72 and lower in the final test. In contrast, node 5 included more students (n = 21) who scored 72 and lower but less students with 80 points and over (n = 21; 28.8 %) compared to the same categories of node 6.

The variable of test anxiety significantly classified node 1 (low gritty learners) into two groups, X^2 = 11. 636, df = 1, p = 0.001. One group was composed of the students with low levels of text anxiety (node 3) and the other with higher text anxiety levels (node 4). Both groups were dominated by those students getting 72 points or below; however, there were more successful students who indeed got scores between 73 and 79 points (n = 10) or more than these (n=12) in the group with higher text anxiety levels. In contrast, there were no students who got over 80 points in the group with lower levels of test anxiety. In this essence, node 4 possessed a significantly higher percentage of top successful students (n = 12; 30 %) compared to node 3 (n = 0).

Given the third level of the tree depth, control beliefs for learning was found to be significant for splitting node 5, X^2 = 6.824, df = 1, p = 0.018 into two groups as respondents with moderate control beliefs for learning and those with high level of control beliefs. The group with higher control beliefs included significantly higher proportions of students with an average point of 72 or below (58.8 %) while the group with moderate control beliefs contained significantly higher proportions of students with an achievement score ranging between 73 and 79 points (48.2 %). Only three students in the higher control beliefs group and 18 students in the moderate control beliefs group scored as top achievers (over 80 points) as an achievement grade. Thus, those with high level control beliefs for learning appeared to be less successful in English.

Given some "if-then" type of rules using, for instance, for node 6, one can say that if a student reported a high level of language-specific grit and self-efficacy for learning, it was with 0.533 probability that this student was going to be a high achiever of English. Moreover, if a student was a low-level gritty learner of English and at the same time had low test anxiety, there was no probability that this student would become a high achiever in English (node 3). Furthermore, if a student possessed a moderate degree of control beliefs, a moderate level of self-efficacy and a high level of language-specific grit, there was only 0.196 probability that she/he would get lower scores in the final test. However, if this student had higher degrees of control beliefs for learning but not a moderate one as was given in the above case, the probability value that this student would get lower scores in the final test increased up to 0.588.

Overall accuracy and predictive potential of the model in classifying the sample of this study are shown in Table 5. It was seen that almost 54 % of the participants (n = 98) were accurately classified in the current sample. This result also meant that when the students' motivational characteristics (from six motivational dimensions of MSQL and one-dimensional PS) are known, the prediction risk is 46 % in this sample. However, when a test sample is used for cross-validation, this risk is 57 %.

Table 5

Classification Matrix

	Predicted			
Observed	<= 72.00	73.00 - 79.00	80. 00 +	% Correct
<= 72.00	47	11	6	73.4 %
73.00 - 79.00	19	27	15	44.3 %
80.00 +	15	18	24	42.1 %
Overall %	44.5 %	30.8 %	24.7 %	**53.8 %**

Note. Dependent Variable = Achievement Scores, Resubstitution = 46 %, Cross-validation = 57 %.

Discussion and Future Directions

The results from the CHAID for RQ1 indicated that task value, self-efficacy and intrinsic motivation were significantly associated with students' language-specific grit with task value differentiating the students with different degrees of language-specific grit as the strongest independent variable. These three variables should be particularly investigated in future language-specific grit studies. The results from the CHAID for RQ2 revealed that students with higher achievement scores had higher levels of language-specific grit for learning English, self-efficacy and text anxiety but surprisingly lower levels of control beliefs. Therefore, moderate but not high levels of control beliefs for learning is appreciated in order to promote students' achievement. However, future researchers should approach this implication with some caution in relation to the data collection instrument used. That is, the items in the control beliefs subscale might have provoked some negative opinions due to their sentence structures and negative wordings in Turkish. When the items in the control beliefs subscale were examined individually, one can easily see that these items in Turkish can also purport the idea that learners are to blame themselves or should consider their lacking related to the amount of study behaviors in the face of undesired learning outcomes. In this regard, Turkish students might have understood the items of the control beliefs dimension from a negative point of view instead of the positive connotations with the appreciation of efforts to manage an activity as was originally dedicated to them in English by the original instrument developers.

A certain number of independent variables (including demographics included in this study) or their sub-levels showed no potentials to differentiate high level gritty and successful learners of English from their less gritty or successful peers. Thus, a significant degree of reduction occurred in terms of model dimensionality as an expected result with data mining

analyses aiming to discover the real structure embedded within the data (Milanović & Stamenković, 2016). Therefore, such reductions and significant best subsets of independent variables should be considered carefully in the design of future studies.

This current study provided strong evidence for the presence of associations between grit for learning and other two other main variables, motivation and achievement. Muenks, Yang, and Wigfield (2018) previously found a similar result to the current study in that they reported strong relationships between effort sub-scale of general trait-level grit and the two variables, motivation and achievement in high school students. It was further reported in their study that self-efficacy and task value perceptions of the learners revealed strong associations with grit, which was again similar to the findings of this current study. The results from this current research also showed that grit was related to intrinsic motivation, which strongly corroborated with the results from previous studies (Changlek & Palanukulwong, 2015; Karlen, Suter, Hirta, & Maag Merki, 2019). In contrast to previous evidence about negative associations between test anxiety and grit (Changlek & Palanukulwong, 2015; Çelik & Sarıçam, 2016; Holtby, 2018), test anxiety was found to possess a facilitative role in promoting learners' grit in learning English in this study. In this essence, some researchers in the literature previously discussed the presence of two types of anxiety, facilitative and debilitative (Alpert & Haber, 1960; Carrier, Higson, Klimoski, & Peterson, 1984; Jones, 1995). Here, with this group of learners, facilitative type of anxiety might have worked in the sense that an obligatory exam to pass to the main faculty department at university posed some sort of a difficulty to do and work more for the students.

Another corroborating piece of evidence supporting the existence of links between self-efficacy perceptions and grit belonged to Rojas, Reser, Usher, and Toland (2012) who found associations between grit and self-efficacy and self-regulation scores in reading and math from

the elementary level students. The results from Reraki, Celik, and Sarıçam's (2015) study also supported the current evidence as to the presence of associations between grit and academic motivation and achievement of university students. Similarly, Hagger and Hamilton (2019) found a significant association between grit (effort sub-scale) and high school students' science grades. In contrast, some research studies revealed contrasting results or weak explanations as to the associations when investigating how grit was related to achievement and motivation (Bazelais, Lemay & Doleck, 2016; Karlen, et al., 2019, Lumontod, 2019; Taşpınar & Külekçi, 2018).

While the above evidence supports the relationships between grit and achievement and motivational correlates, it is also important to note that effort dimension of the widely used grit scale was found to be consistently and (more) significantly related to achievement or motivation variables in comparison to the consistency of interest sub-scale by several researchers (Credé, Tynan, & Harms, 2017; Datu, Valdez, & King, 2016; Karlen et al., 2009; Muenks, Wigfield, Yang, & O'Neal, 2017; Steinmayr, Weidinger, & Wigfield, 2018; Wolters & Hussain, 2015). Such findings contributed to the use of a unidimensional instrument in this current research in that the PS instrument utilized in this study included or emphasized the effort dimension for the purposes of its content. In addition, the results from this study confirmed the use of PS as a reliable tool to investigate grit as a domain-specific construct in language learning.

One limitation could be related to sample size employed in the study for data mining analyses require the use of large sample sizes for the analyses to produce reliable results. However, when the purpose is to diagnose and identify the presence of any associations as a preliminary outlook, the use of smaller sample sizes is also appropriate (Milanović &

Stamenković, 2016). This study considered as a preliminary attempt to investigate the domain specificity of grit appear to be exempt from the limitation pertaining to sample size.

Given the pedagogical implications in the light of the results of this study, it could be recommended that educational interventions and trainings should be developed in order to promote students' grit for learning foreign languages. In such educational interventions, the constructs that are supportive of grit such as goal orientations and self-efficacy should be included and promoted. In line with the positive psychology understanding and implications supported by Seligman, Ernst, Gillham, Reivicha, and Linkins (2009), it is believed that skills that can increase grit or grit-like constructs and positive emotions can be taught and developed over time.

One comment should be made here concerning the strong influence of self-efficacy not only upon the students' grit for learning but also upon their achievement scores in English as a research finding from this study. Further research should be conducted to investigate and test the existence of multivariate causal relationships among these three variables as the literature concerning the presence of mutual associations between these variables has been already established by several researchers (Bandura, 2001; Multon, Brown, & Lent, 1991; Duckworth et al., 2007; Mohammadyari, 2012). In addition, the findings of this study implied the probability of another three-party relationship among motivation, grit and achievement for future research to investigate and the use of more advanced and varied data analysis methods is recommended to understand such multivariate relationships among the variables. It is seen that there is already a dominance of quantitative research designs in research into grit in the literature. Therefore, qualitative and mixed-design studies are especially recommended for future purposes in order to

understand the real nature of the construct in the light of learners' personal understandings and perceptions related to their grittiness.

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